Possible cross-border participation in capacity mechanisms

Cross-border participation in capacity mechanisms: EURELECTRIC CRM consultation response (1)

- **Generation adequacy** should take into account **contribution of cross border interconnectors** with a firm commitment between involved MS
- An as **large market coverage** as possible in order to minimize distortions on the competitive market (at regional level or in coordination with other markets)
- **Consideration of cross-border transmission in the dimensioning of national CRM**
- Any **capacity mechanism should be open to electricity undertakings operating in other Member States**, to the extent they are able to make the capacity available in a market with CRM (during system stress).
- This could theoretically be achieved by having a common capacity mechanism for several bidding zones. There could be auctions per bidding zone according to the same principles as market coupling:
  - **each capacity bidding in its own zone, and to the extent there is firm (long-term) cross-border capacity between bidding zones (called XB CRM), bids could compete in neighboring zones via a "CRM coupling mechanism"**

Cross-border participation in capacity mechanisms: EURELECTRIC CRM consultation response (2)

- CRM as such might have a complex design. Therefore, one should try to keep it as simple as possible.
- Cross-border capacity selling would **be more difficult in case there are different capacity mechanisms in different bidding zones** or no capacity mechanism at all in a neighboring bidding zones : **therefore EURELECTRIC pleads for harmonization of CRM implementation to the extend possible**
- However, we can demonstrate that even with different mechanisms, achieving cross-border CRM competition is still possible (see annexes).
- With cross-border CRM partipation, part of the adequacy of a MS is in hands of "a neighbour", the more common criteria are used to set the required adequacy quality (expressed e.g. by LOLE), the less "free riding" solutions are possible, and this might be a prerequisite when setting up cross-border CRM participations on a larger than national scale

Cross-border participation: EURELECTRIC key messages

- **Generation adequacy** should take into account **contribution of cross border interconnectors** with a firm commitment between involved MS

- EURELECTRIC recognises the **complexity** of the CRM cross-border participation concept and pleads for **harmonisation of the national CRM** to facilitate the participation of foreign generation

- **EURELECTRIC proposal** (see below) for a cross-border participation mechanism is **only one possible design**

EURELECTRIC proposal: main principles

- **Any participant (national or foreign)** in a CRM has to fulfill the **same requirements and market rules** (e.g. certification, penalty regime, availability requirements, energy producing requirements etc.)

- It should **not be possible** to participate in **more than one CRM** at the same time (no double earnings)

- **TSOs** should **propose capacity volume** that can participate cross-border and this should be **approved by relevant regulators.** The higher this amount of XB capacity, the more XB CRM competition will be possible.

- The cross-border participation in CRM should have **no influence** on the cross-border allocation for forward, day-ahead, intra-day and balancing markets

EURELECTRIC proposal: using a principle of market coupling

- A **possible design** could be based on the **same principles as DA market coupling**
  - A common auction to determine the CRM price in different bidding zones (market coupling arrangement for CRM) could be arranged in case of a common CRM based on auctions
  - Cross-border participation up to allocated cross-border CRM capacity could be organized implicitly in case of a CRM based on auctions
  - The right to cross-border participation could be auctioned separately (explicit auction) in case of a CRM not based on auctions

EURELECTRIC proposal: two purposes of allocation of cross-border capacity

- Cross-border capacity can be allocated for two purposes:
  - To use commonly resources to ensure adequacy (amongst 2 or more BZ)
    - Allocation process = once for (e.g.) Year+X (to be used during the Xth year), in order to allow resources (i.e. supply or demand) from another bidding zone to be part of the local CRM → only the firm XB capacity to be offered, called **XB CRM**
  - To ship energy from one bidding zone to another
    - Allocation process = continously in steps: forward, day ahead, intraday, balancing; aim is to maximise economic surplus → ALL XB capacity to be offered, called **XB CAP**
- Congestion rent accumulated during these two auctions should be used for building cross-border interconnector capacity

