Scalable Complex Orders Project Meeting #4

3rd December 2021

Agenda

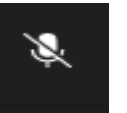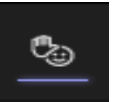**Session 1: Project Management (15 min)**

- Project Plan Update
- Reminders

Session 2: Further Analysis on Conversion 2 Results (1hr 20 min)

- Responses to questions received from Members, Analysis Re-cap
- Member Insights Sharing

- **Q&A (15 min)**

- **Next Steps (10 min)**

Housekeeping Rules

✓ *Keep your video switched off*

✓ *Raise the hand if you have a question*

✓ *Keep your line muted unless asking a question*

Agenda

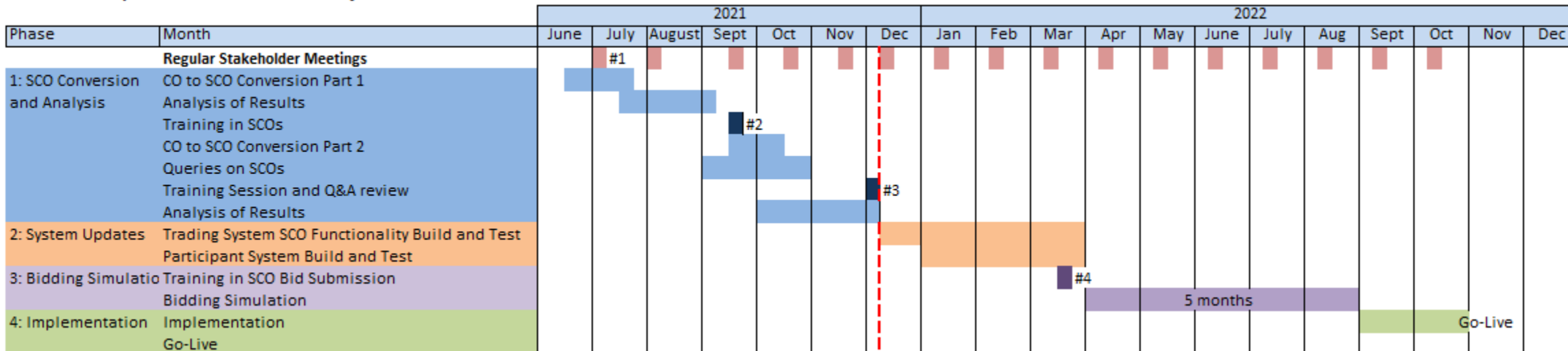**Session 1: Project Management (15 min)**

- Project Plan Review

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- Member Insights Sharing

- Next Steps (10 min)

- Q&A (15 min)

Session 1: Project Plan Review

Scalable Complex Orders - Overview Project Plan

Complete Tasks	Current Tasks	Future Tasks
Analysis and Feedback of Conversion 2 Data	Further Analysis of Conversion 2 Data	Provision of Technical Specification (before Christmas)
Initiation of work streams in both MRC and SEM-GB regions	N-Side support of queries on Analysis & SCO's	Dec-Jan: Submit questions/clarifications on the Technical Specification
Member Meeting #3 (15 Oct)	Member Meeting #4 (3rd Dec)	Jan-March: Member build of SCO product submission/retrieval
		Member Meeting #5 (4th Feb)

Session 1: Reminders

#5 – 4th February 2022

 - (Technical Specification run through, and Questions and Answers)

- Potential revisions to project plan

#6 – Tentatively early March 2022

Meeting invites will be issued ahead of each event.

Agenda

Session 1: Project Management (15 min)

- Project Plan Review

- Reminders

Session 2: Conversion Analysis (1hr 20 min)

- Responses to questions received from Members, Analysis Re-cap

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- Next Steps (10 min)

- Q&A (15 min)

Utilisation of the MAV allows volume which is out of merit with respect to the market clearing price to clear i.e. an element of "must run" functionality in the DAM. If the complex order clears, is this MAV is guaranteed in each hour? In other words, are there are no circumstances where the complex order clears and the MAV does not clear at any time during the complex order horizon?

- A MAV is guaranteed in each hour, but market participants can specify a different MAV in each hour. For example, it is possible to specify a MAV = 100MW in hour 1, MAV = 200 MW in hour 2, MAV = 0 MW in hour 3, etc.

- In this example, If the complex order is accepted, then at least 100 MW in hour 1, and at least 200 MW in hour 2 must be cleared.

