

I-SEM ETA Detailed Design
Balancing Market
Form of Offers and Bids
4 February 2015

I-SEM ETA Design Overview

Ex-ante markets

- Determine quantities & prices

Physical Notifications

- PNs define generation/consumption in absence of Bid Offer Acceptance, by TSO

Balancing

- TSO increases/decreases generation/consumption by Bid-Offer Acceptance at balancing market price or Bid-Offer Price

- TSO dispatches Bids and Offers to minimise some objective function subject to various constraints

Imbalance Settlement

- Determine balancing market/imbalance price

- Imbalances cleared

I-SEM ETA Detailed Design Issues

Ex-ante markets

- ┆ Intraday Markets (IDM) and EUPHEMIA for Day-Ahead (DAM)

Physical Notifications

- ┆ Physical feasibility

- ┆ Correspondence with traded positions

Imbalance Settlement

- ┆ Balancing Market/Imbalance Price calculation

Balancing

- ┆ How are Offers and Bids defined and paid?

- ┆ What is the appropriate TSO objective function

- ┆ Price not paid under certain circumstances: non-firm access, ex-ante traded positions

I-SEM Balancing Market Detailed Design Issues

Basic Format of Offers & Bids

- Simple MWh vs MW Relative to FPN vs MW Absolute
- Payments in the event of non-delivery
- Simultaneous operation of Balancing and Intraday Markets

Firmness of Bid-Offer Acceptances

Recovery of Costs using Simple Incs/Decs

- Block bids
- Mutually exclusive block bids
- Non monotonically increasing (decreasing) offer(bid) prices?

Rebidding

- Scope for rebidding of prices
- Scope for rebidding of prices following acceptances
- Possible trade-off between pricing complexity and pricing flexibility. Circumstances when rebidding is needed/allowed

Recap on Physical Notifications

Physical Notifications (PNs) represent profile of generation (demand) generator (supplier) intends to generate (consume) unless instructed otherwise by TSO by way of Bid-Offer Acceptance

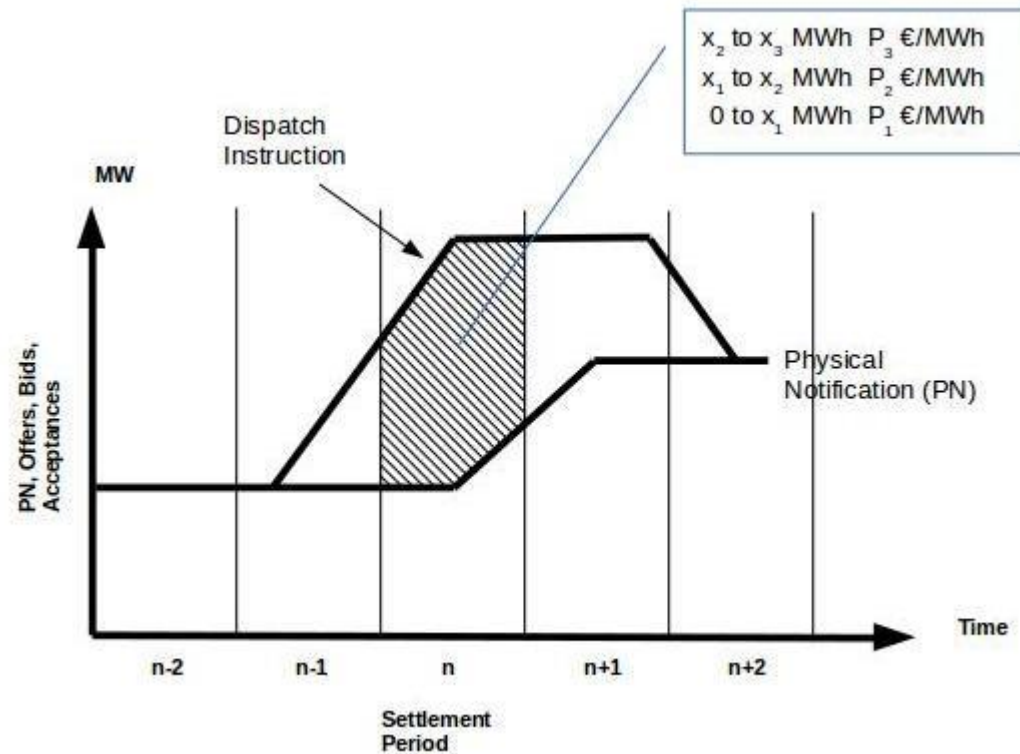
Issue of PN “granularity”

TSO has to balance system from second-to-second and so requires MW profile of generation
Participant better placed than TSO to determine how it wishes to deliver (hourly) traded quantities. (Costs different amount to generate 100MW for an hour and 0MW for 30 minutes and 200MW for 30 minutes.)

