

# I-SEM Trialing of EUPHEMIA

Working Group 12

18<sup>TH</sup> May 2016



# Agenda

- SEMO Update
- Unscripted Phase 1 Inputs and Results
- Unscripted Phase 2 Results
- Trial Report
- Arrangements for Input to Report
- Next Steps

# SEMO Update

# SEMO Update – Recent Activities

- Work on close out of the trials continues:
  - Draft report circulated
  - Unscripted phase two data sent to APX for execution
  - Discussion with RAs about the content of the report
  
- Final meeting of the working group:
  - Engagement to close out report will be bilateral
  - Co-operation throughout the trials has been greatly appreciated
  - Further engagements through liaison groups
  
- EUPHEMIA mailbox will not be monitored following report:
  - Queries should be sent to [I-SEMproject@sem-o.com](mailto:I-SEMproject@sem-o.com)

# SEMO Update – Recent Activities

- NEMO BLG meeting held 05/05/2016:
  - Presentations by ECC
  - Discussed arrangements for clearing and collateral
  - NEMO implementation work is ongoing
  - Next NEMO BLG set for July 7
  
- BLG on EUPHEMIA scheduled for 29/06:
  - Will discuss the trial at a high level
  - Will outline the findings of the report
  - Intended for non-WG members but all are welcome

# SEM Study Runs

# SEM Study Runs for Comparison

- WG asked for SEM solver runs to use as comparison for trial outputs:
  - Ex-Ante 1 run ran with WD1 wind volumes
  - Once with full ATC
  - Once with zero ATC
  - MIP 600 used due to similarity of solver parameters and solve times
  
- SEM study outputs:
  - Higher prices in zero ATC as expected
  - Higher generation costs

# SEM Study Runs for Comparison

- Significant differences between SEM MSP and EUPHEMIA:
  - Interconnector scheduling (many flows counter intuitive in SEM)
  - Unit representation (explicit COD/TOD vs. more implicit)
  - Different objective functions and primary solver
- EUPHEMIA results are linked to assumptions:
  - Results have changed across trial batches as assumptions change
  - Assumptions not necessarily reflective of I-SEM behaviour
  - Assumptions not reflective of SEM behaviour in Commercial Phase
- Direct comparison of results to the SEM is inappropriate:
  - Any SEM data should be used for reference only



# SEM Study Runs for Comparison

Batch 4 Average Prices		Full ATC SEM Study	Zero ATC SEM Study
Date	Average of MarketPrice	Average of SMP	Average of SMP
22/06/2014	€ 44.58	€ 43.75	€ 59.34
25/11/2014	€ 83.98	€ 76.61	€ 75.44
24/01/2015	€ 53.64	€ 44.76	€ 63.52
14/03/2015	€ 86.34	€ 61.30	€ 77.14
11/04/2015	€ 52.90	€ 43.64	€ 55.92
Grand Total	€ 64.29	€ 54.01	€ 66.27

- Study run results will be released
- Underlying conditions of runs are the same
- Demand participation effects results

# Unscripted Phase 1

# Unscripted Phase 1 Inputs

- Previous breakdown was based on one batch only:
  - ❑ Did not reflect changes to behaviour
  - ❑ Number of changes between 1A and 1B
- Breakdown of order types by batch investigated:
  - ❑ Changes between 1A and 1B highlighted
  - ❑ Mix of complex and linked block orders similar
  - ❑ Changes to individual units more than overall mix
  - ❑ Many participants changed order type for units between batches

# Unscripted Phase 1A Inputs

## Wind

Company	Price Taker	Price Maker
BGE	X	
Energia	X	
Gaelectric	X	
Power NI	X	
SSE	X	

## Demand

Company	Price making order	Price taking order
BGE	X	
Electric Ireland	X	
Energia		X
Power NI		X
PrePay Power		X
SSE		X

## Thermal

Company	Linked block only	Complex only	Mix
AES			X
Aughinish Alumina		X	
BGE		X	
Bord na Mona			X
ESB GWM		X	
Energia			X
Gaelectric	X		
Power NI PPB			X
SSE	X		
TEL			X

