Agenda

- 10:30-10:45 Welcome and Introduction
- 10:45-11:30 Capacity Requirement and De rating
- 11:30-13:00 Product (i) Scarcity (ii) Market Reference Price
- Lunch
- 13:45-14:15 Product (iii) Strike Price (iv) Other
- 14:15- 14:30 Eligibility
- 14:30-15:15 Supplier and Institutional Arrangements

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Capacity Requirement

Dundalk, 28 September 2015

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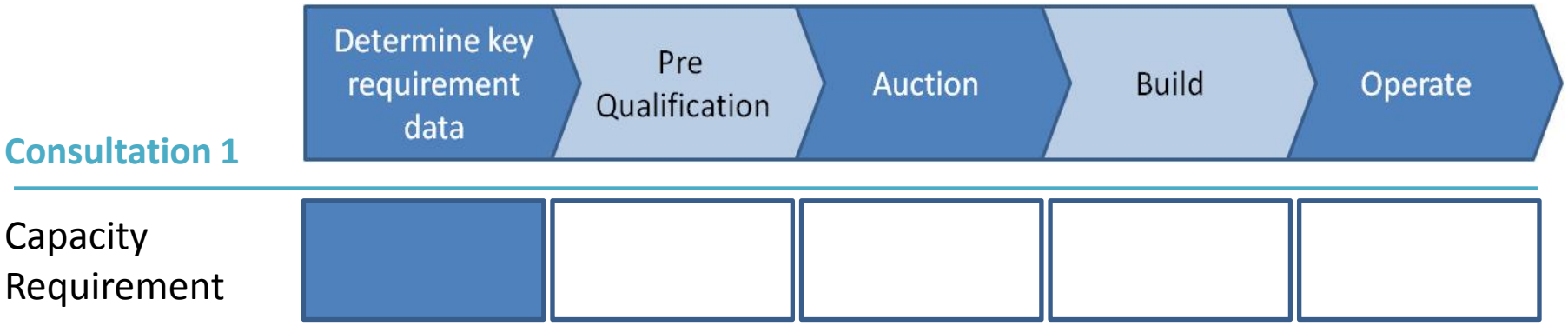
Determining the Capacity Requirement



Topics Covered	Decision
1) Security Standard	8 Hours Loss of Load Expectation
2) Accounting for Unreliability	De-rated Requirement, based on marginal de-rating
3) Accounting for Demand Forecasting Uncertainty	Optimal Scenario. Allow to evolve with best practice
4) Adjusting Capacity Requirement	Single capacity zone for the I-SEM

Security Standard – 8 Hour LoLE

- Existing 8 Hour LoLE Security Standard to be retained
  - Starting point is to take each situation as it is at present and only change it if necessary
  - €0 - €19.1 million/year cost
  - Reserve margin needed for a small system is proportionately higher than for a large system resulting in greater cost per customer to maintain given LOLE standard

Accounting for Plant Unreliability

Two options were presented :

- **Total Requirement**: This approach would determine the total "nameplate" or “installed” capacity required to meet the specified security standard. May result in a capacity requirement greater than forecast demand, with a margin to cover for the risk of plant outages.
- **De-rated Requirement**: Under a de-rated approach, capacity providers will only be eligible for capacity contracts up to a defined fraction of their nameplate capacity. This will vary by capacity type, reflecting typical reliability and hence impact on the total nameplate for capacity

Decision: **De-rated Requirement**:

- Supports efficient competition between different plant types

Options to Model Forecasted Demand

Single average Scenario

- Based on an average set of inputs
- Risks delivering a capacity requirement that is too low

Worst Case Scenario

- Based on a 1 in 20 “bad” winter
- Risks over procuring capacity in most years

Optimal Scenario

- Requirement is determined based on a number of scenarios
- Optimal scenario is the one which minimises the regret cost

Stochastic Modelling

- Employ a method of modelling in which one or more of the inputs within the model are random