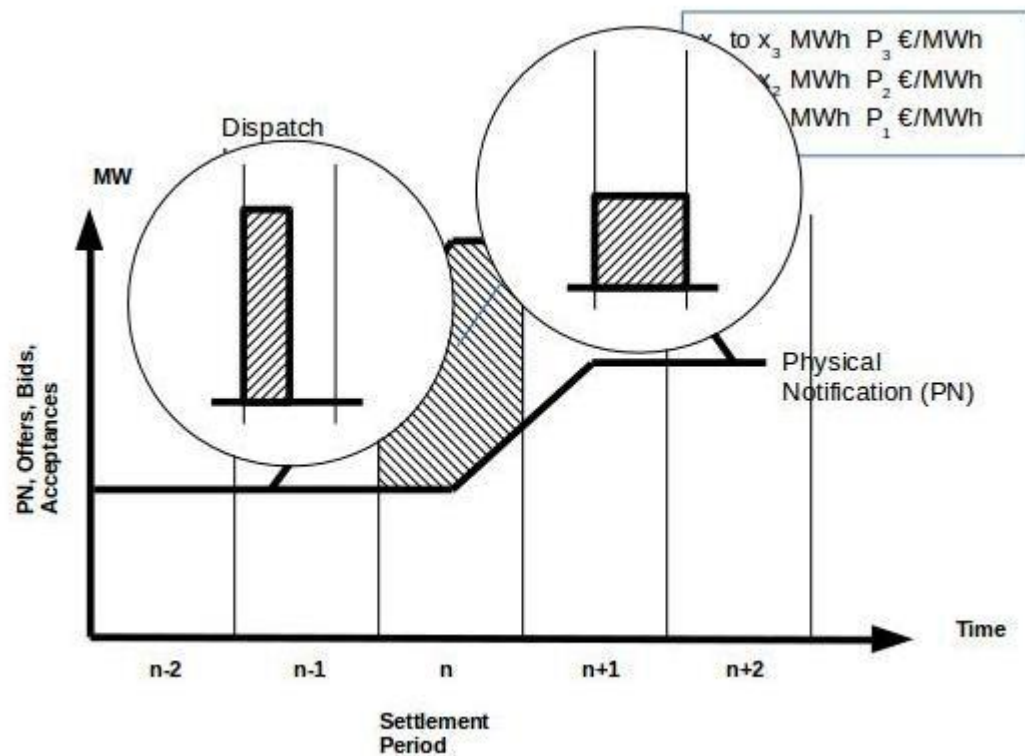
Basic Bid-Offer Formats

- Simple MWh blocks
- MW Relative to PNs
- Absolute MWs

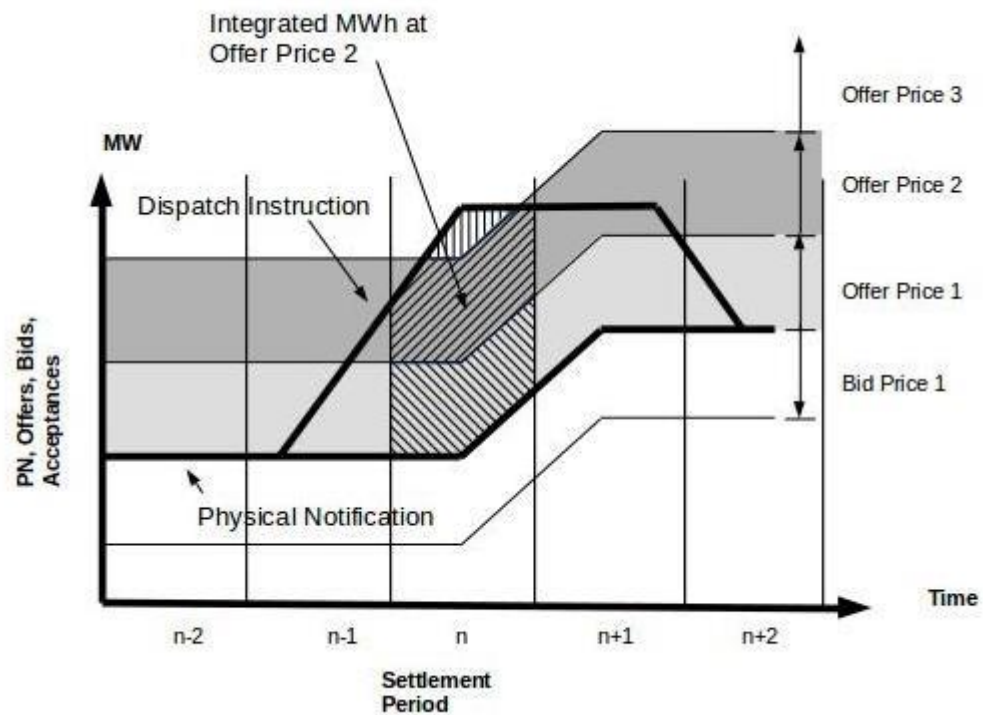
Basic Bid-Offer Format - Simple MWh Offers & Bids