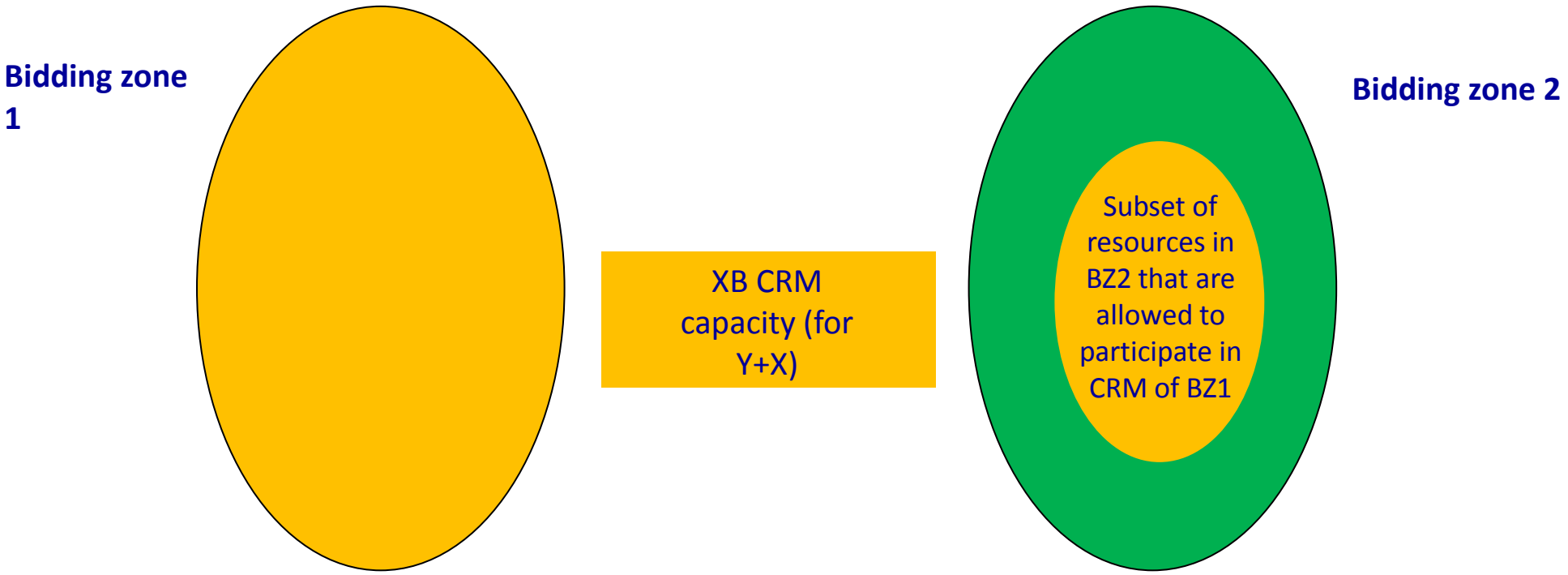
EURELECTRIC proposal: how to use XB CRM capacity

- A CRM in general:
  - Should not require to "deliver energy",
  - But only to be "**available**" (if not : penalty); however,
    - However, a CRM committed generator will 'produce energy' when it is in the money; this is generally the case when a bidding zone is tight
    - and a CRM committed demand will 'accept to be interrupted' at some given conditions
- XB CRM: should thus also not oblige to ship energy !
  - The energy markets, i.e. DA, ID and BAL, will set the direction of the energy flow and the use of the total XB CAP
- Only CRM obligation is to be "available" under the same conditions as resources committed to the CRM in the other bidding zone
  - Requires that TSO have agreed availability rules and how to verify the availability of the resources
  - When an implicit XB CRM allocation mechanism is used (i.e. the market coupling model), as it is not possible to identify which resource is committed to which bidding zone, the availability criteria need to be identical between the BZ.

EURELECTRIC proposal: details of the design

Allocation process for XB CRM

Determining those resources from BZ 2 that are allowed to participate in CRM of BZ 1



Resources from BZ2 committed to CRM in BZ1 cannot be committed also to CRM in BZ2

XB CRM is limited to a firm part of XB capacity that allows resources in BZ2 to be considered as they are located in BZ1

CRM models

- Capacity Resources have to determine the value of the CRM they need (see annex)
- Whatever the mechanism in place, resources will determine the market value of this CRM
  - Could be a central organised trading (e.g. capacity auction)
  - Could be a decentral organised trading (e.g. capacity obligations)
- Let us assume a **CRM auction** is in place (for other models: see annexes)

Initial CRM needs in 2 adjacent bidding zones

Bidding zone 1		Bidding zone 2	
Capacity (MW)	Price (k€/MW/Y)	Capacity (MW)	Price (k€/MW/Y)
1000	5	25	20
2000	8	25	22
500	15	50	28
696	25	50	31
3	27	50	34
1	30	50	37
2500	35	50	40
50	37	50	43
50	42	50	46
50	47	50	49
50	52	50	52
50	57	50	55
50	62	50	58
50	67	50	61
50	72	50	64
50	77	50	67
50	82	50	70
50	87	50	73
50	92		
50	97		
50	102		
50	107		
50	112		
50	117		
50	122		

←Individual biddings corresponding to the amount of money needed to keep the plant or to invest the plant

merit order bidding list in the local BZ auctions →

Without XB CRM participation: what would be CRM value in BZ 1 if 7500 MW is needed, and in BZ 2 if adequacy requires 500 MW ?: see next slide