- The complex order is rejected in all hours if it is not possible to meet these minima while remaining in-the-money over the whole day (clearing horizon)

MAV applied to all complex orders in the simulations (round 2, Options 1 & 2)

Classic Complex Order (without MAV + low steps)
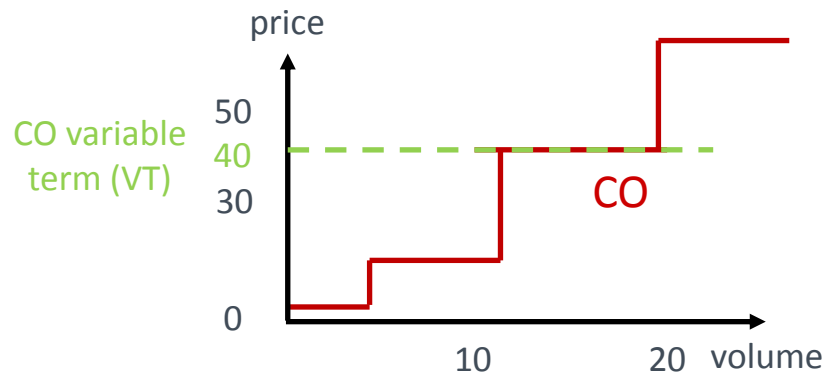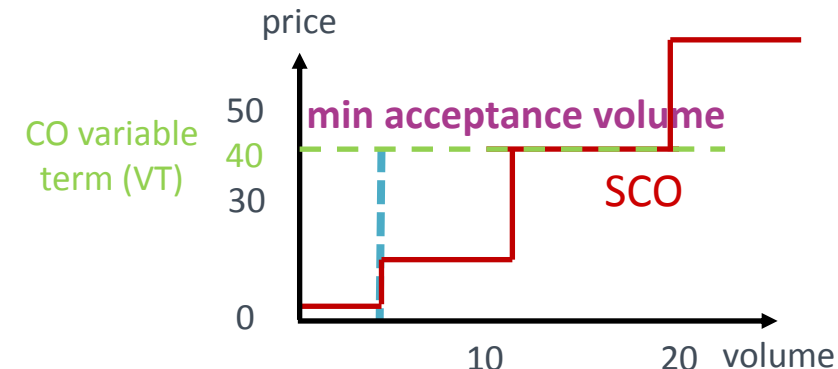
Scalable Complex Order (with MAV)

- A minimum acceptance volume is defined to ensure the acceptation of the 1st step (= technical minimum volume) in each hour. **Other MAV in each hour could be specified by the market participant, it is here a choice of the conversion strategy.**

- Fixed Terms are adapted in the spirit of the conversion rule n°1 (developed by N-SIDE) used in the first round of simulations

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

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

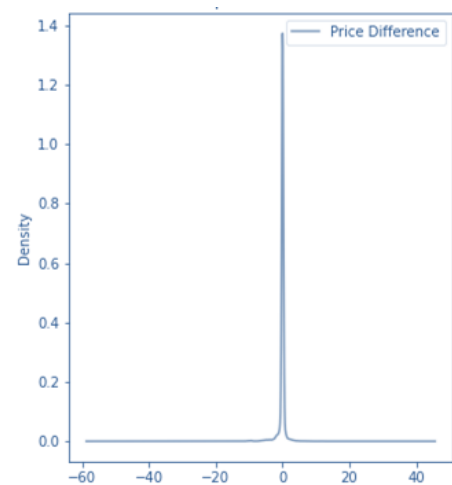- Impact on paradoxically rejected complex order volumes

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)	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%**

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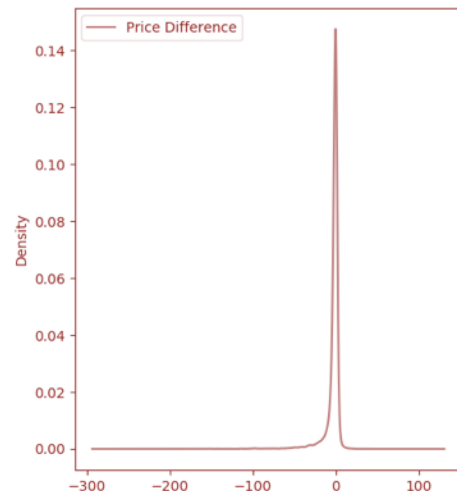
- *identical* **28% of the time** (6309 hourly periods out of 8784)
- **different by less than 1 €/MWh 79 % of the time** (8098 hourly periods out of 8784)

- *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)