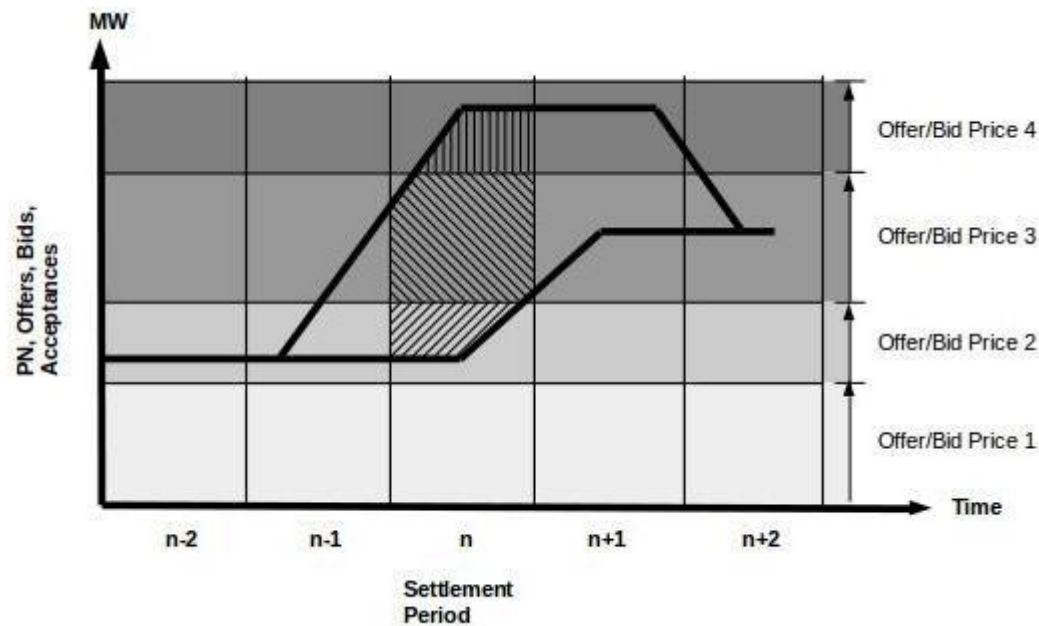
Basic Bid-Offer Format - Simple MWh Offers & Bids