Bidding zone 1		Bidding zone 2	
Capacity (MW)	Price (k€/MW/Y)	Capacity (MW)	Price (k€/MW/Y)
1000	5	25	20
3000	8	50	22
3500	15	100	28
4196	25	150	31
4199	27	200	34
4200	30	250	37
6700	35	300	40
6750	37	350	43
6800	42	400	46
6850	47	450	49
6900	52	500	52
6950	57	550	55
7000	62	600	58
7050	67	650	61
7100	72	700	64
7150	77	750	67
7200	82	800	70
7250	87	850	73
7300	92		
7350	97		
7400	102		
7450	107		
7500	112		
7550	117		
7600	122		

Outcome of separated CRM markets (i.e. without XB CRM)

Bidding zone 1		Bidding zone 2	
Capacity (MW)	Price (k€/MW/Y)	Capacity (MW)	Price (k€/MW/Y)
1000	5	25	20
3000	8	50	22
3500	15	100	28
4196	25	150	31
4199	27	200	34
4200	30	250	37
6700	35	300	40
6750	37	350	43
6800	42	400	46
6850	47	450	
6900	52	500	52
6950	57	550	
7000	62	600	58
7050	67	650	61
7100	72	700	64
7150	77	750	67
7200	82	800	70
7250	87	850	73
7300	92		
7350	97		
7400	102		
7450			
7500	112		
7550			
7600	122		

In BZ 1, the needed CRM would be 112 k€/MW/Y

In BZ 2, the needed CRM would be 52 k€/MW/Y

Total CRM cost for BZ1 = 840.000 k€/Y
Total CRM cost for BZ2 = 26.000 k€/Y
Total CRM cost for BZ1+2 = 866.000 k€/Y

The red resources both in BZ1 and BZ2 would not earn the CRM, and purely from economic perspective, plant owners would normally decommission these plants, plant investment decision would be negative for new plants to be built

Outcome of coupled CRM markets subject to a XB CRM of 250 MW between BZ1 and BZ2

Bidding zone 1		Bidding zone 2	
Capacity (MW)	Price (k€/MW/Y)	Capacity (MW)	Price (k€/MW/Y)
1000	5	25	20
3000	8	50	22
3500	15	100	28
4196	25	150	31
4199	27	200	34
4200	30	250	37
6700	35	300	40
6750	37	350	43
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7100	72	700	64
7150	77	750	67
7200	82	800	70
7250	87	850	73
7300	92		
7350	97		
7400	102		
7450	107		
7500	112		
7550	117		
7600	122		

In BZ 1, the needed CRM would be 87 k€/MW/Y for 7250 MW local capacity and 250 MW XB CRM capacity

In BZ 2, the needed CRM would be 67 k€/MW/Y for 500 MW local and 250 MW capacity exported CRM to BZ1

TSO would buy 250 MW capacity in BZ2 @67k€/MW/Y and sell it @87k€/MW/Y

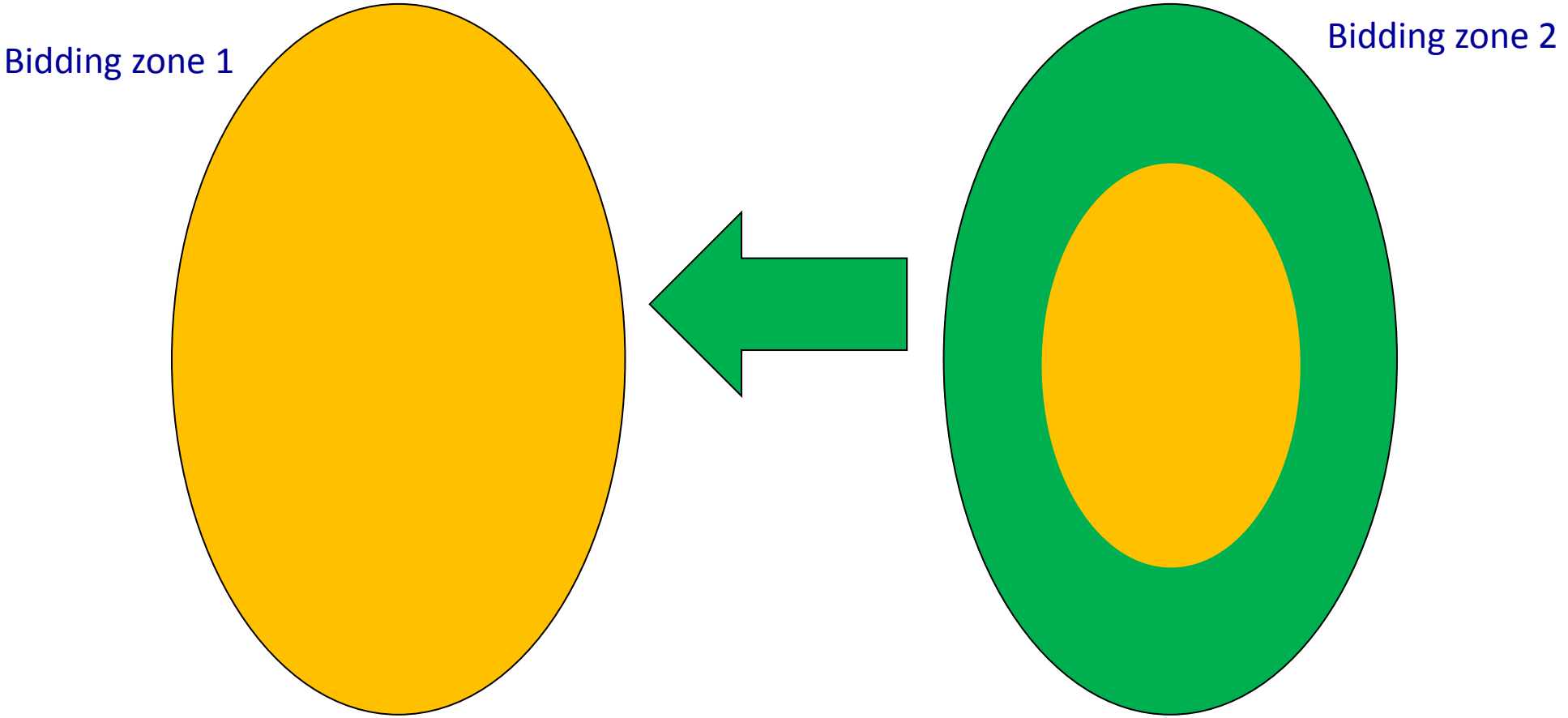
Total CRM cost for 7500 MW BZ1 = 652.500 k€/Y
Total CRM cost for 500 MW BZ2 = 33.500 k€/Y
Total CRM cost for BZ1+2 = 686.000 k€/Y