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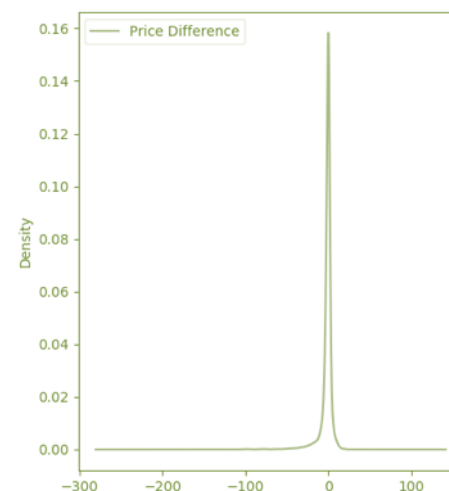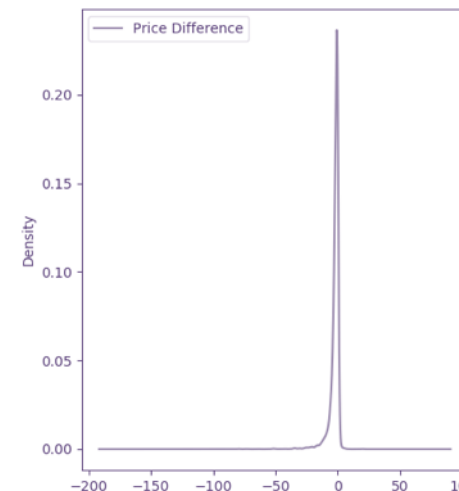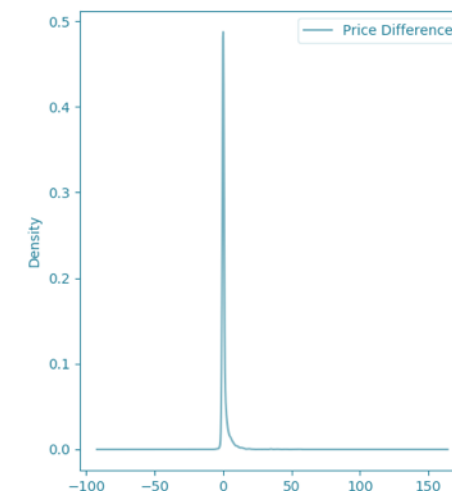
- *identical* **52% of the time** (6309 hourly periods out of 8784)
- **different by less than 1 €/MWh 78 % of the time** (8098 hourly periods out of 8784)

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

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%**

	Conversion 1 Price Difference	Option 1 Price Difference	Option 2 Price Difference	Option 3 Price Difference	Option 4 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
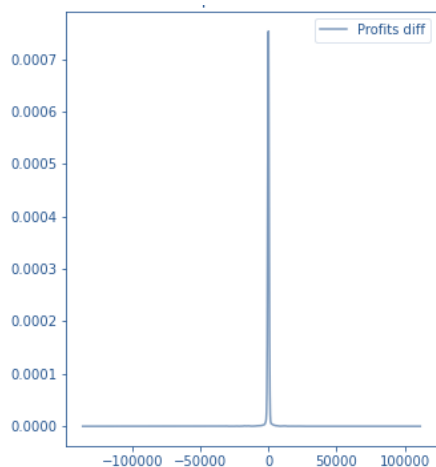- Impact on paradoxically rejected complex order volumes

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 1 € in* 58% of the cases	• *Different by less than 1€ in* 56% of the cases	• *Different by less than 1€ in* 57% of the cases	• *Different by less than 1€ in* 62% of the cases
• Different by less than 5000 € in 98% of the cases	• Different by less than 5000 € in 80% of the cases	• Different by less than 5000 € in 79% of the cases	• Different by less than 5000 € in 66% 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
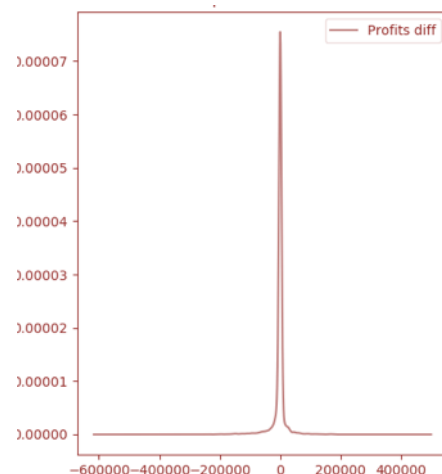## Profits are higher with Option 1