Selecting the Optimal Scenario

Scenario	Forecast Peak Demand (MW)	Capacity Requirement (MW)	VoLL (€k/MWh
1	6,700 MW	7,500 MW	€10k
2	6,850 MW	7,600 MW	€10k
3	7,000 MW	7,700 MW	€10k
4	7,250 MW	7,900 MW	€10k

1

Establish the Scenarios

		Regret cost of too much capacity				Increased MWh lost from too little capacity				Regret Cost (at VoLL) of too little capacity			
		"True" Scenario				"True" Scenario				"True" Scenario			
		1	2	3	4	1	2	3	4	1	2	3	4
CONE (€k/Mwy)		€50.00k	€50.00k	€50.00k	€50.00k								
Scenario Being Evaluated	1	€0k	€0k	€0k	€0k	0	67	670	3350	€0k	€670k	€6,700k	€33,500k
	2	€5,000k	€0k	€0k	€0k	0	0	103	685	€0k	€0k	€1,028k	€6,850k
	3	€10,000k	€5,000k	€0k	€0k	0	0	0	70	€0k	€0k	€0k	€700k
	4	€20,000k	€15,000k	€10,000k	€0k	0	0	0	0	€0k	€0k	€0k	€0k

2

Evaluate components of Regret Cost

Combined Regret Costs						
		"True" Scenario				
		1	2	3	4	Max Regret
Scenario Being Evaluated	1	€0k	€670k	€6,700k	€33,500k	€33,500k
	2	***€5,000k***	***€0k***	***€1,028k***	***€6,850k***	***€6,850k***
	3	€10,000k	€5,000k	€0k	€700k	€10,000k
	4	€20,000k	€15,000k	€10,000k	€0k	€20,000k

3

- Look at total Regret Cost
- Select Scenario with "least worst" regret cost

Figures are for illustrative purposes only

Adjusting the Capacity Requirement

Auction for a single zone

Consistent with current arrangements
Simplest to implement
Assumes construction of N-S Interconnector

Auction for multiple zones

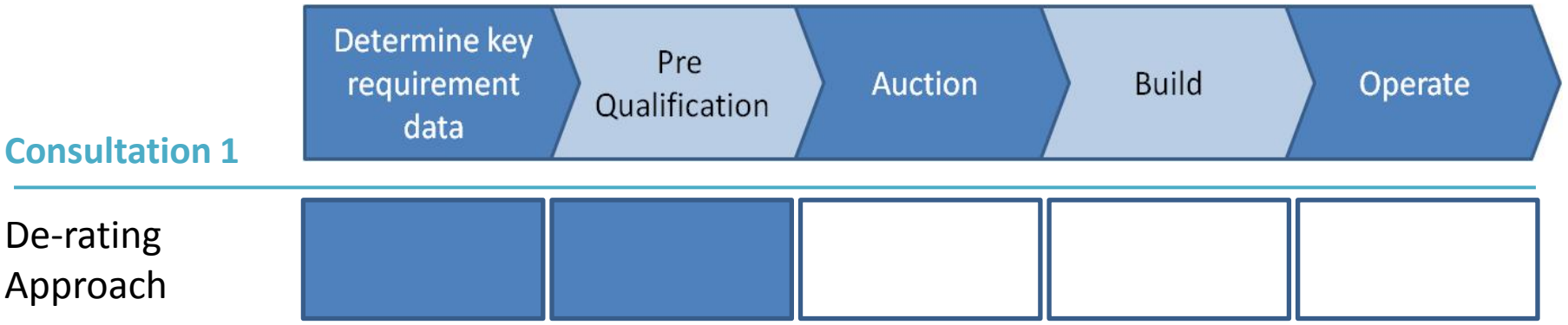
Split the Capacity market in two or more sub markets
More complicated to implement
Potentially raises issues around market power

Locational Price Adjustment

Option can be combined with either above options
Adjusts the price of bids to reflect cost of choosing one provider over another