TSO XB CRM rent = 5.000 k€/Y (to be redistributed, e.g. to all winning capacities in BZ2, or to be used for building/guaranteeing more interconnection capacity)

Total net CRM cost for BZ1+2 = 681.000 k€/Y

The red resources both in BZ1 and BZ2 would not earn the CRM, and plant owners would normally decommission these plants, or plant investment decision would be negative for plants to be built

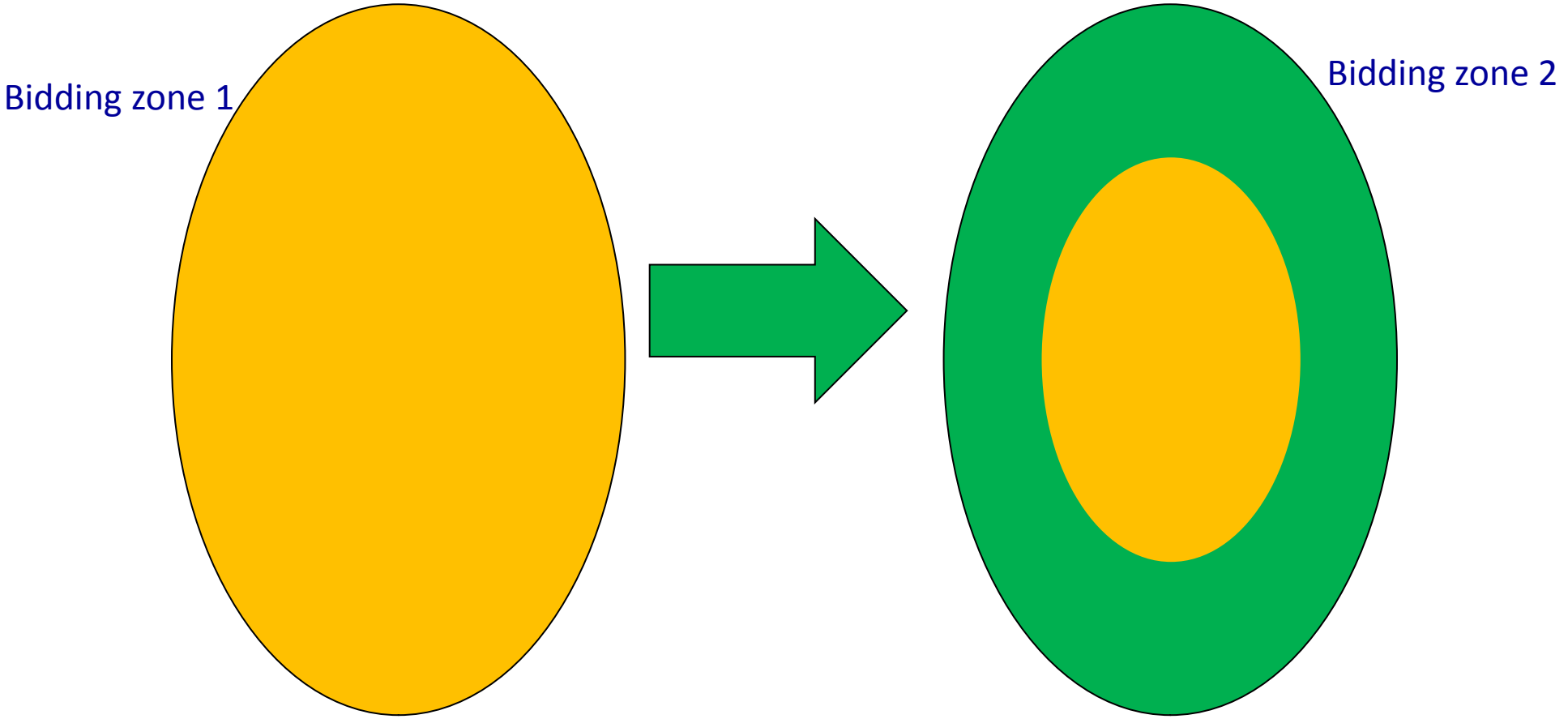