Basic Bid-Offer Format - MW Offers/Bids Relative to PN

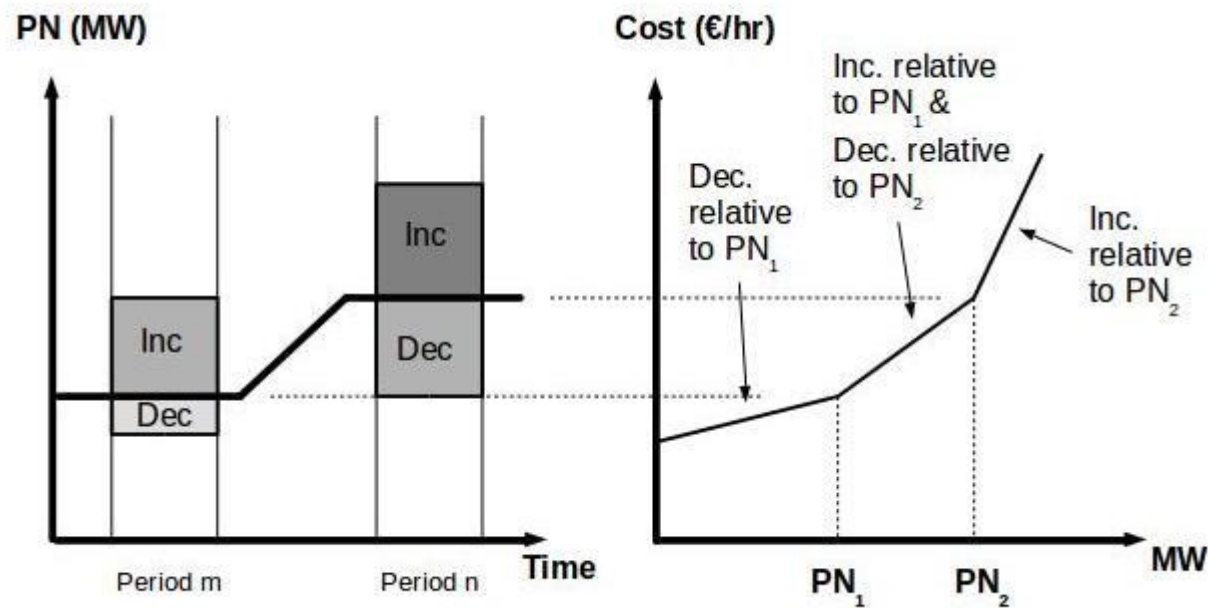


Basic Bid-Offer Format - MW Offers & Bids Relative to Generator Output (“Absolute MW”)



Basic Bid-Offer Format - MW Relative to PN

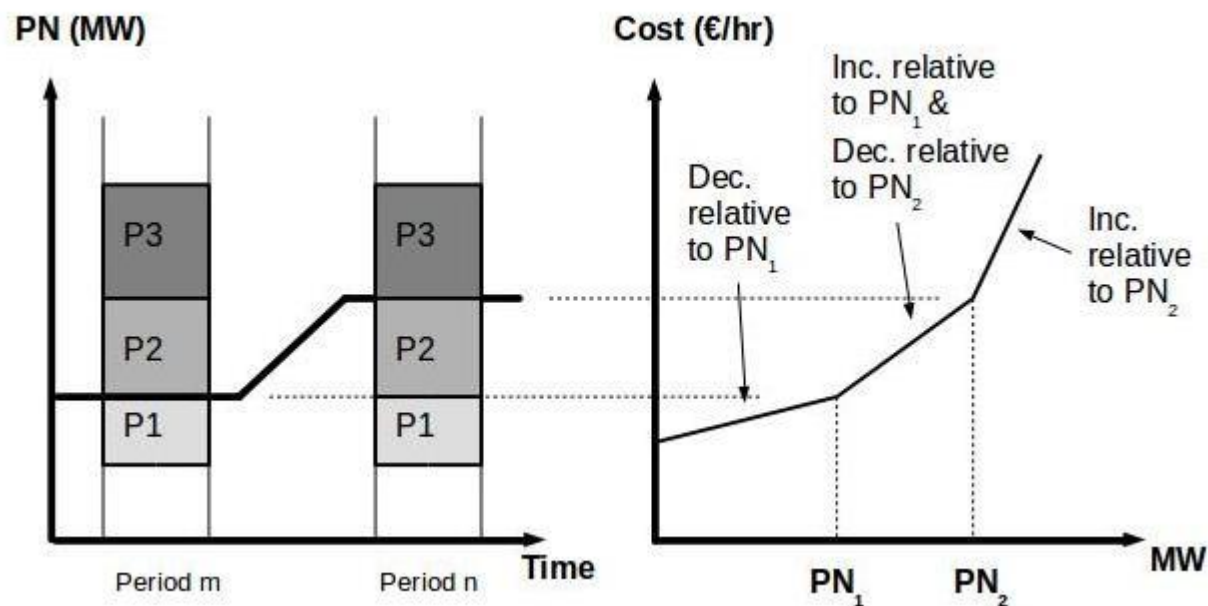
- Does this reflect participant (generator) costs?
- Or will Incs & Decs have to be revised after every change in PN?



- What if PN changes within Settlement Period?

Basic Bid-Offer Format - Absolute MW

□



- Does this better reflect participant costs?
- Participant may still revise incs and decs.
- If cost function doesn't change then optimal dispatch does not change just because PN changes \Rightarrow Possible for intraday trading to continue?

