Scalable Complex Orders
Project Meeting #3

15th October 2021

Agenda

Session 1: Project Management (15 min)

- Project Plan Review
- Reminders and Updates

Session 2: Conversion Analysis (1hr 20 min)

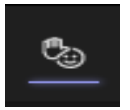
- Questionnaire Summary
- Overview of Conversion 2
  - Methodology Used
  - Summary Results
- Member Insights Sharing

- **Next Steps (10 min)**
- **Q&A (15 min)**

Housekeeping Rules

- ✓ *Keep your video switched off*

- ✓ *Raise the hand if you have a question*



- ✓ *Keep your line muted unless asking a question*

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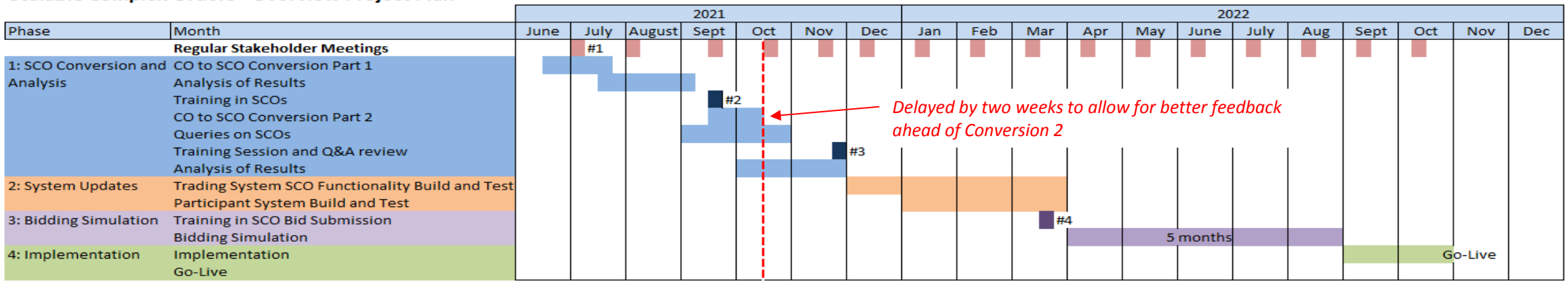
Session 1: Project Plan Review

Scalable Complex Orders - Overview Project Plan



Complete Tasks	Current Tasks	Future Tasks
Analysis and Feedback of Conversion 1 Data	Member Meeting #3 (15 Oct)	Member Analysis and Queries on Conversion 2 Data to SEMOpx/N-Side (12 Nov)
Adaptation of Conversion 1 Methodology	Provision of Conversion 2 Data	Member Meeting #4 (19 Nov)
Questionnaire	N-Side support of queries on Analysis & SCO's	
Member Meeting #2 (17 Sept)		

*red items indicate member involvement requested

Session 1: Reminders

#3 – 15th October 2021 (Conversion 2 Results)

#4 – 19th November 2021 (Conclusion on Conversion 2 Results)

Meeting invites will be issued ahead of each event.

Agenda

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Session 2: Conversion Analysis (1hr 20 min)

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- **Next Steps (10 min)**
- **Q&A (15 min)**

Questionnaire Summary

- 4 of 9 current complex order users responded
  - Thank you for taking the time to complete
  - Responses were very useful in helping to consider scenarios for Converison 2

- Main themes on responses to next conversion options:
  - *Fixed Term*: Increase, Increase/Decrease, don't change (use P*)
  - *Cost Curves*: 1st step match VMIC, increase cost curves, leave cost curves alone
  - *Price Forecasts*: use different price forecast, on/off peak, use actuals, don't change
  - *Minimum Acceptance Volume*: worth exploring, set to Min Avail Gen
  - Also, request for multiple scenarios evaluated

- Feedback discussed with N-Side and Conversion 2 scenarios identified
  - N-Side have accommodated the multiple scenarios request

- Scenarios for Conversion 2
  - Round 2 Option 1: Minimum Acceptance Volume (first step of bid curve)
  - Round 2 Option 2: Minimum Acceptance Volume (first step of bid curve) + Fixed Terms Increased 20%
  - Round 2 Option 3: Fixed Term Increased 20% (No MAV)
  - Round 2 Option 4: Fixed Term Decreased by 20% (No MAV)

Analysis of Market impacts resulting from the different conversion rules

N-SIDE
OPTIMIZING YOUR DECISIONS

Important remarks

- In theory, **not possible to have no market impact**, as **products are slightly different**
- **"Low market impact"** essentially **good to "ease the transition"** but **doesn't mean that market results with Classic Complex Orders are an ideal benchmark**
  - The "Classic Complex Order" misses Min. Acceptance Volumes and features "two types of variable costs"
  - The increased expressiveness of the SCO product should benefit to market participants
  - The increased expressiveness of the SCO product should benefit to the overall market efficiency

Conversion rules in scope

Round 1 – Conversion rule 1 (benchmark)

Round 2 Option 1: Addition of a Minimum Acceptance Volume (MAV) = Quantity of the 1st step of the bid curve in each period

- Leads to substantially lower CO cleared volumes and higher market prices
- Increasing Fixed Terms, or modifying bid curves to increase 1st P-Q step would only degrade the situation → discarded
- However, best conversion rule in terms of profits

Round 2 Option 2: Addition of a (MAV) and Fixed Terms from Round 1 decreased by 20 %

- Only partially mitigate the negative impact of Option 1
- Leads to the lowest average paradoxically rejected volumes

Round 2 Option 3: Fixed Terms from Round 1 increased by 20 % (no MAV)

- High market impacts linked to more SCO being rejected, leading to higher prices but also higher paradoxically rejected volumes

Round 2 Option 4: Fixed Terms from Round 1 decreased by 20 % (no MAV)

- Rather low market impacts but higher than with Conversion 1 (Round 1)

Agenda

Conversion rules in scope in the 2nd round of simulations

Comparison of the conversion rules

- **Impact on market prices**
- Impact on profits of complex orders
- Impact on cleared volumes
- Impact on paradoxically rejected complex order volumes

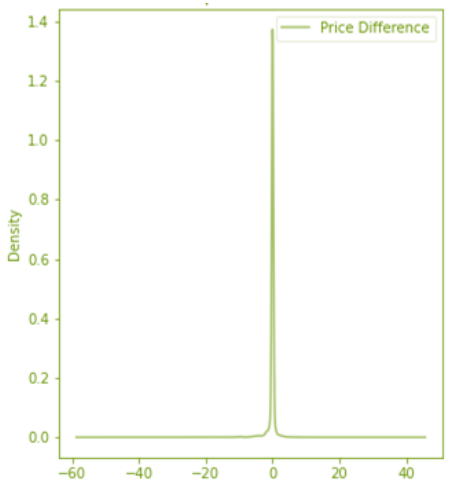
Technical minimum volumes and Classic vs Scalable Complex Orders