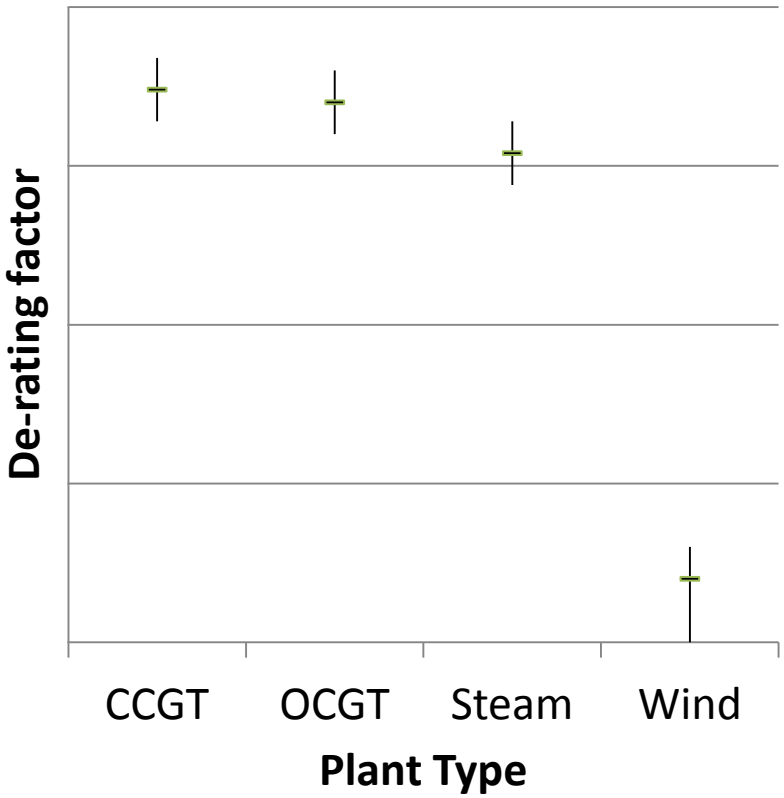
- TSO Generation Capacity Statement indicates that the North-South interconnector will be in place by 2019
- The I-SEM is expected to continue to be a single energy zone

De-rating Approach



Topics Covered	Decision
1) Technology ‘v’ Plant Specific	Technology with relative dead-band
2) Historic ‘v’ Projection ‘v’ Hybrid	Hybrid – Historic, adjust for projection in exceptional cases
3) Marginal ‘v’ Average (Forced Outage Rate)	Marginal de-rating factors
4) Grandfather de-rating factors	No grandfathering

Technology with a dead-band



- Standard de-rating factor will be determined for each technology type – based on historic data
- Operators will be free to choose their de-rating factor within a range
- TSOs to develop detailed methodology for determination of de-rating factors
  - Early work indicates de-rating factor will vary with plant size

Questions

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Product: Scarcity Pricing

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Administered Scarcity Pricing
Key decisions

Key Decision 1: Should we have Administered Scarcity Pricing (ASP)?

- **Option 1: In the Balancing Market (BM**)
- Option 2: As a additional performance incentive in the CRM only
- Option 3: No, do not include

Key Decision 2: How should we define Scarcity?

- **Option 1: When there is reduced operating reserv**e
- Option 2: When there is Lost Load only, in which case the price would be VoLL

Key Decision 3: Administered Scarcity Price level

- Option 1: Cap at the same level in GB (£3,000 until Winter 2018/19, £6,000 thereafter)
- Option 2: **Based on SEM VoLL**

Key decision 1: Should we have administered scarcity?