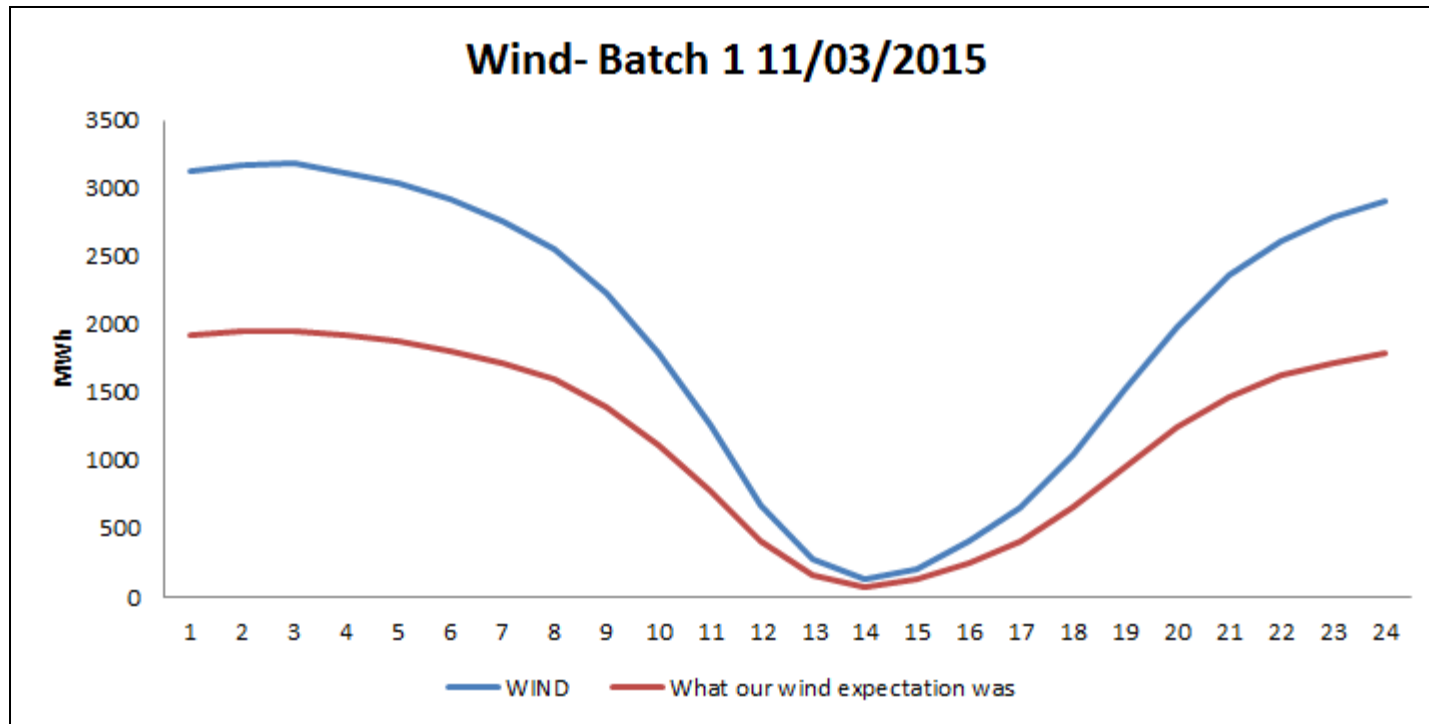
# Unscripted Phase 1B Inputs

Wind	Company	Price Taker	Price Maker
	BGE	X	
	Energia	X	
	Gaelectric	X	
	Power NI	X	
	SSE	X	

Demand	Company	Price making order	Price taking order
	BGE		X
	Electric Ireland	X	
	Energia	X	
	Power NI	X	
	PrePay Power		X
	SSE		X