Conclusions

The lowest impact on market prices is obtained with conversion 1

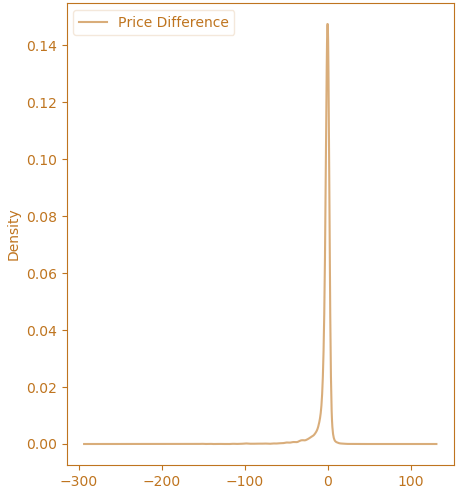
Prices with Classic CO – **Prices with Scalable CO**
Historical data 2020 – Euphemia 10.6 – 8784 observations

Conversion 1 (Round 1)



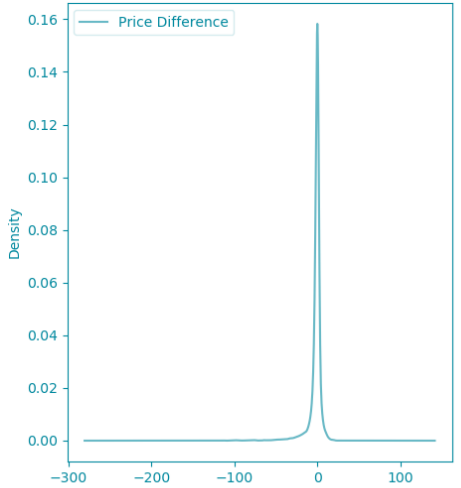
- ***identical* 72% of the time** (6309 hourly periods out of 8784)
- **different by less than 1 €/MWh 92 % of the time** (8098 hourly periods out of 8784)

Round 2 Option 1
Minimum Acceptance Volumes
FT conversion from Round 1



- ***identical* 28% of the time** (6309 hourly periods out of 8784)
- **different by less than 1 €/MWh 79 % of the time** (8098 hourly periods out of 8784)

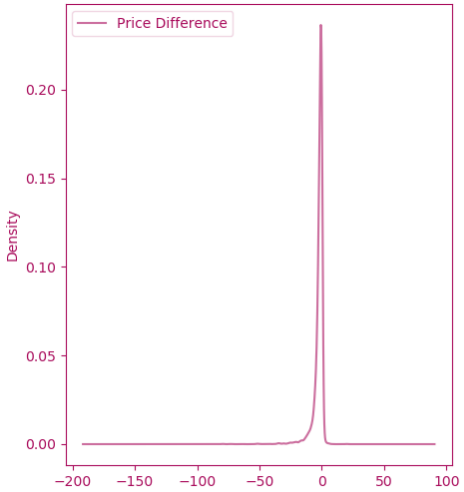
Round 2 Option 2
Minimum Acceptance Volumes
FT conversion from Round 1 **– 20%**



- ***identical* 23% of the time** (6309 hourly periods out of 8784)
- **different by less than 1 €/MWh 49 % of the time** (8098 hourly periods out of 8784)

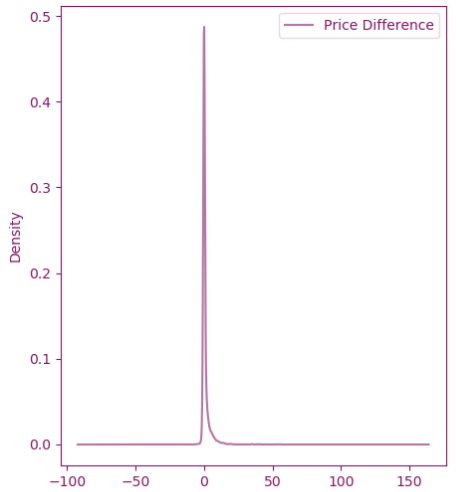
Adding MAV tends to lead to higher market prices with SCOs due to less SCO matched (cf. lower cleared volumes below)

Round 2 Option 3
FT conversion from Round 1 **+ 20%**



- ***identical* 10% of the time** (6309 hourly periods out of 8784)
- **different by less than 1 €/MWh 43 % of the time** (8098 hourly periods out of 8784)

Round 2 Option 4
FT conversion from Round 1 **– 20%**



- ***identical* 52% of the time** (6309 hourly periods out of 8784)
- **different by less than 1 €/MWh 78 % of the time** (8098 hourly periods out of 8784)

Option 4 leading to more SCO accepted and lower prices

N.B.
Positive difference →higher profits with Classic CO
Negative difference →higher profits with Scalable CO

The lowest impact on market prices is obtained with conversion 1

Prices with Classic CO – **Prices with Scalable CO (€/MWh)**
Historical data 2020 – Euphemia 10.6 – 8784 observations

	Conversion 1 (Round 1)	Round 2 Option 1 Minimum Acceptance Volumes FT conversion from Round 1	Round 2 Option 2 Minimum Acceptance Volumes FT conversion from Round 1 – 20%	Round 2 Option 3 FT conversion from Round 1 + 20%	Round 2 Option 4 FT conversion from Round 1 – 20%
	Price Difference	Price Difference	Price Difference	Price Difference	Price Difference
mean	-0,16565	-3.44364	-2.33973	-2.48356	1.011827
std	1,499967	10.94492	9.483722	5.239626	3.650918
min	-32,7	-187.48	-175	-121.09	-28.14
1%	-5,8419	-51.0425	-45.0255	-22.9119	-1.2717
5%	-1,1585	-17.3185	-14.3125	-9.0185	-0.3
10%	-0,25	-8.217	-6.527	-5.65	-0.02
20%	0	-3.734	-2.974	-3.364	0
25%	0	-2.7825	-2.2	-2.8	0
30%	0	-2.16	-1.65	-2.36	0
40%	0	-1.198	-0.7	-1.72	0
50%	0	-0.33	0	-1.21	0
60%	0	0	0	-0.81	0
70%	0	0	0	-0.4	0.23
75%	0	0	0.06	-0.21	0.59
80%	0	0	0.32	-0.06	1.044
90%	0,03	0.35	1.78	0	3.067
95%	0,3485	1.26	4.16	0.02	5.81
99%	2,2834	5	9.98	1.11	13.8838
max	19,56	24.51	35.75	19.95	100

N.B.
Positive difference →higher prices with Classic CO
Negative difference →higher prices with Scalable CO