Option	Pros	Cons
Option 1: Yes-in BM	Capacity providers strongly incentivised	Exacerbates any hole in the hedge
	Suppliers strongly incentivised to reduce consumption	
	Consistent with GB approach - if coincident scarcity	
	Consistent with EC direction	
Option 2: Yes-via CRM	Capacity providers strongly incentivised	Potential distortion in trade with GB
	Reduces impact of hole in the hedge issue	Suppliers less incentivised to reduce consumption

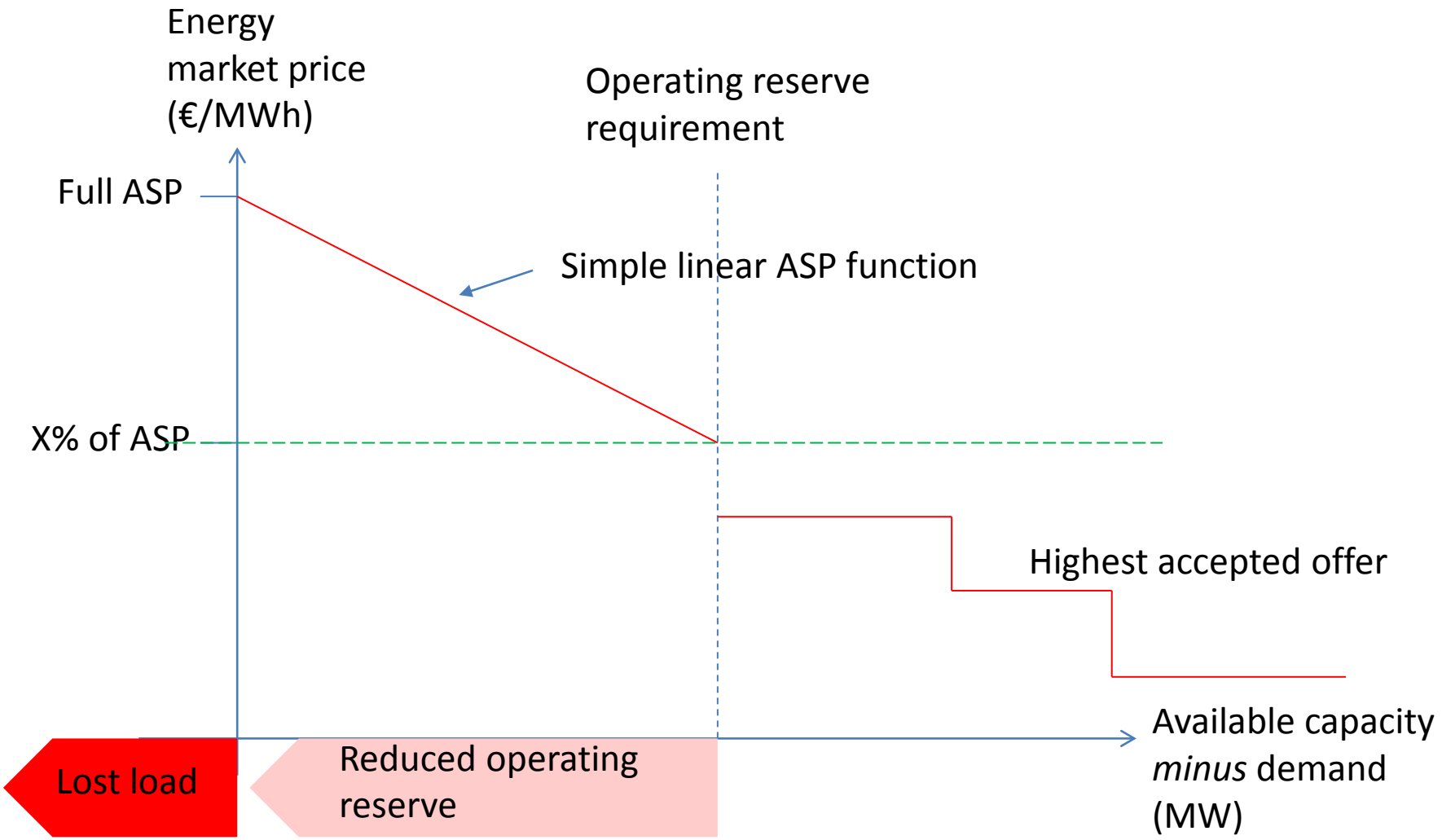
- Introducing scarcity based pricing in the energy BM:
  - Generates purer economic signals
  - Consistent with EC direction
- Risk to unhedged Suppliers (hole in the hedge is manageable)