Complex Order Profits with Classic CO – Complex Order Profits with Scalable CO
Historical data 2020 – Euphemia 10.6 - 8948 observations
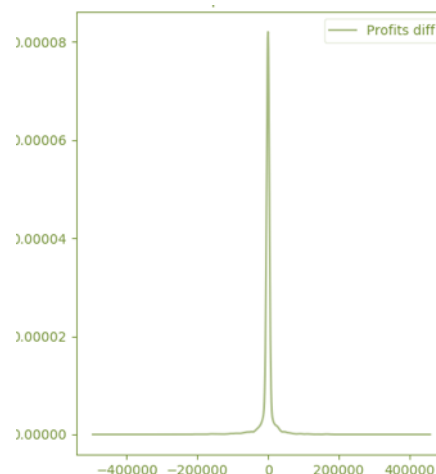
	Conversion 1 (Round 1)	Round 2 Option 1 Minimum Acceptance Volumes FT conversion from Round 1	Round 2 Option 2 Minimum Acceptance Volumes FT conversion from Round 1 − 20%	Round 2 Option 3 FT conversion from Round 1 + 20%	Round 2 Option 4 FT conversion from Round 1 − 20%
	Profits Difference	Profits Difference	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
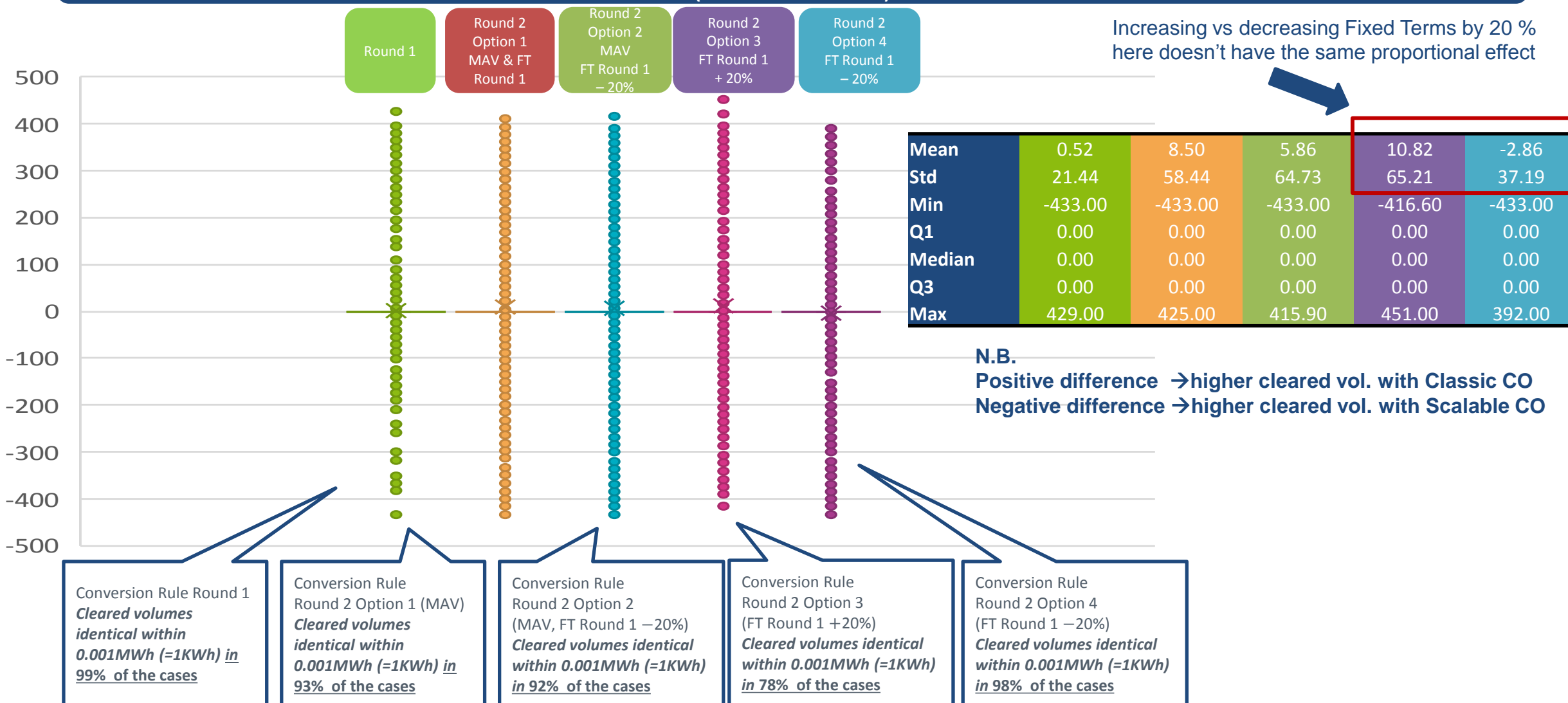
Conclusions