Interactions between the BM & IDM

- As per HLD, the BM will run in parallel to the IDM

 - Energy balancing and re-dispatch actions taken from same BM

- This parallel running is not necessarily a feature of other EU markets

 - BETTA BM opens at end of the IDM

- There are issues to be considered around the interactions between BM and IDM

- e.g Un-contracted CCGT is started by the TSO early in the BM – how can it trade in the IDM

 - Shouldn't be allowed to turn itself off

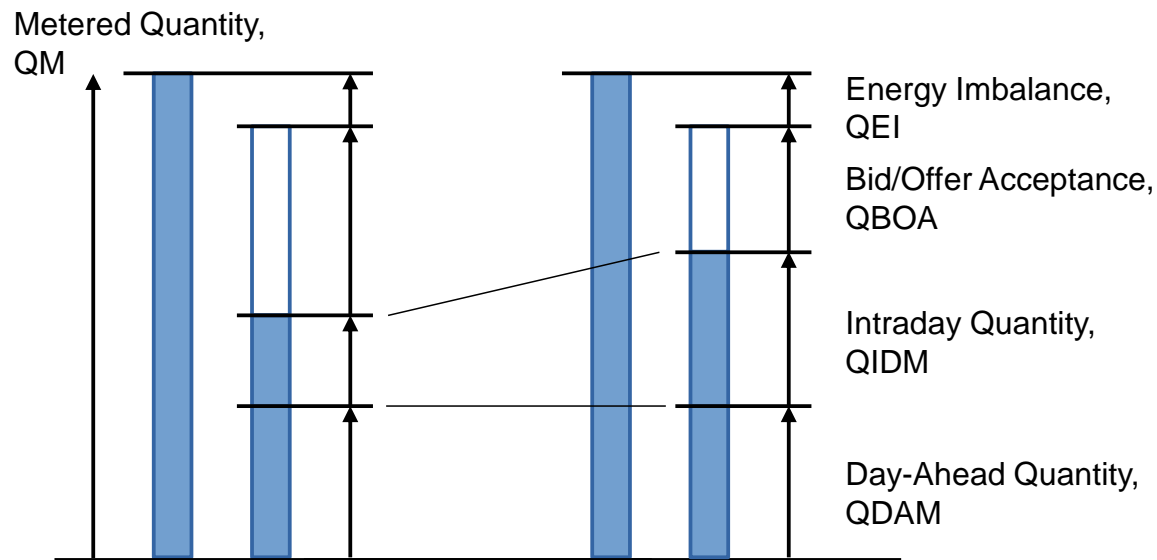
 - Should it have freedom to trade

But how should IDM trades interact with BM in the event of an overlap.

Bid-Offer Format & Intraday Trading

⌋ If cost function doesn't change then optimal dispatch does not change just because PN changes (Absolute MW format). Decouples dispatch decision from PN.

⌋ Possible for intraday trading to continue?



⌋ Intraday Price exchanged for Bid Offer Acceptance Price (PBOA)

⌋ OK if Offer/Bid Price equals Imbalance Price or Offer (Bid) Price less (more) than Imbalance Price. Otherwise treat like Bid-Offer non-delivery.

Bid-Offer Format & Intraday Trading

Concern that continued IDM trading could give opportunities for participants to arbitrage, e.g. low (local) system action dec price and high (national) ex-ante market prices, e.g.

- | (1) Gen sells 400MW at DAM price and submits PN;
- | (2) TSO decs Gen by 40MW, i.e. selling back 40MW at lower dec price;
- | (3) Gen resells 40MW in IDM.

But TSO dec'ing Gen by 40MW does not change PN. If Gen fails to reduce demand – for *any* reason – then dec will have been not delivered. Non-delivery rules prevent any arbitrage profit in exactly same manner as e.g. non-firm access.

Bid-Offer Format & Intraday Trading

- Could continued IDM trading and PN revisions compromise the ability of the TSO to efficiently balance the system?
- Under 'Absolute MW' format, change in PN does not change cost function
- All other things being equal, optimal dispatch level will remain unchanged regardless of PN change
 - PN change merely modifies quantities paid at Bid-Offer Prices and quantities paid ex-ante (or imbalance) prices
- Other factors, e.g. system conditions, availability of other generating units, etc., may change which change optimal dispatch. This is an existing problem.
- Notwithstanding, Bid-Offer Prices do not have to change in order to continue reflecting underlying costs, generator could, in principle, choose to revise prices. Would it be reasonable to place any restriction on this?

Firmness of Bid-Offer Acceptances (Undo Prices)

Is firmness of Bid Offer Acceptances an issue?

- Can the TSO unwind / cancel a Bid Offer Acceptance at any stage (within limits of generator/participant dynamics) without compensation?

 - Does generator have to sink costs which may not be recoverable?