Thermal	Company	Linked block only	Complex only	Mix
	AES			X
	Aughinish Alumina		X	
	BGE		X	
	Bord na Mona			X
	ESB GWM		X	
	Energia			X
	Gaelectric	X		
	Power NI PPB			X
	SSE	X		
	TEL			X

# Unscripted Phase 1 Re-run Wind Issue



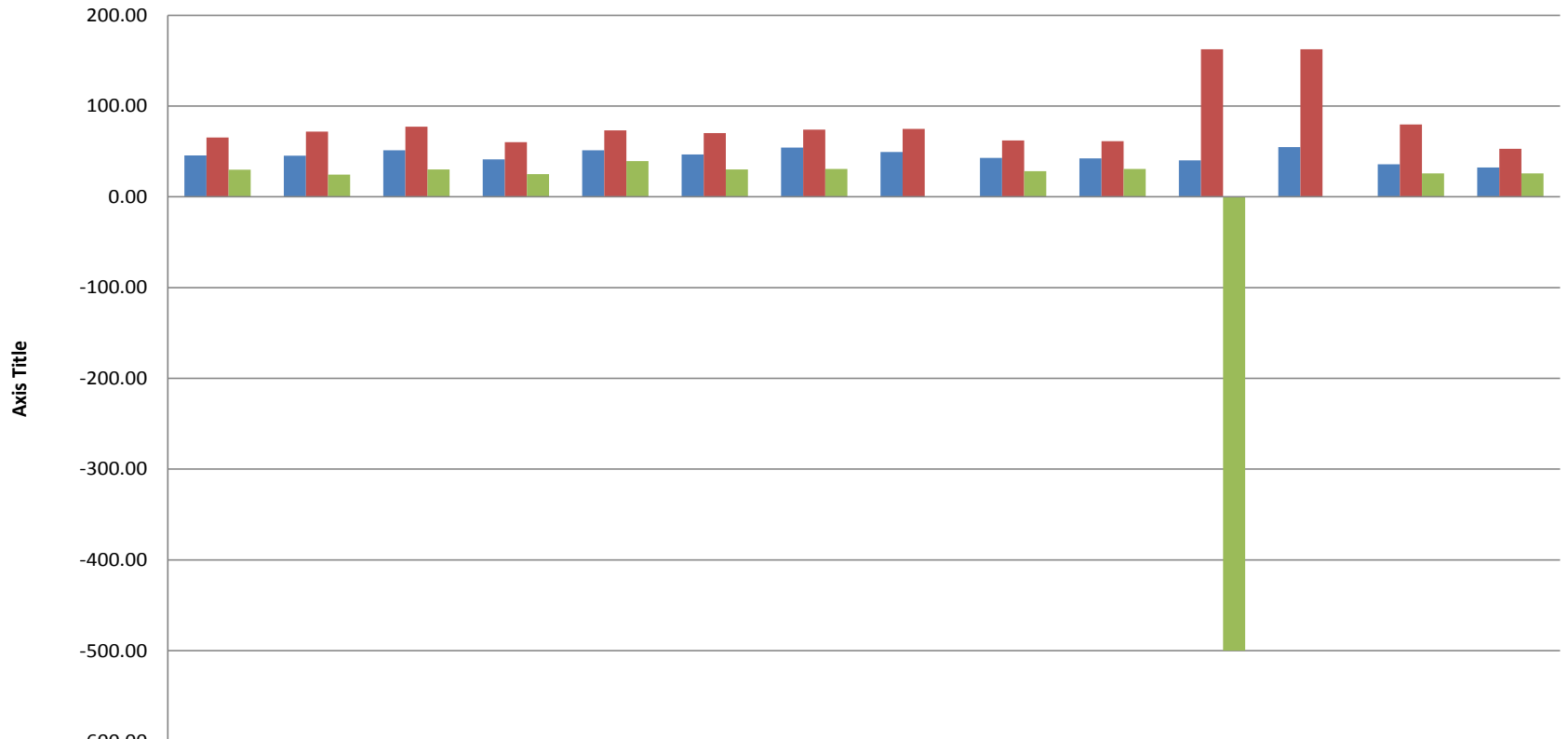
- Batch 1A & 1B re-ran due excessive wind inputs
- Introduced in conversion process and not obvious until results returned

# Unscripted Phase 1 Analysis

- Different to the Scripted Trials:
  - No agreed set of assumptions
  - No expected outcomes to investigate
  
- Too difficult to isolate causes of results:
  - No sight over the assumptions used by participants
  - Multiple strategies used
  - High level analysis only performed
  - Outlying data investigated (high/low prices; high variance etc.)