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)

Round 1

Round 2 Option 1 MAV & FT Round 1

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%

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 <u>complex</u> order cleared volumes per period (MWh) – "Classic CO volumes – Scalable CO volumes"
Production data 2020. Euphemia 10.6
(8784 observations)
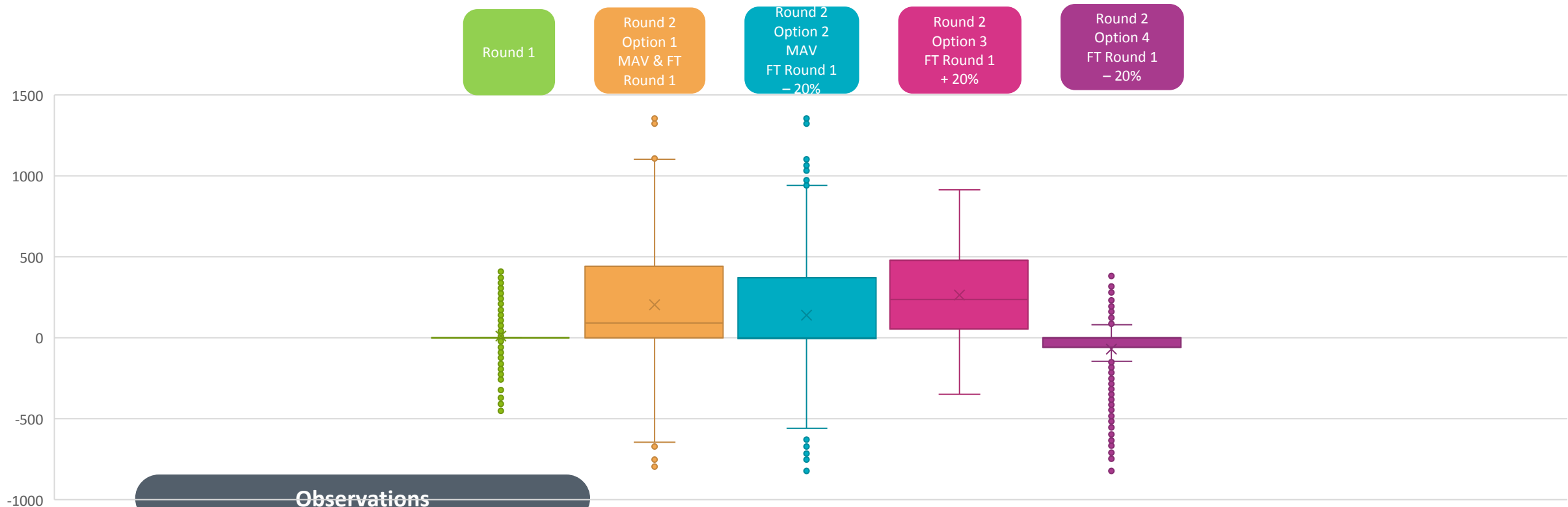
Observations

