



# **Imbalance Energy Price Model**

Workshop Risk Management 03.12.2015



- ➤ Imbalanced balance groups are balanced by the BGC.
- Balance groups turn into imbalance energy supplier/consumer that energy is provided by the BGC.
- > That energy will be settled via the so-called imbalance energy price.
- > Part of that imbalance energy comes from control reserves.
- > Costs of control reserve energy will be allocated via the imbalance energy price.
- In Austria, approx. 30% of the total control reserve costs are charged via the imbalance energy price.
- The remainder will be charged to generators (above 5MW) according to their overall generation.



fair distribution of costs	• Fair distribution of balancing energy costs is desired.
proximity to market price	• Imbalance energy prices should be close to market prices (EPEX or EXAA). Otherwise increasing risk for market participants.
prevent arbitrage	<ul> <li>Two different prices (exchange price, balancing energy price) in one system yields risk of speculation and arbitrage attempts. Create build-in mechanisms to avoid those attempts.</li> </ul>
cause low volatility	• Avoid jumps and volatility of prices.
publishing	<ul> <li>Publishing of all price and quantity data, such that all market participants are able to comprehend pricing. Publishing of current control area imbalance.</li> </ul>
market oriented signals through price model	• Price mechanism should motivate market participants to minimize imbalance energy costs through better forecasts.
one-price model	• One price per time unit, i.e. those who over supply and those who under supply pay/get paid the same price.



- Revenues Energy pos. aFRR IGCC
- Costs Energy pos. aFRR IGCC
- Costs Energy neg. aFRR INC
- Revenues UCTE
- Costs Energy neg. mFRR
- Costs Capacity pos. Default Reserve
- Revenues Energy neg. aFRR
- Costs Energy SecBal Default Reserve

- Revenues Energy neg. aFRR IGCC
- Revenues Energy pos. aFRR INC
- Costs Energy pos. aFRR INC
- Costs UCTE
- Costs Energy pos. mFRR
- Revenues withheld Capacity mFRR
- Costs Energy neg. aFRR
- Costs Capacity neg. aFRR

- Costs Energy neg. aFRR IGCC
- Revenues Energy neg. aFRR INC
- Revenues Energy pos. aFRR
- Revenues Energy neg. mFRR
- Costs Capacity neg. mFRR
- Revenues withheld Capacity aFRR
- Costs Energy pos. aFRR
- Costs Capacity pos. aFRR





#### Control Area Imbalance (01.06.2015)



Power decrease



### **Price Model as Cost Distribution Mechanism**

**According to Control Area Delta** 



## **Pricing Model as Cost Distribution Mechanism**

APCS

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**Imbalance Energy Prices dependent on Control Area Imbalance** 





determine funnel curve	<ul> <li>Cost blocks per months (TR, SR, UA)</li> <li>CAD per 1/4h</li> <li>Seek for 20% socialization for consumers</li> <li>Determine Umax,S</li> </ul>
balancing energy price 1 (for balancing energy)	<ul> <li>Base price = price from MOL or energy exchange price</li> <li>CAD per ¼ h determines surcharge (min=3, max= 200)</li> <li>Imbalance energy price 1 = base prices + surcharge (funnel curve value at CAD)</li> </ul>
balancing energy price 2 (for consumption)	<ul> <li>Imbalance energy price 2 = (total costs – revenues from Imbalance energy price 1)/(aggregated consumption of all balance groups)</li> <li>Imbalance energy price 2 can be negative if revenues are high</li> </ul>
publishing	<ul> <li>Control Area Delta = online on APG homepage</li> <li>Imbalance energy prices will be determined by APCS and published approximately at the end of following month.</li> </ul>



### **Control Area Delta and Imbalance Energy Price**

Imbalance

MWh



MWh

Imbalance

Energy**Monitor**.at

**Imbalance Energy Price Model** 



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The price function (surcharge) will be calculated every month and is valid for the whole one-month settlement period.



### **Imbalance Energy Price Model**

Max

surcharge function





## **Imbalance Energy Prices**



Due to high price offers, the base price reaches high levels, such that revenues from imbalance settlements will be higher than the balancing energy costs. The "surplus" will be paid out through negative socialization.



## **Indicative Prices**

## Concept



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Formula for clearing price is:

$$P_{Clearing,t} = P_{Basis,t} \left\{ \begin{array}{c} + \\ - \end{array} \right\} \min \left( U_{min} + \frac{U_{max} - U_{min}}{V_{max}^2} \cdot V_t^2, U_{max} \right) \left\{ \begin{array}{c} if \ V_t > 0 \\ if \ V_t < 0 \end{array} \right.$$
where

$$P_{Basis,t} = \begin{cases} \max(P_{EXAA,t}, P_{TRL,t}), & \text{if } V_t > 0\\ \min(P_{EXAA,t}, P_{TRL,t}), & \text{if } V_t < 0 \end{cases}$$

- $\sim$  Control Area Imbalance  $V_t$ ,  $P_{TRL,t}$  and  $P_{EXAA,t}$  are know the day after
- Only uncertainty is  $U_{max}$ :  $40 \frac{€}{MWh} \le U_{max} \le 200 \frac{€}{MWh}$



#### $\sim$ The graph shows both extremal values $U_{max,s}$ at 40 and 200.







#### Indicative Prices vs. actual prices in month march:

– estimated Umax = 120 €/MWh





#### Indicative Prices vs. actual prices in month march:

estimated Umax = 40 €/MWh





### On the current day, indicative prices are set to

$$P = \pm \max(3 * P_{EXAAhourly,t}, 75)$$



## **Adjustments Price Model**



- > Price model shall be adjusted coming January 2016.
- > Adjustment goal is to reduce negative socialization.
- Those adjustments will be made based on recommendations from a working group within Österreich Energie association and on the regulators request.



- Base price
  - NEW: MIN/MAX(EXAA DA price, EEX avg. ID price, TR price only on calls)
  - OLD MIN/MAX(EXAA DA price, TR price)
- Other parameters:
  - U\_min = 1,5 €/MWh
  - o U\_max,MIN = 20 €/MWh
  - U\_max,MAX = 200 €/MWh
  - V\_max = 75 MWh, s=0,2
  - Quadratic surcharge function
  - Costs according to current allocation formula

(OLD: 3 €/MWh) (OLD: 40 €/MWh)

Expectations from adjustments:

Reduction of negative socialization and with that reduction of additional revenues form imbalance energy settlement



#### socialization share and Umax<sub>s</sub>

- Umax<sub>s</sub> in adjusted model
- Umax, in current model
- socialization share in adjusted model
- socialization share in current model



Socialization share "gets better" and is located closer to the aimed level of 20%, but is still far away.





## Please have a look at

## www.energymonitor.at