Agenda

Conversion rules in scope in the 2nd round of simulations

Comparison of the conversion rules

- Impact on market prices
- **Impact on profits of complex orders**
- Impact on cleared volumes
- Impact on paradoxically rejected complex order volumes

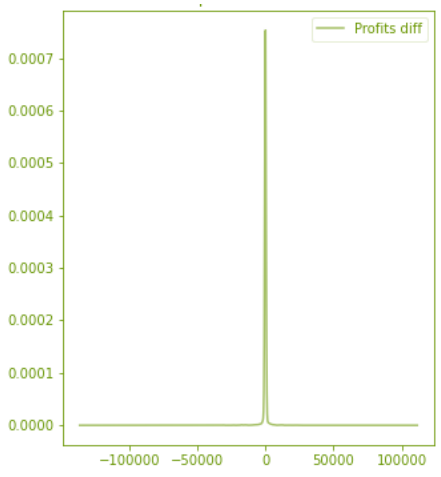
Technical minimum volumes and Classic vs Scalable Complex Orders

Conclusions

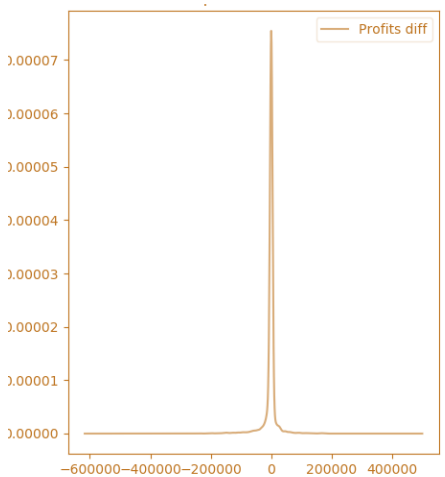
Impact on profits of complex orders is better with conversion 1

Complex Order Profits with Classic CO – Complex Order Profits with Scalable CO
Historical data 2020 – Euphemia 10.6 - 8948 observations

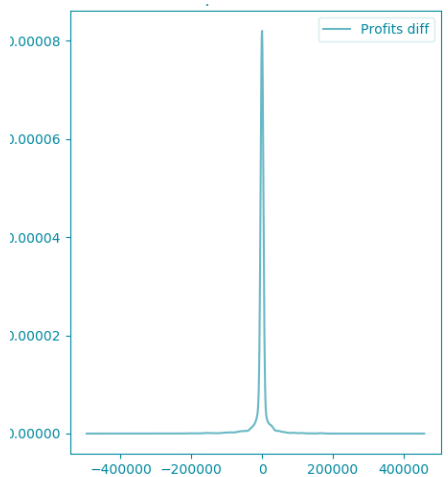
Conversion 1 (Round 1)	Round 2 Option 1 Minimum Acceptance Volumes FT conversion from Round 1	Round 2 Option 2 Minimum Acceptance Volumes FT conversion from Round 1 **– 20%**	Round 2 Option 3 FT conversion from Round 1 **+ 20%**	Round 2 Option 4 FT conversion from Round 1 **– 20%**



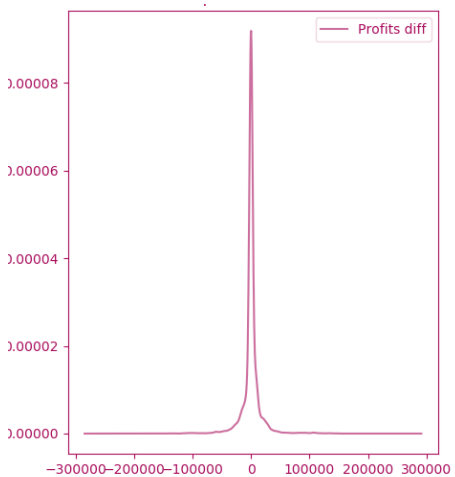
- *Different by less than 1 € in* 71% of the cases
- Different by less than 5000 € in 98% of the cases



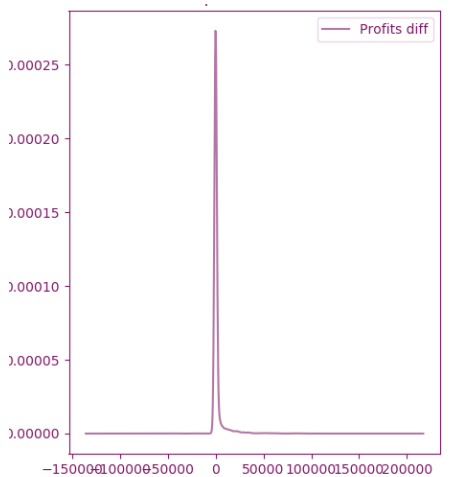
- *Different by less than 1 € in* 58% of the cases
- Different by less than 5000 € in 80% of the cases



- *Different by less than 1€ in* 56% of the cases
- Different by less than 5000 € in 79% of the cases



- *Different by less than 1€ in* 57% of the cases
- Different by less than 5000 € in 66% of the cases



- *Different by less than 1€ in* 62% of the cases
- Different by less than 5000 € in 93% of the cases

N.B.
Positive difference →higher profits with Classic CO
Negative difference →higher profits with Scalable CO

Impact on profits of complex orders is the lowest with conversion 1

Profits are higher with Option 1

Complex Order Profits with Classic CO – Complex Order Profits with Scalable CO
Historical data 2020 – Euphemia 10.6 - 8948 observations

	Conversion 1 (Round 1)	Round 2 Option 1 Minimum Acceptance Volumes FT conversion from Round 1	Round 2 Option 2 Minimum Acceptance Volumes FT conversion from Round 1 – 20%	Round 2 Option 3 FT conversion from Round 1 + 20%	Round 2 Option 4 FT conversion from Round 1 – 20%
	Profits Difference	Profits Difference	Profits Difference	Profits Difference	Profits Difference
mean	-162,153	-2841.03	-1381.84	318.8812	1701.199
std	2913,353	25864.15	23416.7	16970.75	7759.578
min	-74325,3	-337899	-257117	-140692	-47472
1%	-8200,33	-125206	-101870	-54331.2	-755.401
5%	-448,853	-28359.2	-23396.9	-20001.8	-12.7622
10%	-55,159	-9758.31	-7463.81	-10963.5	-5.3E-06
20%	-6E-05	-952.009	-516.888	-1403.28	0
25%	0	-341.667	-128.92	0	0
30%	0	-44.0044	0	0	0
40%	0	0	0	0	0
50%	0	0	0	0	0
60%	0	0	0	0	0
70%	0	0	0	0	3.402768
75%	0	0	0	0	79.27962
80%	0	0	0	3099.608	330.8567
90%	7,932004	92.06658	3898.615	10355.97	2540.313
95%	172,1986	13285.04	18019.12	21141.46	9993.314
99%	3647,634	64119.78	66547.05	61766.11	36391.6
max	49511,98	220107	220107	147181.7	128839.7