- Prior to 1h ahead, generator could, in principle, resubmit a new price straight after initial acceptance

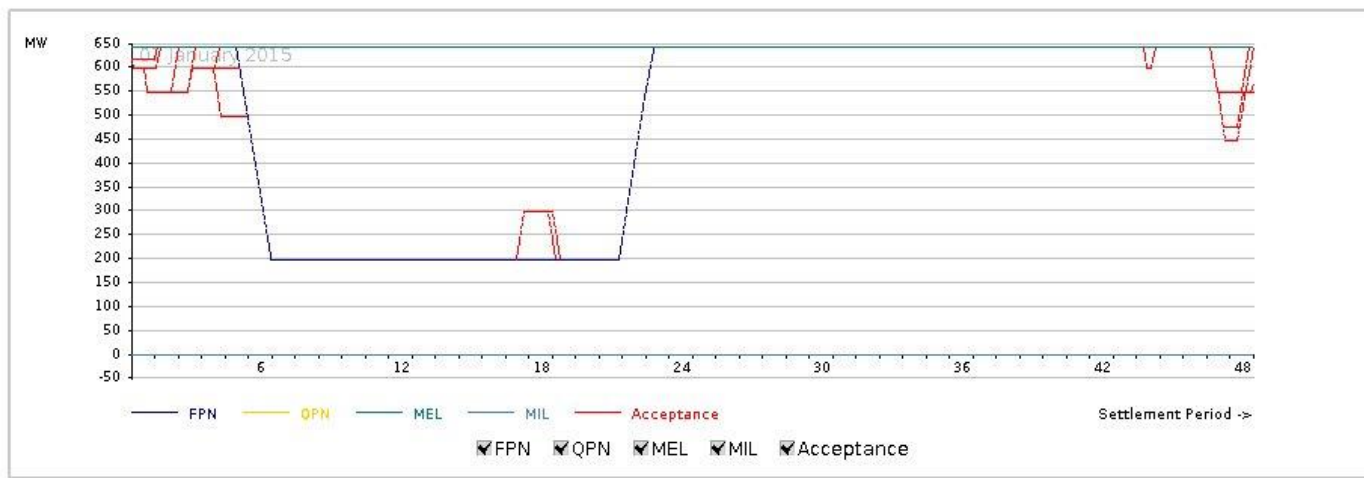
- Not possible if acceptance after gate closure

 - Likely no significant commitment decisions post 1h however

- For I-SEM

 - Are undo prices appropriate

Firmness of Bid-Offer Acceptances (Undo Prices)



FPN Data

Sett Period	From Time (GMT)	From Level	To Time(GMT)	To Level
T_DRAXX-1, T, Drax Power Ltd, DRAXX-1				
1	2015-01-01 00:00	645.000	2015-01-01 00:30	645.000
2	2015-01-01 00:30	645.000	2015-01-01 01:00	645.000
3	2015-01-01 01:00	645.000	2015-01-01 01:30	645.000
4	2015-01-01 01:30	645.000	2015-01-01 02:00	645.000
5	2015-01-01 02:00	645.000	2015-01-01 02:15	645.000
5	2015-01-01 02:15	645.000	2015-01-01 02:30	495.000
6	2015-01-01 02:30	495.000	2015-01-01 02:59	205.000
6	2015-01-01 02:59	205.000	2015-01-01 03:00	200.000
7	2015-01-01 03:00	200.000	2015-01-01 03:30	200.000
8	2015-01-01 03:30	200.000	2015-01-01 04:00	200.000
9	2015-01-01 04:00	200.000	2015-01-01 04:30	200.000

QPN Data

Sett Period	From Time (GMT)	From Level	To Time(GMT)	To Level
T_DRAXX-1, T, Drax Power Ltd, DRAXX-1				
1	2015-01-01 00:00	0.000	2015-01-01 00:30	0.000
2	2015-01-01 00:30	0.000	2015-01-01 01:00	0.000
3	2015-01-01 01:00	0.000	2015-01-01 01:30	0.000
4	2015-01-01 01:30	0.000	2015-01-01 02:00	0.000
5	2015-01-01 02:00	0.000	2015-01-01 02:30	0.000
6	2015-01-01 02:30	0.000	2015-01-01 03:00	0.000
7	2015-01-01 03:00	0.000	2015-01-01 03:30	0.000
8	2015-01-01 03:30	0.000	2015-01-01 04:00	0.000
9	2015-01-01 04:00	0.000	2015-01-01 04:30	0.000
10	2015-01-01 04:30	0.000	2015-01-01 05:00	0.000
11	2015-01-01 05:00	0.000	2015-01-01 05:30	0.000

Firmness of Bid-Offer Acceptances (Undo Prices)