# Unscripted Phase 1 Results

## Price Comparisons - Unscripted Phase 1



	1A	1B	1A	1B	1A	1B	1A	1B	1A	1B	1A	1B	1A	1B
	20150311		20150601		20150609		20150804		20151117		20151202		20151227	
■ Average Price	45.58	45.19	51.38	41.28	51.19	46.61	54.35	49.25	43.01	42.27	40.12	54.74	35.78	32.19
■ Max Price	65.32	71.72	77.34	60.14	73.32	70.12	74.13	74.88	62.16	61.37	162.64	162.64	79.76	52.91
■ Min Price	29.85	24.41	30.06	25.11	39.41	30.23	30.72	0.00	28.27	30.77	-500.00	0.00	25.78	25.78

- -€500 and €0 prices due to margin in early hours
- Complex units kept at min gen due to -€500 orders



# Unscripted Phase 1 Analysis – Demand Values

1A

Sum of Quantity	Column Labels								
Row Labels	11/03/2015	01/06/2015	09/06/2015	04/08/2015	17/11/2015	02/12/2015	27/12/2015	Grand Total	
PT_400031	39206.4	35240	40290.8	32510.2	43072.9	40973.7	31042.2	<b>262336.2</b>	
PT_400080	1215.3	1150.4	976	998.9	1300.8	1359.3	1495.3	<b>8496</b>	
SU	5417.4	4300.2	4736.8	4504.3	5326.9	5583.4	4644.8	<b>34513.8</b>	
SU_500051	8756.8	6951.5	7657.1	7280.8	8610.4	9025.1	7508.3	<b>55790</b>	
SU_BGE	9445.8	7505	8260.9	7859.1	9287.3	9732.3	8099.8	<b>60190.2</b>	
SU_Energia	14826.7	11769.4	12964.4	12327	14578.9	15280.9	12712.2	<b>94459.5</b>	
SU_SSE	22183	15839	20593	17531	20755	22296	17076	<b>136273</b>	
Grand Total	<b>101051.4</b>	<b>82755.5</b>	<b>95479</b>	<b>83011.3</b>	<b>102932.2</b>	<b>104250.7</b>	<b>82578.6</b>	<b>652058.7</b>	

1B

Sum of Quantity	Column Labels								
Row Labels	11/03/2015	01/06/2015	09/06/2015	04/08/2015	17/11/2015	02/12/2015	27/12/2015	Grand Total	
PT_400031	39206.4	32037	32965	36794.6	39157.7	36325.4	34811.2	<b>251297.3</b>	
PT_400080	1215.3	1150.4	976	998.9	1300.8	1359.3	1495.3	<b>8496</b>	
SU	5417.4	4300.2	4736.8	4504.3	5326.9	5583.4	4644.8	<b>34513.8</b>	
SU_500051	8757.5	6951.8	7657.9	7281.2	8611.7	9026.8	7507.9	<b>55794.8</b>	
SU_BGE	9447.3	7499.3	8260.7	7854.6	9289.2	9736.7	8099.9	<b>60187.7</b>	
SU_Energia	14826.7	11769.4	12964.4	12327	14578.9	15280.9	12712.2	<b>94459.5</b>	
SU_SSE	22183	15839	20593	17531	20755	22296	17076	<b>136273</b>	
Grand Total	<b>101053.6</b>	<b>79547.1</b>	<b>88153.8</b>	<b>87291.6</b>	<b>99020.2</b>	<b>99608.5</b>	<b>86347.3</b>	<b>641022.1</b>	