- 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 conversion rules

Impact on cleared
Simple demand **order volumes**
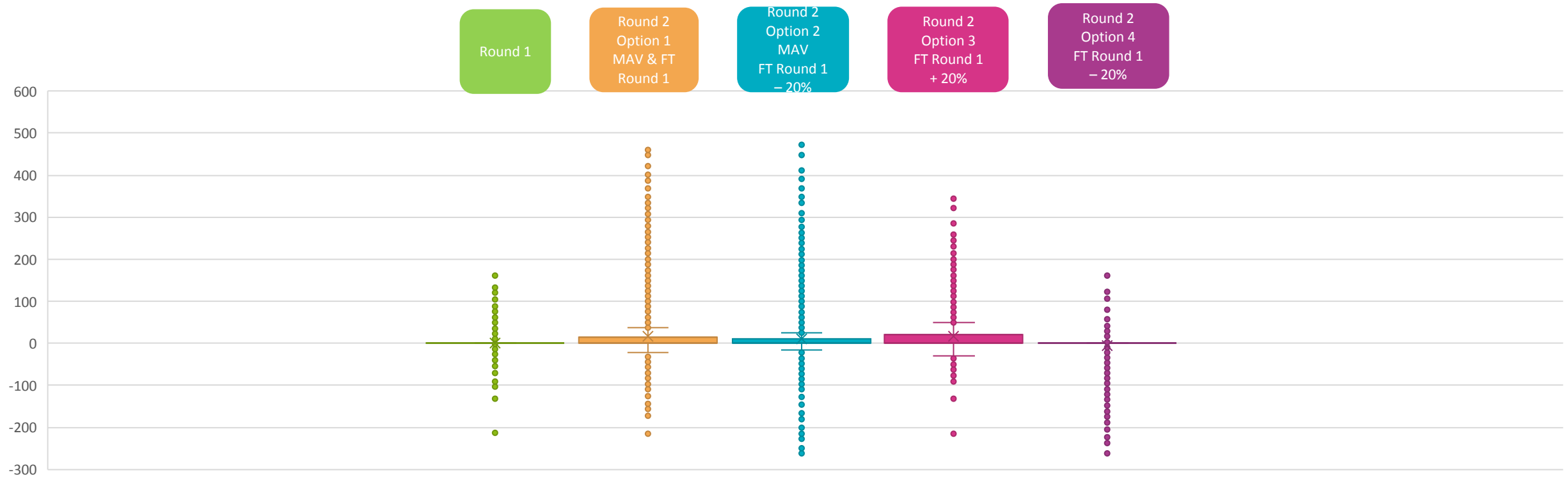
Ireland

N-SIDE
OPTIMIZING YOUR DECISIONS

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)

Round 1

Round 2
Option 1
MAV & FT
Round 1

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%

Observations

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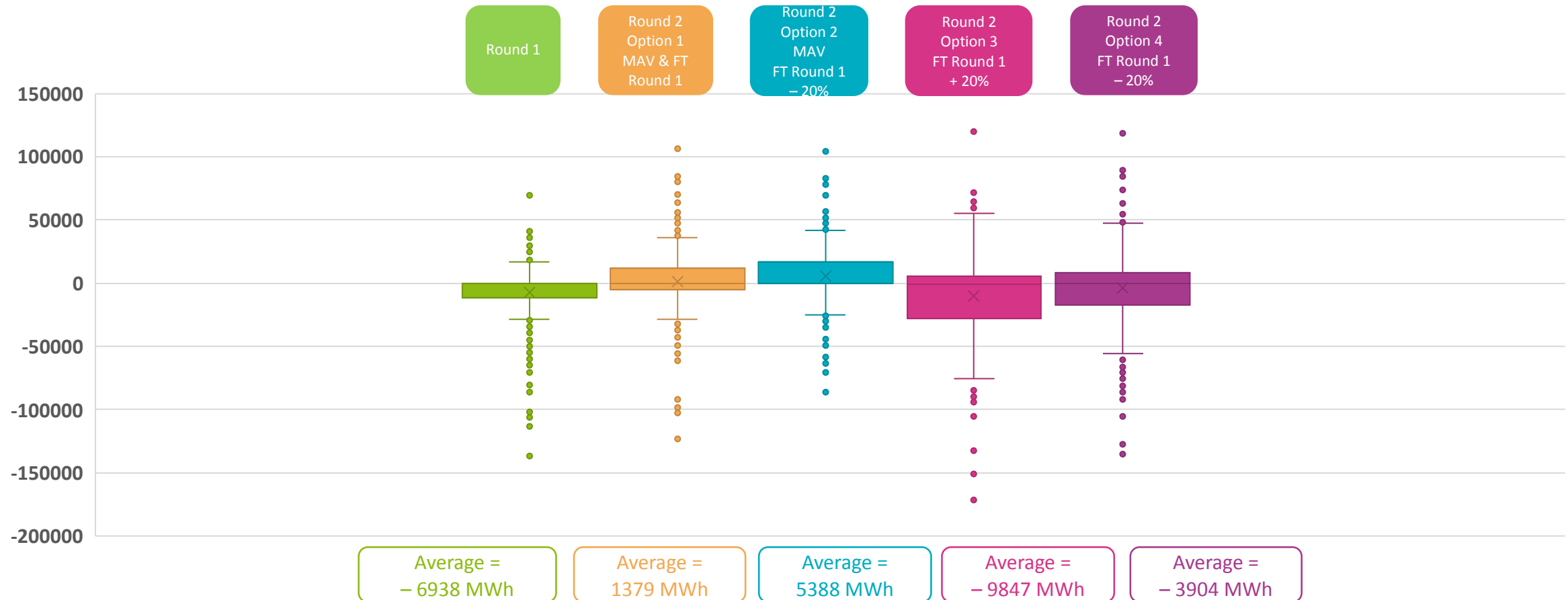
Agenda