N.B.
Positive difference →higher profits with Classic CO
Negative difference →higher profits with Scalable CO

Highest profits on average with Option 1, assuming the same conversion is used by all market participants

Agenda

Conversion rules in scope in the 2nd round of simulations

Comparison of the conversion rules

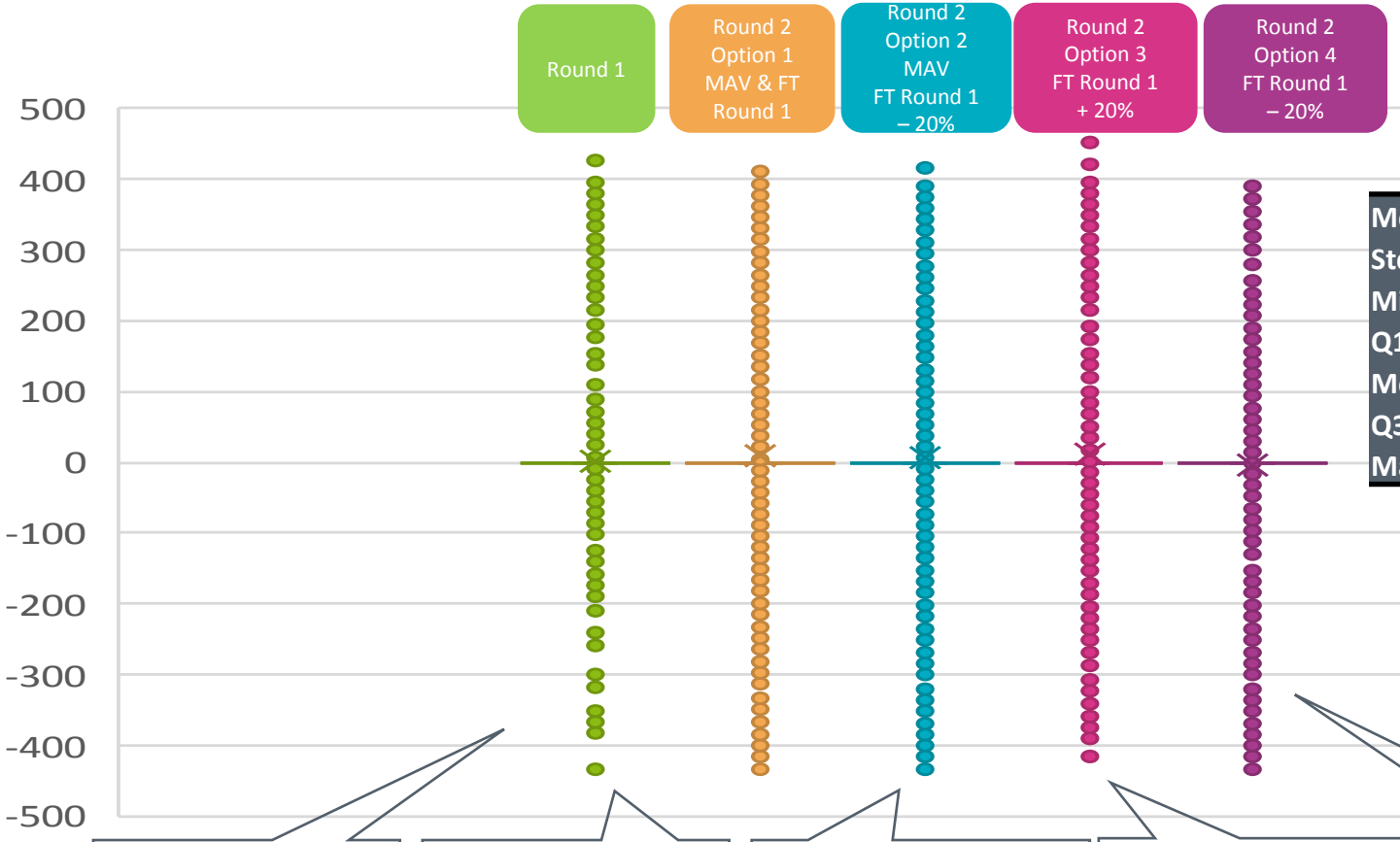
- Impact on market prices
- Impact on profits of complex orders
- **Impact on cleared volumes**
- Impact on paradoxically rejected complex order volumes

Technical minimum volumes and Classic vs Scalable Complex Orders

Conclusions

Impact on cleared volumes is in general modest, and lowest with Conversion 1

Comparison of complex order cleared volume per period per complex order **(MWh) – "Classic CO volumes – Scalable CO volumes"**
Production data 2020. Euphemia 10.6
(214 752 observations)



Increasing vs decreasing Fixed Terms by 20 % here doesn't have the same proportional effect

Mean	0.52	8.50	5.86	10.82	-2.86
Std	21.44	58.44	64.73	65.21	37.19
Min	-433.00	-433.00	-433.00	-416.60	-433.00
Q1	0.00	0.00	0.00	0.00	0.00
Median	0.00	0.00	0.00	0.00	0.00
Q3	0.00	0.00	0.00	0.00	0.00
Max	429.00	425.00	415.90	451.00	392.00

N.B.
Positive difference →higher cleared vol. with Classic CO
Negative difference →higher cleared vol. with Scalable CO

Conversion Rule Round 1
Cleared volumes identical within 0.001MWh (=1KWh) in 99% of the cases