- Difference due to individual strategy
- In line with unscripted phase approach

# Unscripted Phase 1 Conclusion

- Main goal related to inputs:
  - Could participants create their own orders
  - Would different participants use different order types
  - Would strategies differ from the Scripted Trials
  
- Goals were achieved:
  - High level of participation (generation and supplier)
  - Variance across orders used by participants
  - Outlying data can be explained based on inputs
  - Results much improved from Initial Phase batch one

# Unscripted Phase 2

# Unscripted Phase 2 Inputs

- Inputs received 10/05:
  - Many thanks to those involved
  - No issues with received data
  - Minor changes agreed bilaterally, where required
  
- Processing steps performed by SEMO on data:
  - Volumes rounded to 1 decimal place
  - Money amounts rounded to 2 decimal places
  - Data collated into two files (2A and 2B)
  - Data converted to EUPHEMIA format

# Unscripted Phase 2A Inputs

Wind	Company	Price Taker	Price Maker
	BGE	X	
	Energia		X
	Gaelectric	X	
	Power NI	X	
	SSE	X	

Demand	Company	Price making order	Price taking order
	BGE	X	
	Electric Ireland		X
	Energia		X
	Power NI		X
	PrePay Power		X
	SSE		X

Thermal	Company	Linked block only	Complex only	Mix
	AES			X
	Aughinish Alumina		X	
	BGE		X	
	Bord na Mona		X	
	ESB GWM		X	
	Energia			X
	Gaelectric	X		
	Power NI PPB			X
	SSE			X
	TEL			X

# Unscripted Phase 2B Inputs

Wind	Company	Price Taker	Price Maker
	BGE	X	
	Energia		X
	Gaelectric	X	
	Power NI	X	
	SSE	X	

Demand	Company	Price making order	Price taking order
	BGE		X
	Electric Ireland	X	
	Energia	X	
	Power NI	X	
	PrePay Power		X
	SSE		X

Thermal	Company	Linked block only	Complex only	Mix
	AES			X
	Aughinish Alumina		X	
	BGE		X	
	Bord na Mona		X	
	ESB GWM		X	
	Energia			X
	Gaelectric	X		
	Power NI PPB			X
	SSE			X
	TEL			X

# Unscripted Phase 2 Inputs – Wind and Demand Values

Fuel Type	Wind		Fuel Type	Wind
2A			2B	
Row Labels	Sum of Quantity		Row Labels	Sum of Quantity
11/03/2015	34629.9		11/03/2015	34630.7
01/06/2015	40733.35		01/06/2015	40734.8
09/06/2015	2901		09/06/2015	2902.6
04/08/2015	32835.7		04/08/2015	32837.4
17/11/2015	32852.35		17/11/2015	32854
02/12/2015	13007.7		02/12/2015	13009.2
27/12/2015	44689.3		27/12/2015	44690.8
Grand Total	201649.3		Grand Total	201659.5

- Batch 2 Wind volumes match across sessions A & B
- Rounding only, very small volumes

# Unscripted Phase 2 Inputs – Wind and Demand Values

2A

Row Labels	PT_400080	SU_500051	SU_BGE	SU_EI	SU_Energia	SU_SSE	Grand Total
11/03/2015	1264.0	8342.6	9447.2	42013.5	15354.0	22183.0	<b>98604.4</b>
01/06/2015	1150.5	6622.1	7498.8	34351.1	12188.0	15839.0	<b>77649.5</b>
09/06/2015	975.8	7294.6	8261.2	37838.8	13425.6	20593.0	<b>88389.0</b>
04/08/2015	998.7	6936.2	7854.4	34504.5	12765.4	17531.0	<b>80590.1</b>
17/11/2015	1300.7	8203.0	9288.8	42550.6	15097.5	20755.0	<b>97195.6</b>
02/12/2015	1359.5	8598.3	9736.2	44599.7	15824.4	22296.0	<b>102414.0</b>
27/12/2015	1495.5	7152.9	8100.1	35605.7	13164.5	17076.0	<b>82594.7</b>
<b>Grand Total</b>	<b>8544.769832</b>	<b>53149.7</b>	<b>60186.64</b>	<b>271463.8752</b>	<b>97819.4</b>	<b>136273</b>	<b>627437.385</b>