What happens if: BZ1 short, BZ2 long



Energy will flow from BZ2 to BZ1 up to available DA XB capacity (e.g. 700 MW, much more than the 250 MW XB CRM capacity); TSO will verify if the 750 MW contracted CRM are available in BZ2, and if the 7250 MW contracted CRM are available in BZ1

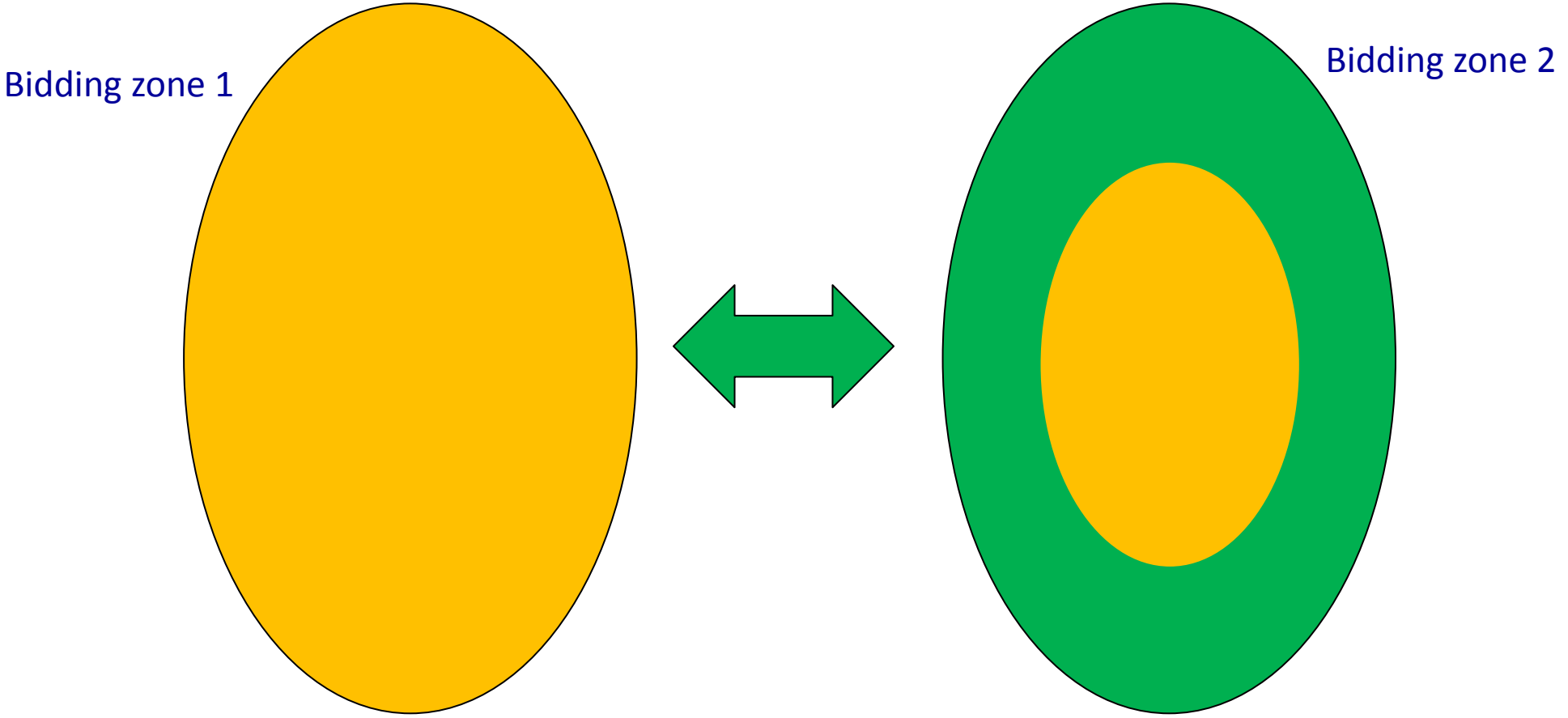
Because allocation via “market coupling”: the individual set of 250 MW resources in BZ2 for BZ1 cannot be distinguished.