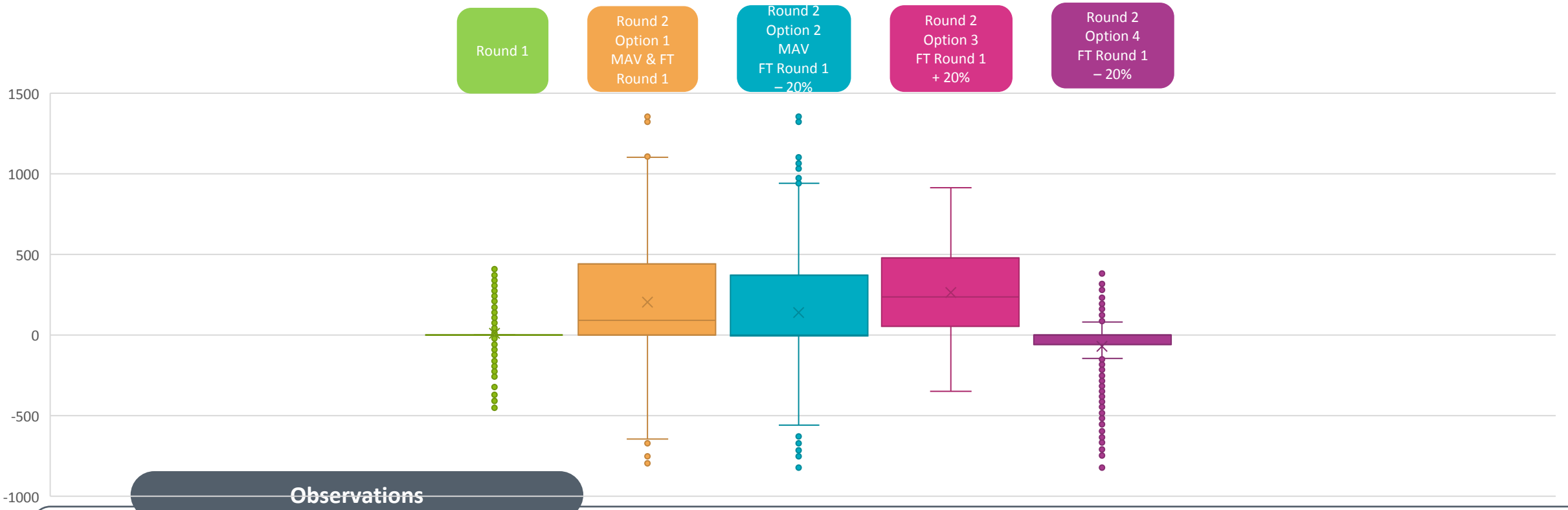
Conversion Rule Round 2 Option 1 (MAV)
Cleared volumes identical within 0.001MWh (=1KWh) in 93% of the cases

Conversion Rule Round 2 Option 2 (MAV, FT Round 1 −20%)
Cleared volumes identical within 0.001MWh (=1KWh) in 92% of the cases

Conversion Rule Round 2 Option 3 (FT Round 1 +20%)
Cleared volumes identical within 0.001MWh (=1KWh) in 78% of the cases

Conversion Rule Round 2 Option 4 (FT Round 1 −20%)
Cleared volumes identical within 0.001MWh (=1KWh) in 98% of the cases

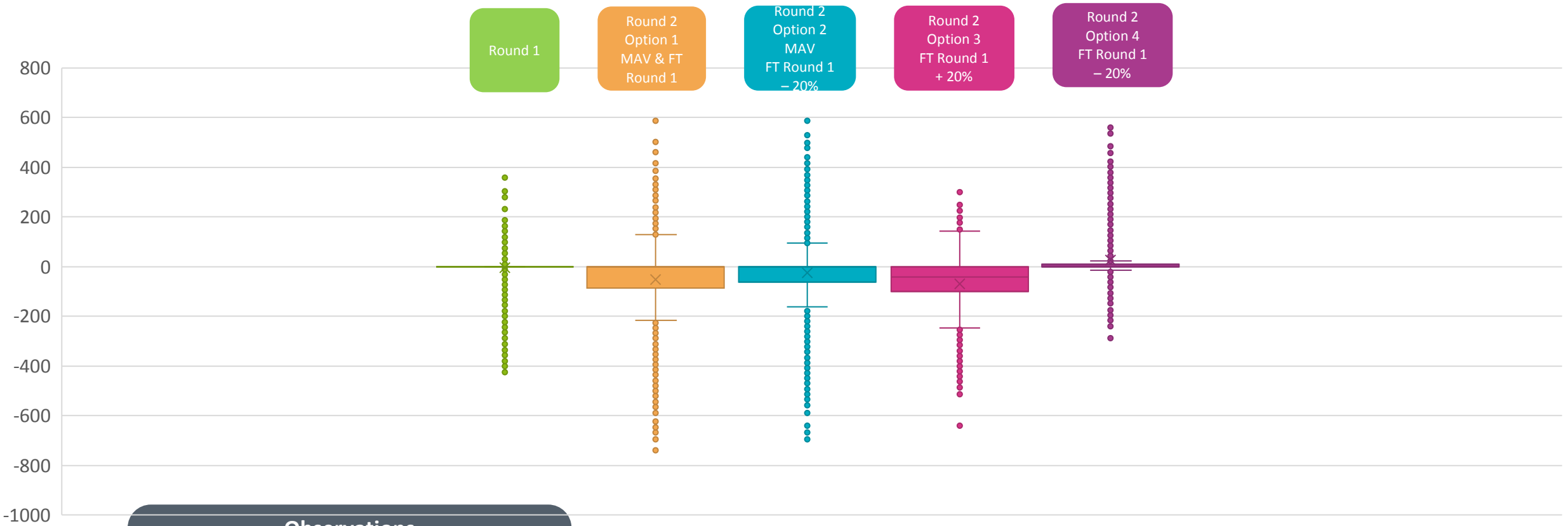
Comparison of total complex order cleared volumes per period (MWh) – "Classic CO volumes – Scalable CO volumes"
Production data 2020. Euphemia 10.6
(8784 observations)



Observations

- Lower complex order volumes are cleared with Options 1, 2, and 3, due to the increased Fixed Terms in Option 3, or the additional MAV constraints: MAV constraints force acceptances of (here) low price P-Q pairs in case of acceptance of the SCO, that would lead to violations of min. income conditions (MIC), and more SCOs are rejected because their MIC would not be met.
- Conversion 1 and Option 4 lead to the smallest differences compared to the Classic CO case, consistent with the other low market impacts observed for these conversion rules

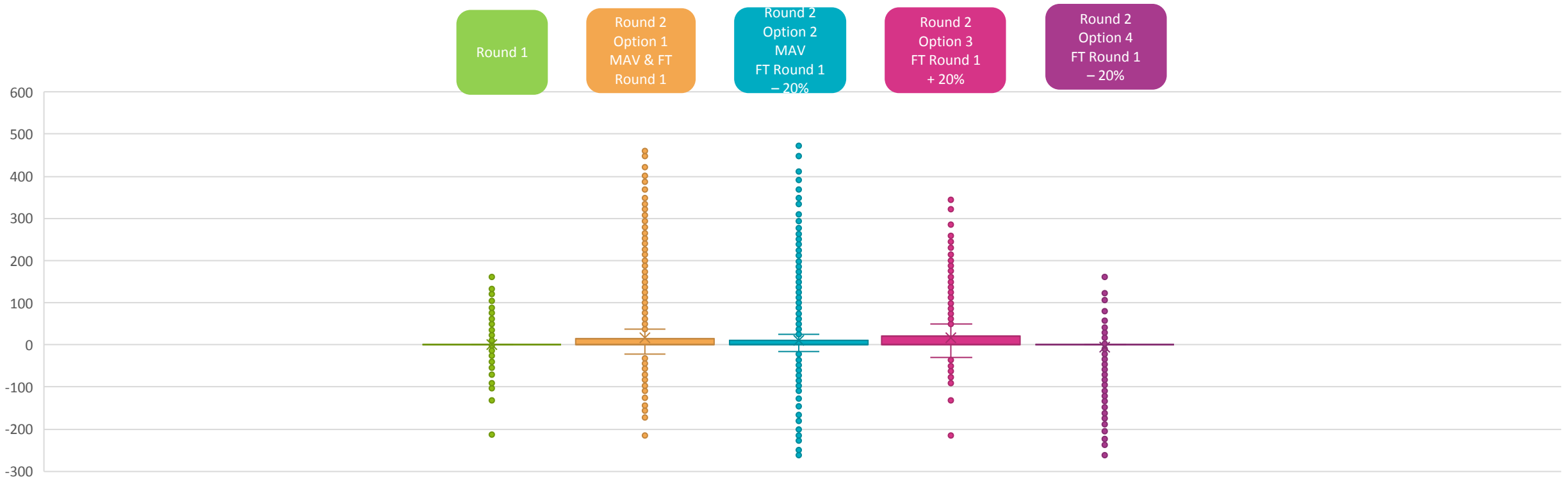
Comparison of total supply simple order cleared volumes per period (MWh) – "Classic CO volumes – Scalable CO volumes"
Production data 2020. Euphemia 10.6
(8784 observations)