2B

Row Labels	PT_400080	SU_500051	SU_BGE	SU_EI	SU_Energia	SU_SSE	Grand Total
11/03/2015	1264.0	8344.4	9447.3	42013.5	15352.8	22183.0	<b>98605.0</b>
01/06/2015	1150.5	6624.0	7499.3	33350.7	12189.2	15839.0	<b>76652.7</b>
09/06/2015	975.8	7295.8	8260.7	35634.7	13428.0	20593.0	<b>86188.0</b>
04/08/2015	998.7	6939.2	7854.6	35357.1	12766.6	17531.0	<b>81447.2</b>
17/11/2015	1300.7	8204.3	9289.2	41310.6	15097.0	20755.0	<b>95956.8</b>
02/12/2015	1359.5	8598.3	9736.7	42001.7	15826.1	22296.0	<b>99818.3</b>
27/12/2015	1495.5	7153.3	8099.9	36438.7	13163.6	17076.0	<b>83427.0</b>
<b>Grand Total</b>	<b>8544.769832</b>	<b>53159.3</b>	<b>60187.7</b>	<b>266107</b>	<b>97823.3</b>	<b>136273</b>	<b>622095.0698</b>

- Batch 2 demand volumes are closer but still have variances due to strategy
- In line with unscripted phase approach



# Trial Report

# Trial Report – Goals of Phases

- Scripted Trials:
  - Expand on the Initial Phase findings
  - Explore the order types further to develop understanding
  - Provide sufficient knowledge to allow for the Unscripted Trials
  
- Unscripted Trials:
  - Allow active participation by WG members
  - Allow trialling of multiple strategies
  - Allow for participant choice
  
- The goals of both sets of trials have been met

# Trial Report – Assumptions

- Baseline for assumptions are those of the Initial Phase:
  - Representation of SEM data
  - Use of historical trading days
  - Which order types will be used
  - Etc.
  
- Primary change is the removal of the BCOP from orders
  
- Individual batch assumptions as per trial script:
  - Tracks the per batch or per session assumption changes
  - Still subject to overarching global assumptions

# Trial Report – Scripted Batch One Results

- Price making demand had large effect:
  - Large volume available at a low price
  - Acted as the marginal unit in a number of trading periods
  - Acted as proof of concept
  
- Price making demand not fully reflective:
  - Uniform average did not reflect scarcity
  - Prices effectively priced out certain participants (e.g. peakers)
  - Volume of price making demand may have been too high
  
- Little difference based on order type used:
  - Follows on from the effects of price making demand

# Trial Report – Scripted Batch Two Results

- Price making demand had lesser effect than in batch one:
  - ❑ Demand fully cleared more often and prices were reflective of scarcity
  - ❑ Similar trend in hours for partial clearance
- Different implementation of complex orders had different risks:
  - ❑ Altering PQ pairs helped mitigate scheduling risk (i.e. shutdowns)
  - ❑ Altering accounting of no-load led to cheaper market schedule
  - ❑ Altering accounting of no-load led to risk of under-recovery of costs
- Little overall effect to changing MAR in isolation:
  - ❑ Similar prices and mix of units regardless of MAR
  - ❑ Did effect individual unit scheduling and risk

# Trial Report – Scripted Batch Three Results

- Change to calculation of fuel cost dropped complex order prices:
  - ❑ Lower overall MIC led to lower pricing
  - ❑ Same trends between methods as seen in batch two
- Little effect of the change to LB order methods:
  - ❑ Similar results across methods (e.g. use overlapping blocks etc.)
- Little effect to using different orders for twin plant:
  - ❑ Some changes where linked block is used over complex
  - ❑ Scheduling altered due to the inclusion of explicit profiling
  - ❑ Linked to assumptions used – could be built into complex order