Bid-Offer Level Data

Bid Offer Pair Number	From Time (GMT)	From Level (MW)	To Time (GMT)	To Level (MW)	Bid Price (£/MWh)	Offer Price (£/MWh)
T_DRAXX-1, T, Drax Power Ltd, DRAXX-1						
-4	2015-01-01 00:00	-645.000	2015-01-01 00:30	-645.000	-250.00000	45.00000
-3	2015-01-01 00:00	-155.000	2015-01-01 00:30	-155.000	-44.95000	45.00000
-2	2015-01-01 00:00	-95.000	2015-01-01 00:30	-95.000	-44.95000	45.00000
-1	2015-01-01 00:00	-95.000	2015-01-01 00:30	-95.000	-44.95000	45.00000
1	2015-01-01 00:00	100.000	2015-01-01 00:30	100.000	25.00000	80.00000
2	2015-01-01 00:00	645.000	2015-01-01 00:30	645.000	25.00000	150.00000
-4	2015-01-01 00:30	-645.000	2015-01-01 01:00	-645.000	-250.00000	45.00000
-3	2015-01-01 00:30	-155.000	2015-01-01 01:00	-155.000	-44.95000	45.00000
-2	2015-01-01 00:30	-95.000	2015-01-01 01:00	-95.000	-44.95000	45.00000
-1	2015-01-01 00:30	-95.000	2015-01-01 01:00	-95.000	-44.95000	45.00000
1	2015-01-01 00:30	100.000	2015-01-01 01:00	100.000	25.00000	80.00000
2	2015-01-01 00:30	645.000	2015-01-01 01:00	645.000	25.00000	150.00000
-4	2015-01-01 01:00	-645.000	2015-01-01 01:30	-645.000	-250.00000	45.00000
-3	2015-01-01 01:00	-155.000	2015-01-01 01:30	-155.000	-44.95000	45.00000
-2	2015-01-01 01:00	-95.000	2015-01-01 01:30	-95.000	-44.95000	45.00000
-1	2015-01-01 01:00	-95.000	2015-01-01 01:30	-95.000	-44.95000	45.00000
1	2015-01-01 01:00	100.000	2015-01-01 01:30	100.000	25.00000	80.00000
2	2015-01-01 01:00	645.000	2015-01-01 01:30	645.000	25.00000	150.00000

Source: www.bmreports.com

Recovery of Start Up Costs

- ┆ Recovery of start up costs not expected to be an issue with a BM where bids are submitted 1h in advance
 - ┆ Commitment decisions are made at this point
 - ┆ Peakers only plants likely to be committed
 - ┆ Main actions will be moving plant on the system up and down
- ┆ BETTA balancing market opens only one hour before delivery.
 - ┆ Hence any start-ups are instructed and paid for 'out of market'
 - ┆ STOR contracts
 - ┆ BM Start-Up
- ┆ I-SEM will have balancing market opening immediately after DAM
- ┆ TSO may need to commit plants in the BM and before 1h ahead
 - ┆ Local constraints
 - ┆ Reserves

Recovery of Start Up Costs (2)

	Peaker	CCGT
Capacity (MW)	50	400
Start Up Cost (€)	1,000	100,000
€/MWh	20	250

- Recovery of large start up costs through simple hourly PQ pairs may lead to spikey bids
- Could be an issue if this feeds through to energy imbalance price (pricing to be discussed later)
- Other options could be considered
 - Start Up Contracts
 - Block Bids
 - Explicit Start Up Costs

Recovery of Start Up Costs (3)

Start Up Contracts

- Straightforward to implement
- Transparency could be an issue
- How to procure
 - Bilateral or competition
 - Length of contract

Block Bids

- Consistency with DAM and IDM
- Should offer a level of flexibility in the BM
 - Flexible blocks
- Would that flexibility be sufficient for the TSOs

Explicit Start Up Costs

- Consistency with current SEM
- Might make commitment and dispatch decisions more straightforward
- Does it require a more complex algorithm than other options