Observations

- Higher simple supply order volumes are cleared with Options 1, 2, and 3: this is consistent with having lower SCO cleared volumes → compensated here by simple supply orders (impact on simple demand orders seem rather low, see next slide)

Comparison of total demand simple order cleared volumes per period (MWh) – "Classic CO volumes – Scalable CO volumes"
Production data 2020. Euphemia 10.6
(8784 observations)



Observations

Impact on cleared simple demand orders is in general low, save a few outliers related to outliers for complex and simple supply orders

Agenda

Conversion rules in scope in the 2nd round of simulations

Comparison of the conversion rules

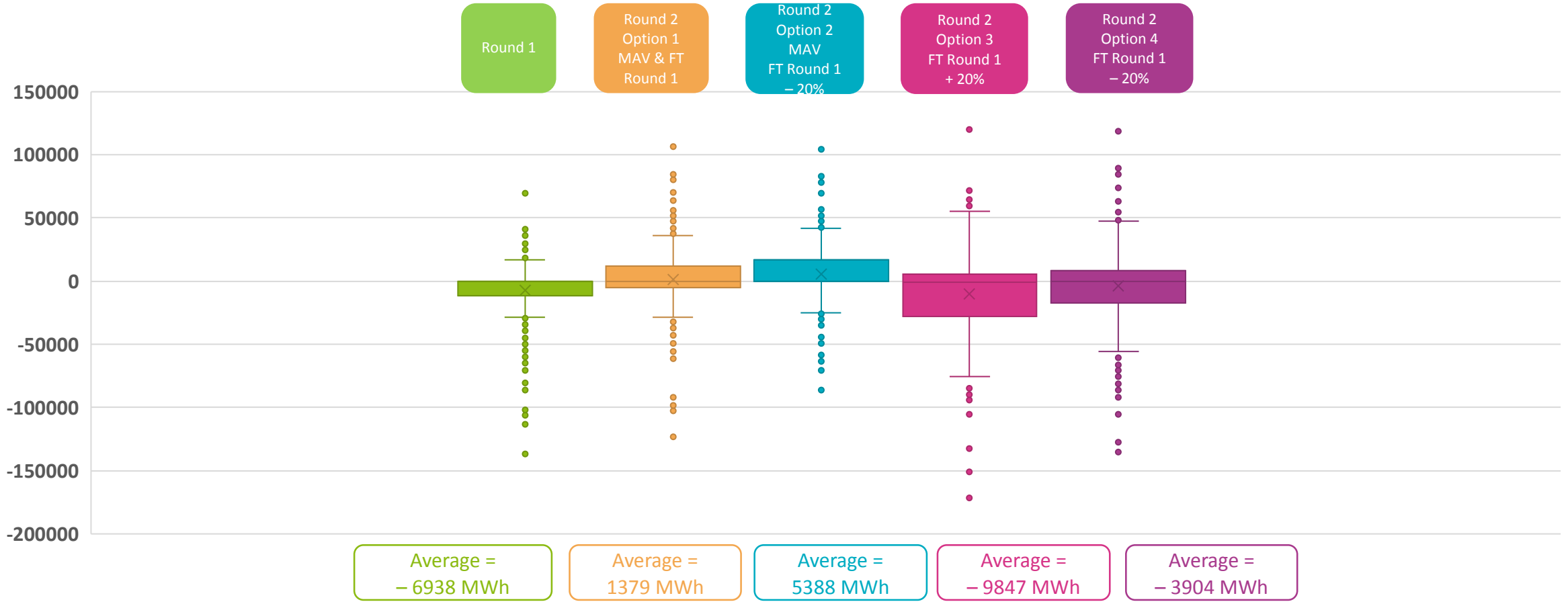
- Impact on market prices
- Impact on profits of complex orders
- Impact on cleared volumes
- **Impact on paradoxically rejected complex order volumes**

Technical minimum volumes and Classic vs Scalable Complex Orders

Conclusions

Comparison of conversion rules

Impact on paradoxically rejected orders → uncleared volume



Observations

- Slightly higher volumes tend to be paradoxically rejected after the translation from CO to SCO with
  - Conversion 1 in Round 1
  - Conversion Round 2 Option 3
  - Conversion Round 2 Option 4
- Conversions Round 2 Option 1 & 2 featuring MAV lead to less paradoxically rejected (PR) volumes → this should be related to MAV which would incur losses if the orders were accepted, and the orders can less often be considered as PR.

Agenda

Conversion rules in scope in the 2nd round of simulations

Comparison of the conversion rules

- Impact on market prices
- Impact on profits of complex orders
- Impact on cleared volumes
- Impact on paradoxically rejected complex order volumes

Technical minimum volumes and Classic vs Scalable Complex Orders

Conclusions

Classic Complex Orders do not fully ensure that “technical minimums” are met

→ Scalable Complex Orders guarantee minimum volumes even without setting 1st P-Q pairs to low levels

Here, **technical minimums defined as quantity of the 1st P-Q pair** (1st step) of each complex order bid curve

Differences “Cleared volume – Technical Minimum” (MWh)
for activated Classic Complex Orders - Historical data 2020 – Euphemia 10.6 – 215 424 observations

- Negative values correspond to cases where the cleared volume in a given period for a given complex order is lower than the quantity of the 1st P-Q pair
- Such a situation occurs in 2020 in 4% of the periods for activated Classic Complex Orders, despite having 1st P-Q pairs set to very low levels to avoid rejection
- Scalable Complex Orders ensure by construction that technical minimums are met, without having to set the 1st P-Q pair to a very low level