# Trial Report – Scripted Batch Four Results

- Alignment of load effected LB more than complex:
  - Due to the alignment of the blocks with the load
  - Blocks were not adjusted with the new load
  - Each showed changes to the I/C flows and timings of peak prices
- Use of a zero VT caused issues with cost under recovery:
  - More instances and magnitude of losses greater
  - Potential mitigation would be to include a fixed fuel cost or raise PQs
- Pricing of linked block similar to complex when coupled:
  - Final outcome will be coupled the majority of the time
  - Volatility is still present in de-coupled scenarios

# Trial Report – Paradoxically Rejected Orders

- Full analysis of linked block out of scope:
  - Would require too detailed an analysis
  - Time and resourcing not available to perform analysis
  
- Analysis performed at high level for complex orders:
  - Similar amounts in batches but for differing units
  - Batch four had fewer instances (contained zero VT runs)
  - Trend of occurrences for twin plant
  - Trend of occurrences for units near the average price



# Trial Report – Unscripted Trials

- Inputs received from a range of participants:
  - Many orders could use different conditions
- Participants were able to implement strategies:
  - Order formation followed different assumptions than Scripted Trials
  - Participants were able to use multiple methods
  - Participants could change orders between batches
- Analysis performed at a high level:
  - No assumptions to check
  - Analysis performed on outlier data

# Trial Report – View on implementation

- Simple orders may be used by majority of units:
  - Supplier, hydro, wind, peaker etc.
  - Provide easiest route to market
  
- Baseload/mid-merit & storage units may not use simple orders:
  - Will not be able to account for characteristics
  - Will require block or complex orders
  
- Implementation should use a range of orders:
  - Simple orders
  - Block orders (linked block and exclusive groups)
  - Complex orders

# Arrangements for Input to Report

# Trial Report – Drafts of Report

- First draft 06/04:
  - Majority of the report included
  - Covered as far as Unscripted Phase 1 results
  - Some additional analysis not complete at time of drafting
  - Intention that included sections will not be changed before comments
  
- Second draft:
  - Contains previously blank sections
  - Changes to other sections in red line
  - Section 9 now reworked into section 8.5

# Trial Report – Additional Sections

- Analysis not complete at time of first draft:
  - Unscripted phase two inputs
  - Unscripted phase two results
  - Paradoxically rejected orders
  - Executive summary
  
- Sections will not change message of the document:
  - Conclusions primarily drawn from Scripted Trials
  - Unscripted Trials focused on participation rather than results
  - Paradoxical rejection is supplementary to scope of the trials

# Trial Report – Changes for Section 9

- Reworking of the section:
  - No longer outlined as a recommendation
  - Has been restructured to be included in the conclusions
  - Still outlines the same implementation
  
- Agreed that report is a public document:
  - Report will outline the view of the WG and SEMO
  - Report is not directly making recommendation to any party
  - View of the WG and SEMO will feed directly into NEMO implementation work by EirGrid/SONI

# Trial Report – Process for feedback on initial points



- Draft has been based on summary statement feedback
- Any verbal feedback today will be factored into report
- Updated draft will be shared following unscripted phase results

# Trial Report – Individual Views

- Report will need to reflect consensus:
  - Will be based on all feedback received
  - Some views may not match the consensus of feedback
  - Not all views may be expressed in the text
  
- SEMO propose that individual views may be published:
  - Supplementary to the report
  - Will be published by SEMO in same location
  - Will be marked per organisation
  
- These will be published following the report:
  - Allow for views to reflect the final wording including feedback



# Next Steps

## Next Steps

- Participants to provide comments on report by 27/05:
  - Early provision of comments appreciated where possible
  - Comments will be accounted for in published version where possible
  
- SEMO to publish final report 31/05:
  - Will be published on SEMO website
  - Will be circulated to working group members
  - Notification through market message for non WG members
  
- Further engagement through I-SEM liaison groups:
  - BLG on EUPHEMIA 29/06 (once-off)
  - BLGs on NEMO are still on-going (next meeting July 7<sup>th</sup>)

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