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

Round 1

Round 2 Option 1 MAV & FT Round 1

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%

Average = − 6938 MWh

Average = 1379 MWh

Average = 5388 MWh

Average = − 9847 MWh

Average = − 3904 MWh

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 leads 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
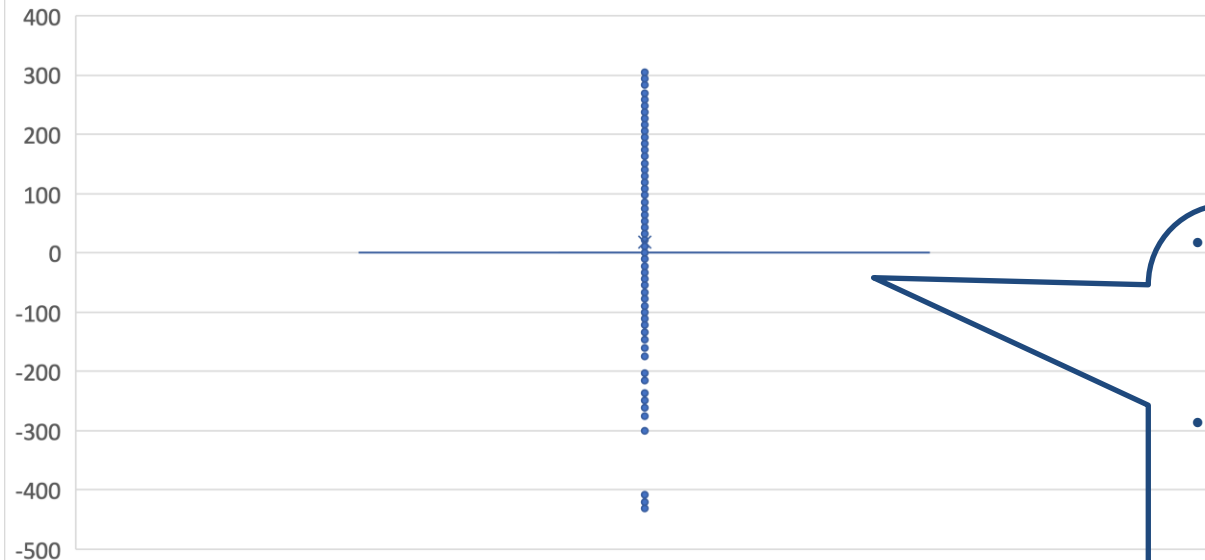
- Negative values correspond to cases where the cleared volume in a given period for a given complex order is lower than the quantity of the 1st P-Q pair

- 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)

- Responses to questions received from Members, Analysis Re-cap

- Member Insights Sharing

- **Next Steps (10 min)**

- **Q&A (15 min)**

Next Steps

❑ Technical Specification Issued (before Christmas)

❑ Dec-Jan: Submit questions/clarifications on the Technical Specification

❑ Next Meeting 4th February
- Questions & A on Technical Specification
- Project Plan Update