Agenda

Conversion rules in scope in the 2nd round of simulations

Comparison of the conversion rules

- Impact on market prices
- Impact on profits of complex orders
- Impact on cleared volumes
- Impact on paradoxically rejected complex order volumes

Technical minimum volumes and Classic vs Scalable Complex Orders

Conclusions

Results summary

Conversion rule	Round 1 (Conversion 1)	Round 2 Option 1 MAV	Round 2 Option 2 MAV + FT Round 1 – 20%	Round 2 Option 3 FT Round 1 + 20%	Round 2 Option 4 FT Round 1 – 20%
Impact on market prices	Low	Medium to high higher with SCO (highest prices)	High higher with SCO	High higher with SCO	Medium lower with SCO
Impact on Profits per CO	Low higher with SCO	Medium to high higher with SCO (highest profits)	Medium higher with SCO	High lower with SCO	Low lower with SCO
Impact on cleared volumes of Complex Orders	Low lower with SCO	High lower with SCO	Medium lower with SCO	High lower with SCO	Low higher with SCO
Impact on cleared volumes of Simple Supply Orders	Low higher with SCO	Medium higher with SCO	Medium higher with SCO	Medium higher with SCO	Low lower with SCO
Impact on cleared volumes of Simple Demand Orders	Low	Medium lower with SCO	Medium lower with SCO	Medium lower with SCO	Low
Impact on paradoxically rejected volumes (complex orders)	Medium higher PR vol. with SCO	Medium Lower PR vol. with SCO	High lower PR vol. with SCO (lowest)	High higher PR vol. with SCO	Medium higher PR vol. with SCO

N.B. “Higher” or “lower” statements are based on the average values

Conclusions

Comparison of conversion rules

- Conversion 1 works best (lowest market impact), among the different tested options
- Adding a MAV when converting CO to SCO tends to lead to higher market impacts
  - Conversions (Option 1 and 2) leading on average to highest profits, and lowest paradoxically rejected volumes
- Technical minimum volumes cannot be fully guaranteed with the Classic CO even with low 1st P-Q pairs, while SCO can guarantee them by construction even without low 1st P-Q pairs
- As expected, increasing Fixed Terms tends to lead to more rejected SCOs, and decreasing them to more accepted SCOs

General concluding remarks

- Transition should be smooth if adequate Classic CO to SCO conversion rules are used
- There is a between avoiding paradoxical acceptances and avoiding paradoxical rejections
- The new MAV feature in the SCO fully ensures that technical minimums are met in each period
- The analysis of the key conversion rules above should provide a good basis for further tests with parallel runs in 2022
- **Market results will in the end depend on the combination of conversion strategies used by the different market participants**

Agenda

Session 1: Project Management (15 min)

- Project Plan Review
- Reminders and Updates

Session 2: Conversion Analysis (1hr 20 min)

- Questionnaire Summary
- Overview of Conversion 2
  - Methodology Used
  - Summary Results
- Member Insights Sharing

- **Next Steps (10 min)**
- **Q&A (15 min)**

Next Steps for Members

- ❑ ***Receive Conversion 2 Results:*** by 22nd October

- ❑ ***Review Conversion 2 Results and summary information****:* 22nd October – 12th November
  - *Sufficient time or do we need to push out the next meeting to the 26th November??*

- ❑ ***Submit relevant questions to allow investigation*** **before next meeting:** ASAP but by 12th November at the latest

- ❑ **Attend next meeting which will cover final conclusions on Conversion 2 results and any queries raised on Conversion 2 results**: 19th November
  - *Date may be delayed depend on level of queries received (and when they are received), to ensure the meeting has value*

Q&A

Questions?

Appendices

Main objective of the conversion rule n°1 → adapt the Fixed Terms since Minimum Income Conditions

…and hence Fixed Term recovery conditions are different:

CO

$$\sum_t PRICE_t * QUANTITY_t - \boxed{Variable\_Term * \sum_t QUANTITY_t} \geq Fixed\ Term$$

versus

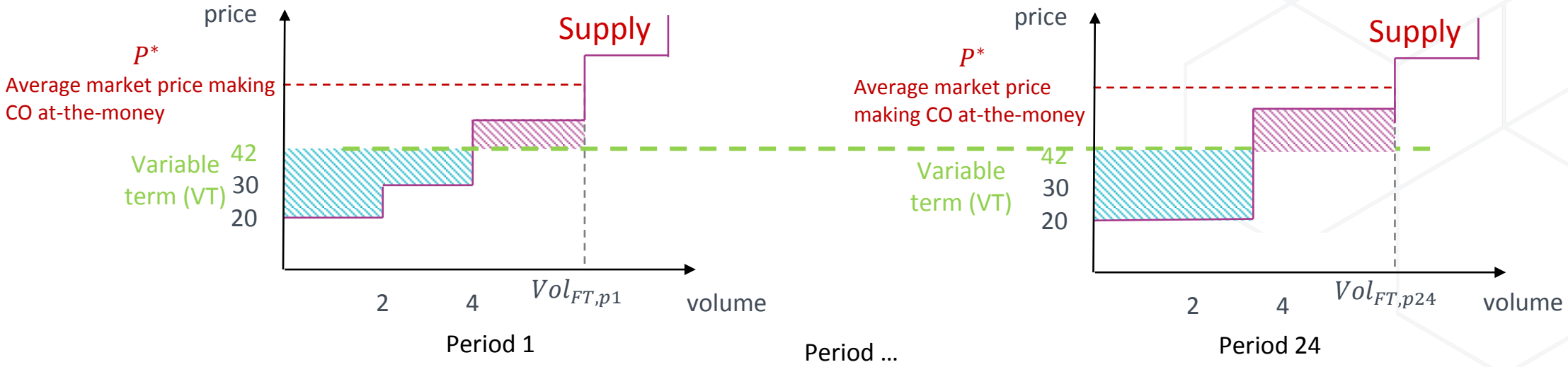
SCO

$$\sum_t PRICE_t * QUANTITY_t - \boxed{Marginal\_Costs\ (bid\ curves)} \geq Fixed\ Term$$

Differences in Variable Costs will be accounted for in the change of Fixed Term

Main objective is to adapt the Fixed Terms since Fixed Term recovery conditions are different

Adaptations consist in shifting *an estimation* of differences in "Variable Costs" (see previous slide) to the Fixed Term



Conversion rule

1. SCO Cost Curve = CO Cost Curve
2. CO Variable Term (VT) dropped → no VT in SCO
3. Find a price P^* (currently a single "daily average price") making the CO is "at-the-money" (Fixed Term and Variable Costs covered by revenues)
4. Find a new Fixed Term for the SCO such that the SCO equivalent to the CO is also at-the-money for P^*