What happens if: BZ1 long, BZ2 short



Energy will flow from BZ1 to BZ2 up to available DA XB capacity (e.g. A XB CAP of 700 MW, much more than the 250 MW XB CRM capacity); TSO will verify if the 750 MW contracted CRM are available in BZ2, and if the 7250 MW contracted CRM are available in BZ1

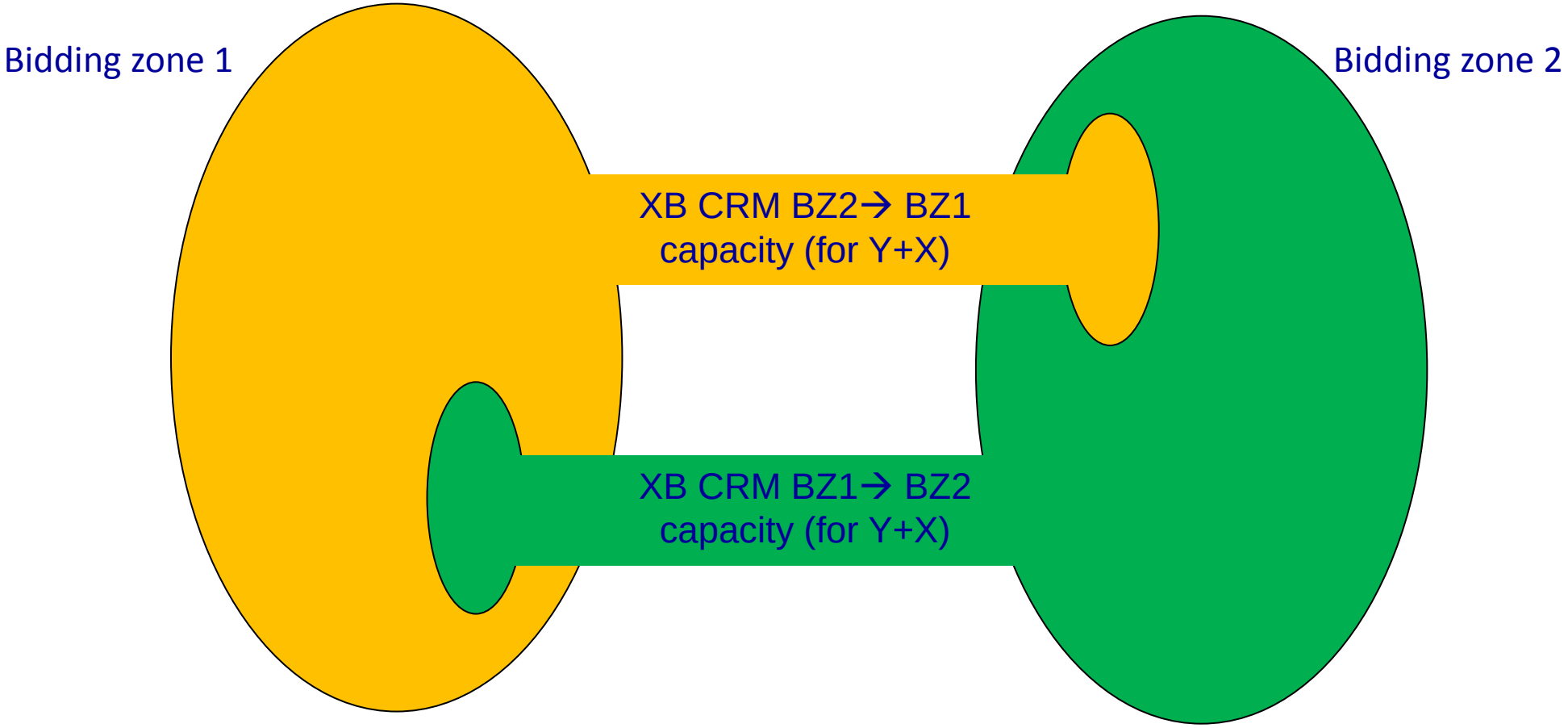
What happens if: BZ1&2 are short



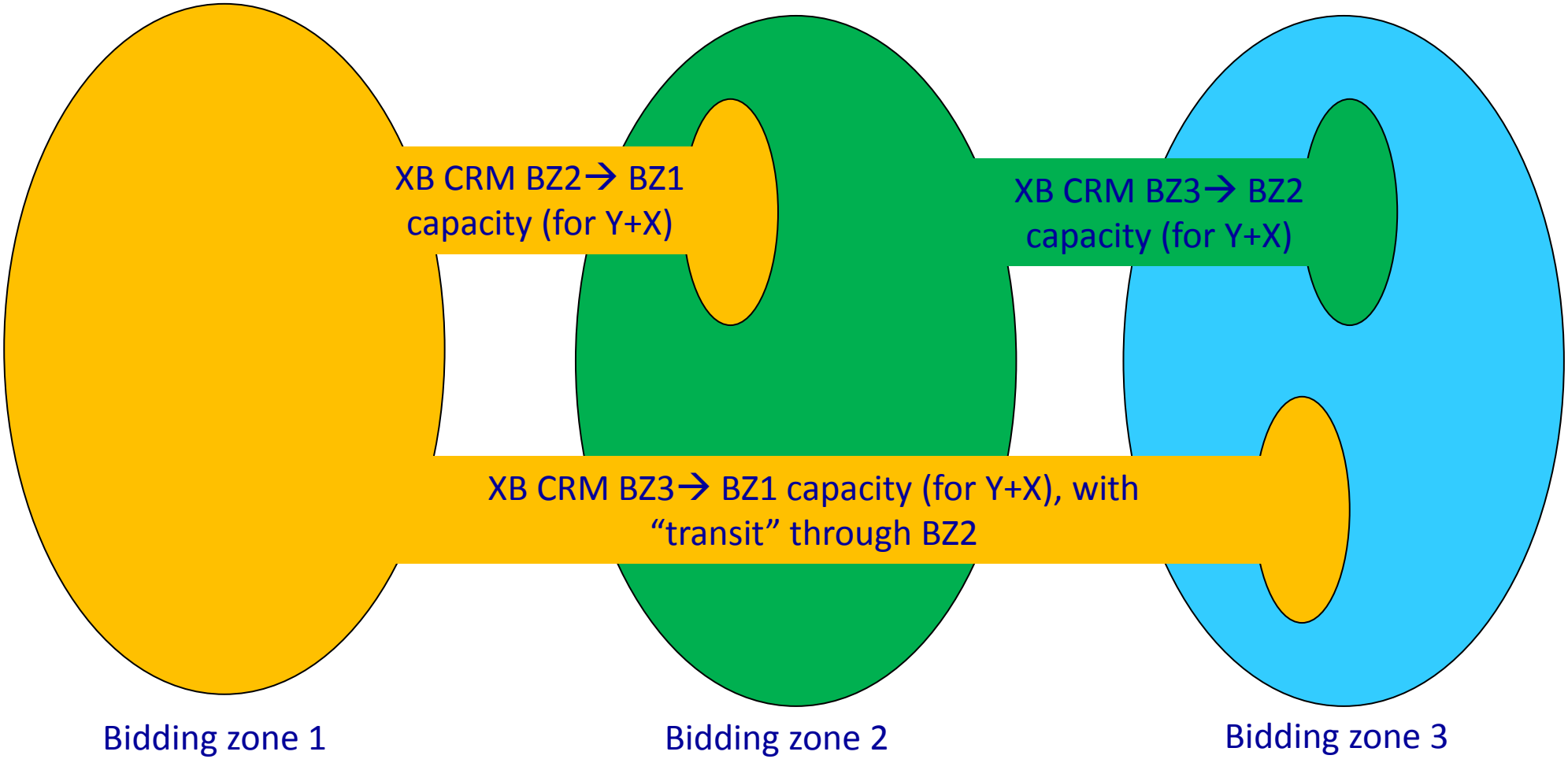
Energy will flow from lowest price zone to the highest one depending on outcoume of DA market coupling; TSOs will verify if contracted 8000 MW CRM are producing in both zones; curtailments (depending on prices) might be necessary. **If this outcome is not acceptable, TSOs should contract more capacity (i.e. review their LOLE criteria).**

Annexes

Annex: XB CRM could be allocated in 2 directions



Annex: the "CRM market coupling"ideas could be further developed for multiple BZ



Outcome if only a CRM in BZ1, no CRM in BZ2

Bidding zone 1		Bidding zone 2	
Capacity (MW)	Price (k€/MW/Y)	Capacity (MW)	Price (k€/MW/Y)
1000	5	25	20
3000	8	50	22
3500	15	100	28
4196	25	150	31
4199	27	200	
4200	30	250	37
6700	35	300	
6750	37	350	43
6800	42	400	46
6850	47	450	49
6900	52	500	52
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7000	62	600	58
7050	67	650	61
7100	72	700	64
7150	77	750	67
7200		800	70
7250	87	850	73
7300			
7350	97		
7400	102		
7450	107		
7500	112		
7550	117		
7600	122		

In BZ 1, the needed CRM would be 87 k€/MW/Y for 7500 MW

In BZ 2, the needed CRM would be 37 k€/MW/Y for 250 MW

TSO would buy 250 MW capacity in BZ2 @37k€/MW/Y and sell it @87k€/MW/Y

Total CRM cost for BZ1 = 652.500 k€/Y
Total CRM cost for BZ2 = 0 (250 MW are paid by TSO of BZ1)

TSO XB CRM rent = 12.500 k€/Y (to be redistributed, e.g. to be used for building/guaranteeing more interconnection capacity)

The red resources would not earn the CRM, and plant owners might decommission these plants, plant investment decision might be negative for new plants to be built

Attention: this is only to show how it works, but this example is not very realistic, as this would mean that adequacy of BZ2 would then be jeorpardised, actually a CRM in BZ2 is in this situation also needed.