❑ Jan-March: Member build of SCO product submission/retrieval

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

Period 1

Period …

Period 24
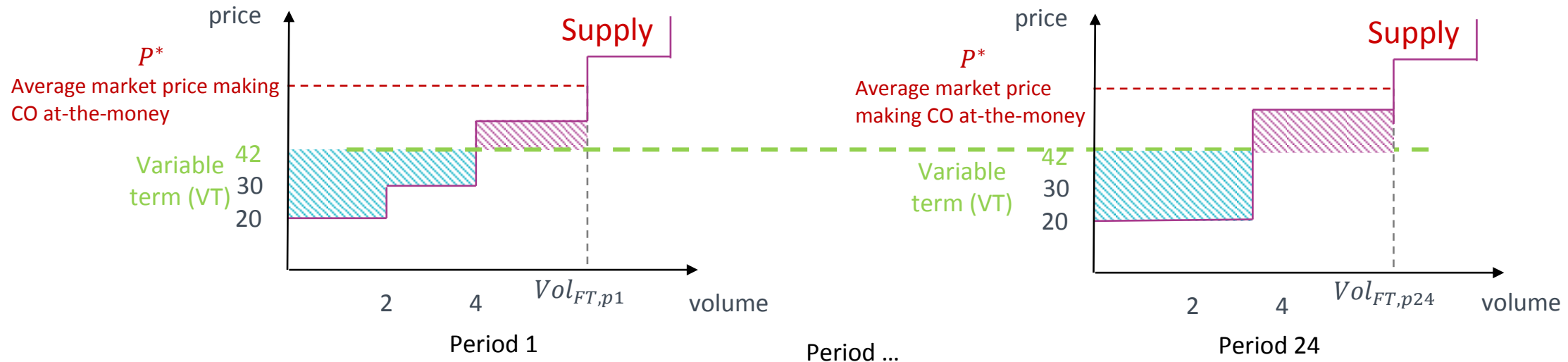
Conversion rule

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)
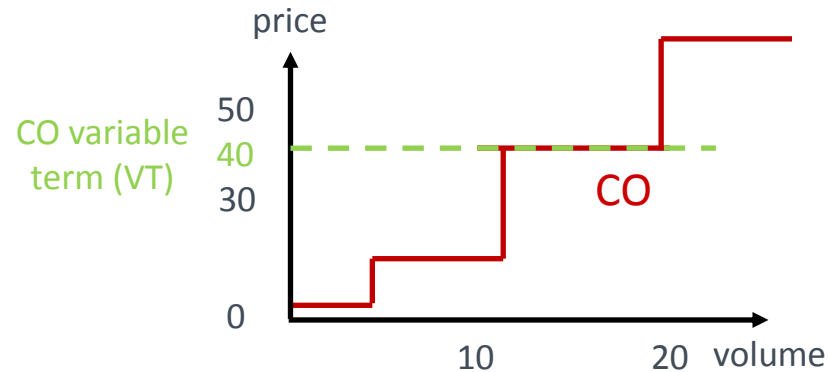

Scalable Complex Order (with MAV)

OMIE's suggestion to combine MAV and existing conversion rule N°1 (promising option)
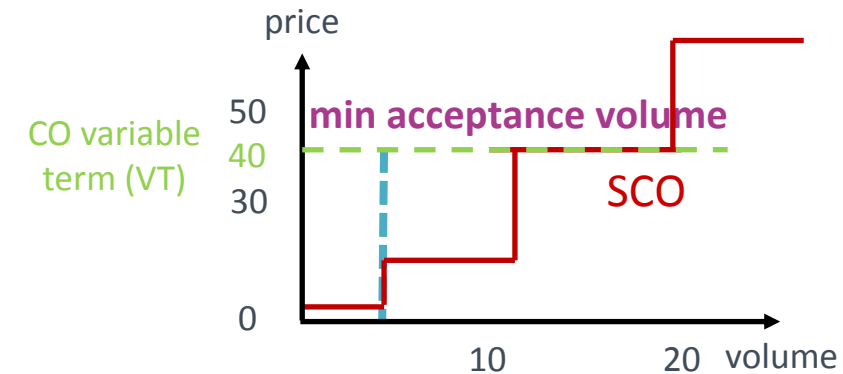
- A minimum acceptance volume is defined to ensure the acceptation of the 1st step (= technical minimum volume)

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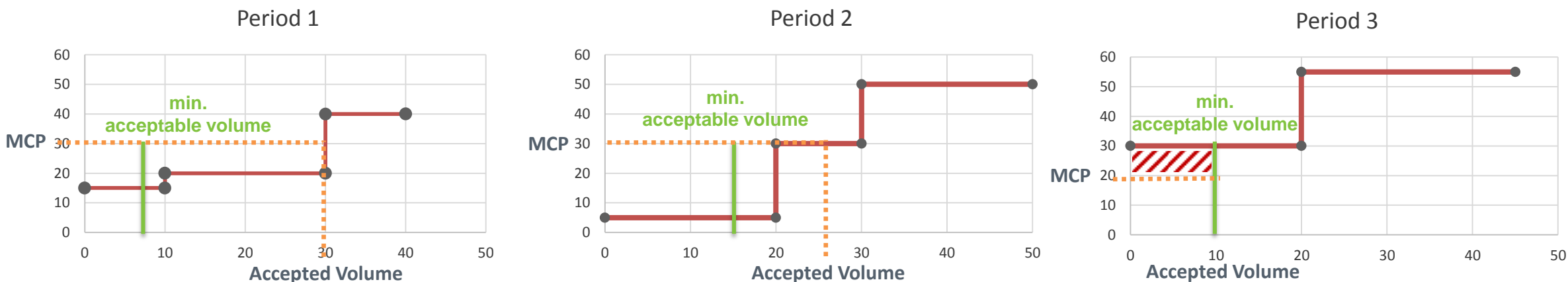
Revenue received by an activated SCO must be greater or equal to Fixed Term + Marginal Costs*

*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!