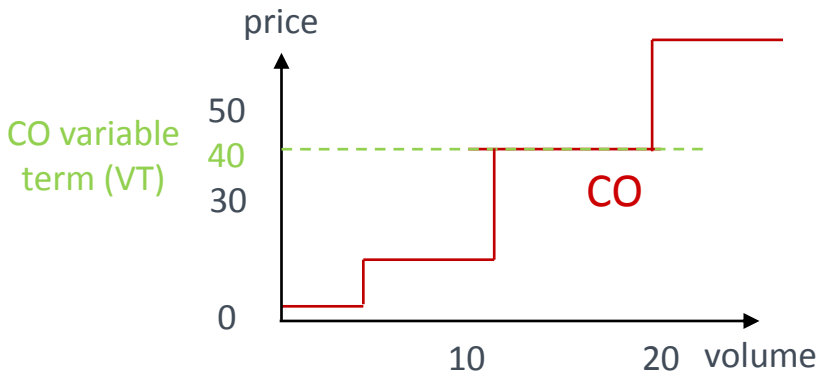
SCO Fixed Term = CO Fixed Term + Area – Area

Area = areas below Variable Term and above Curves

Area = areas above Variable Term and below Curves

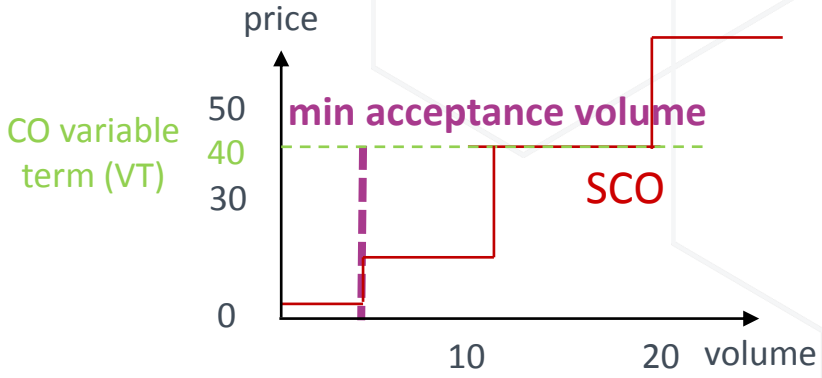
N.B. Considering only blue areas in the Fixed Term correction tends to lead to more SCO rejected than CO. More generally, a trade off exists between rejection induced by the conversion, and the satisfaction of the Min. Income Condition.

Classic Complex Order (without MAV + low steps)



Scalable Complex Order (with MAV)

OMIE's suggestion to combine MAV and existing conversion rule N°1 (promising option)

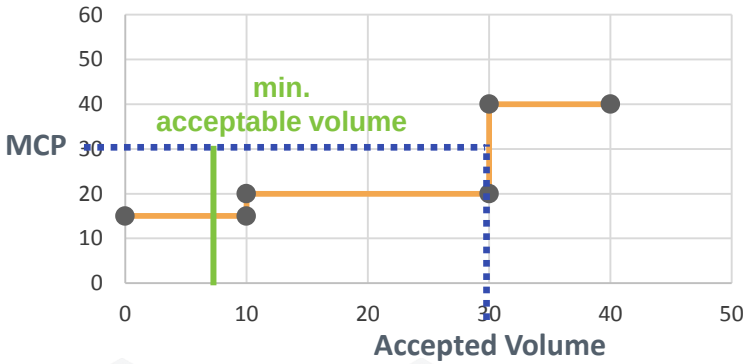


- A minimum acceptance volume is defined to ensure the acceptation of the 1st step (= technical minimum volume)
- Instead of changing the price of that step, Fixed Terms are adapted in the spirit of the conversion rule n°1 (developed by N-SIDE) used in the first round of simulations
- Adaptations of the Fixed Terms can take into account or overlook the so-called "purple areas" as illustrated in backup slides

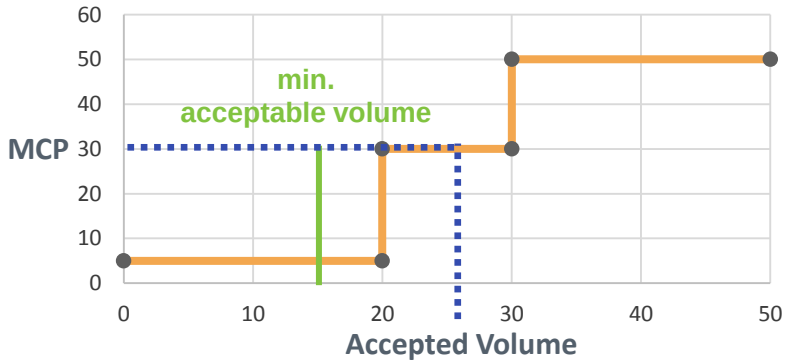
New product

- FT: **Fixed term** in Euros and ***costs in bid curves*** **(or utility on the demand side)**
- ***Minimum acceptance volume*** can be specified (param. *can vary per hour!* → more flexible than curtaible blocks)
- **Ramp conditions** (called load gradients) can be specified, see next slides

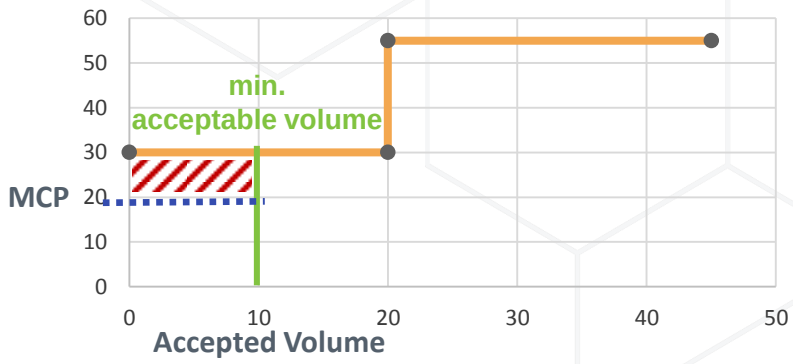
Period 1



Period 2



Period 3



Revenue received by an activated SCO must be greater or equal to Fixed Term + Marginal Costs*

*Marginal Costs = areas below bid curves for accepted volumes

$$\sum_t PRICE_t * QUANTITY_t \geq FT + Marginal\ Costs\ (bid\ curves)$$

Flexible formulation for bidders

- ☑ Different levels of acceptance per hour
- ☑ Load gradients (ramp constraints)
- ☑ Fixed term FT ***in welfare objective***
- ☑ Marginal cost curves
- ✘ ~~Variable cost **VT** (besides cost curves)~~

- ☑ **Minimum acceptances per hour**
- ☑ Can be out-of-the-money at some hours (due to min. acceptance) as long as in-the-money for the whole day (considering **bid curves** & FT)
- ☑ Demand side version with a Maximum Payment Condition

Algorithmically easier and more scalable than Classic Complex Orders!