Explicit XB CRM auction

- In the case that the CRM process would be decentral (capacity obligations), a CRM market coupling would not be possible
- Explicit allocation is then needed in order to select the 250 MW resources in BZ2 that will be allowed to participate in BZ1 CRM obligations
- With limited transparency and foresight, market participants would anticipate a CRM price “around” 87k€/MW/Y in BZ1 and 67 k€/MW/Y in BZ2
- In theory, they would be willing to pay maximum about 20 k€/MW/Y to participate from BZ2 in the CRM of BZ1
- Indeed, they are indifferent to earn either 87k€/MW/Y in BZ1, and to pay 20 k€/MW/Y for the XB CRM (thus net 67 k€/MW/Y) or to earn 67 k€/MW/Y in BZ2
- However, market participants do not have “perfect” foresight, and their bids would be “around” 20 k€/MW/Y, depending on their models, information, own calculations, etc
- Only resources that already need more than 67 k€/MW/Y in BZ2 should (if they have perfect foresight) not be willing to pay 20 k€/MW/Y for the XB CRM auction, but less then the “expected”87 k€/MW/Y minus their own CRM need !

Willingness to pay from plants in BZ2 anticipating 87 k€/MW/Y in BZ1

Bidding zone 1		Bidding zone 2	
Capacity (MW)	Price (k€/MW/Y)	Capacity (MW)	Price (k€/MW/Y)
1000	5	25	20
3000	8	50	22
3500	15	100	28
4196	25	150	31
4199	27	200	34
4200	30	250	37
6700	35	300	40
6750	37	350	43
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7250	87	850	73
7300	92		
7350	97		
7400	102		
7450	107		
7500	112		
7550	117		
7600	122		

Bidding zone 2		willingness to pay in XB CRM auction (arbitrary based on insight of each ressource)
Capacity (MW)	Price (k€/MW/Y)	(k€/MW/Y)
25	20	17
25	22	19
50	28	18.75
50	31	21.2
50	34	22
50	37	17.9
50	40	16
50	43	13
50	46	25
50	49	19.5
50	52	23
50	55	12
50	58	18
50	61	18.9
50	64	16
50	67	19.8
50	70	18
50	73	12

Bidding zone 2		willingness to pay in XB auction	cumulative capacity
Capacity (MW)	Price (k€/MW/Y)	(k€/MW/Y)	MW
50	46	25	50
50	52	23	100
50	34	22	150
50	31	21.2	200
50	67	19.8	250
50	49	19.5	300
25	22	19	325
50	61	18.9	375
50	28	18.75	425
50	58	18	475
50	70	18	525
50	37	17.9	575
25	20	17	600
50	40	16	650
50	64	16	700
50	43	13	750
50	55	12	800
50	73	12	850

In this (fictive) explicit auction, the 250 MW XB CRM would be allocated @19.8k€/MW/Y to the highest 5 bidders for XB CRM capacity. This would determine the subset of generators of BZ2 that are allowed to participate in the CRM obligation scheme of BZ1. The remaining generators in BZ2 could then participate in the local CRM scheme of BZ2, if any

How to let co-exist a central and a decentral system

- First organise a XB CRM auction → it would reveal a XB CRM value of 20 k€/MW/Y
- Second organise in BZ1 the CRM auction, the 250 MW winners of XB CRM auction can participate, it would reveal the CRM value of 87 k€/MW/Y
- Third let the decentral mechanism work in BZ2, the 250 MW winners of XB CRM may not longer participate
  - However, non-contracted players from BZ 1 might have appetite to participate in BZ2: therefore organise a XB CRM from BZ1 to BZ2 (would probably result in a very low value, if any)
  - BZ2 would find its obligation value of 67 k€/MW/Y
- Add principles of secondary market to the XB CRM auction and to the CRM auction in BZ1: this would let further players find the right market value

How to let co-exist a capacity payment model with a capacity auction or capacity obligation model:

- EURELECTRIC has not analyzed yet this case,
- but realizes that there are other possible CRMs like Capacity Payment models,
  - that are based on real time availability
  - and whose design will be influenced by the physical nature of their respective power system together with the level and type of IC
  - where the proposed XB CRM does not fit as it is proposed.