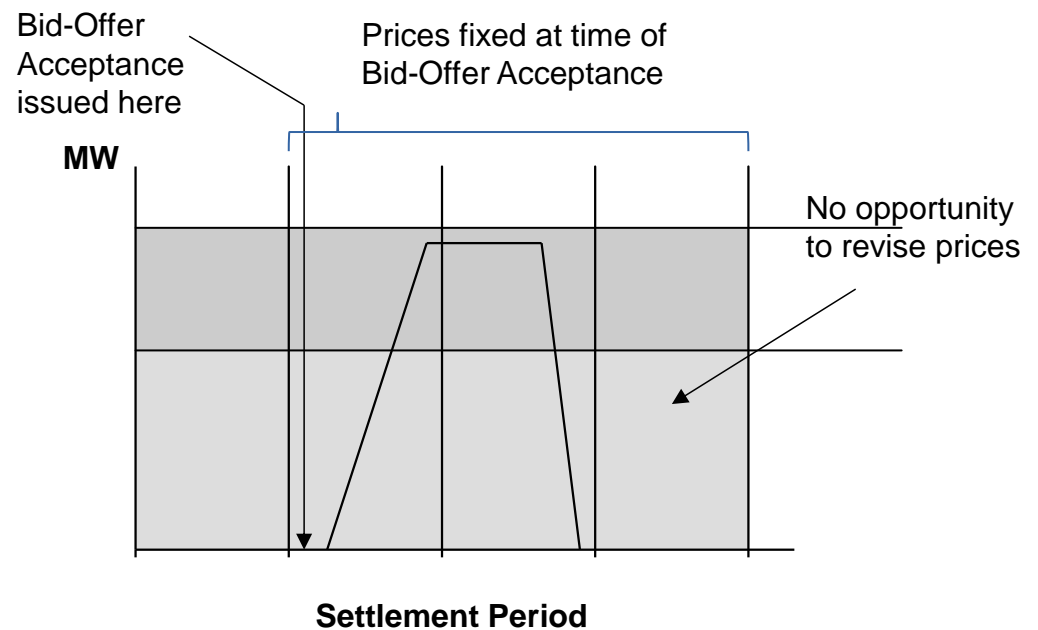
Recovery of Costs using Simple Incs/Decs

Is it appropriate to allow alternative, mutually-exclusive block bids?

ie.g. €x/MWh for 4 Settlement Periods/hours or €y/MWh for 6 Settlement Periods/hours

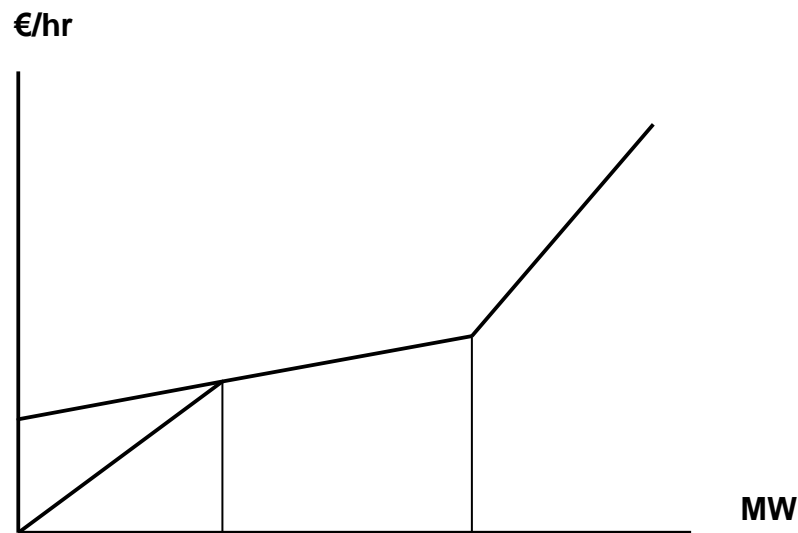
li.e. specify Minimum MWh running

Performs similar function to start-up cost



Recovery of Costs using Simple Incs/Decs

First incremental price higher than subsequent incrementals?



Performs similar function to no-load cost

With mechanisms for recovery of fixed costs, are undo prices necessary?

Rebidding

- ‡ Unlike e.g. BETTA, I-SEM High Level Design has BM and IDM open simultaneously
- ‡ Balancing Market opens shortly after DAM closes
- ‡ Balancing Market opening is when TSO can *start* accepting Offers and Bids. (NB When TSO *stops* accepting Offers/Bids determined by individual genset TOD ~ gives rise to notion of “last chance to call”)
- ‡ PNs, Offers and Bids can be revised until Gate Closure
- ‡ Implies that Offers and Bids can be accepted before the opportunity to revise prices has expired

Rebidding – Freezing Prices

Clearly perverse results if Bid-Offer Prices (P_{BO}) can be revised after they have been accepted by TSO, i.e. participant can merely raise price of accepted Offers / reduce price of accepted Bids.

What has to be “frozen” for accepted Offers and Bids?

- freeze all Bid-Offer Prices for accepted generating unit

- freeze price of accepted Bid-Offer quantities only. Prices for remaining quantities (including dec prices for any accepted incs or inc prices for any accepted decs) can be rebid

- freeze price accepted Bid-Offer quantities and corresponding undo prices

NB if all Bid-Offer Prices frozen for accepted generating units then a scenario could arise where large volume of BM quantities have prices frozen.

- E.g. where many small early BM offer acceptances are needed

Rebidding