Key decision 2: Definition of scarcity and implication for price formation

Option	Pros	Cons	Residual issues
Option 1: Reduced operating reserve: (a) coupled with LoLP multiplier; (b) simple two tier pricing (c) linear approach	Stronger signals at times before load shedding occurs	More instances of high prices, so higher risk	Requires adjustments to RO pay out for instructed reserve
	Consistent with approach in US markets	Requires LoLP calculation implementation (1a only)	
	Supported by Eirgrid		
Option 2: Lost load	Fewer higher prices so less risk	Weaker signals at times before load shedding occurs	
	Simple to implement		

- Option 1 provides stronger signals at times before load shedding occurs
- Likely to go for simple linear function without LoLP calculation. Market price will be higher of market determined and ASP during reduced reserve
- Risk to unhedged Suppliers (hole in the hedge is manageable)

Option 1c- Simple linear function



Key decision 3: level of Full ASP

Option	Pros	Cons
Option 1: Cap at GB levels (£3000 before Winter 2018/19, £6000 from Winter 2018/19)	Removes trade distortion during coincident system stress	Weaker incentives on capacity providers
	Lower hole in the hedge risk	
Option 2: Based on SEM VoLL (approx €11,000, inflated annually)	Strong incentives on capacity providers	Higher hole in the hedge risk
	Reflects true economics for all-island customers	Higher risk priced into auction bids

- Option 2 provides stronger incentives and reflects true economics
- Risk to unhedged Suppliers (hole in the hedge is manageable)
- Higher risk to capacity providers only in event of failure to perform

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Product: Market Reference Price

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Market reference price options

- Option 1: BM price
  - Option 1a: BM price without scarcity pricing;
  - Option 1b: BM price with scarcity pricing (and Eirgrid proposed a variant of this)
- Option 2: 100% Intra-day market price;
- Option 3: 100% DAM price;
- Option 4: Multiple reference market option:
  - Option 4a: A blended price option;
  - **Option 4b: A split market price option**. Any volumes sold in DAM settled at DAM price, remaining unsold RO volume settled against BM price*

*extend to include Intra-Day Market price component

Comparing Option 3 and Option 4b

Key scenario: peaking plant has no real capability to deliver capacity

Assumptions

RO Strike Price	500
Day Ahead Market Price	100
BM price	10000

Capacity provider	Nameplate	ROQ	EAQ	MQ
A (thermal baseload)	100	90	100	100
B (thermal mid-merit)	100	90	70	100
C (thermal peaker)	100	90	0	0
D (wind)	100	10	30	30
Total	400	280	200	230

Supplier		Deemed ROQ	EAQ	MQ
E		100	100	100
F		130	100	130
Total		230	200	230

Stronger penalty for generator who has not delivered

Generator payment: Option 4b

	Ex ante trades	BM payments	RO diff payments	Total
A	€10,000	€0	€0	€10,000
B	€7,000	€300,000	-€156,071	€150,929
C	€0	€0	-€702,321	-€702,321
D	€3,000	€0	€0	€3,000
Total	€20,000	€300,000	-€858,393	-€538,393

Generator payment: Option 3 (DAM)

	Ex ante trades	BM payments	RO diff payments	Total
A	€10,000	€0	€0	€10,000
B	€7,000	€300,000	€0	€307,000
C	€0	€0	€0	€0
D	€3,000	€0	€0	€3,000
Total	€20,000	€300,000	€0	€320,000

Supplier payment: Option 4b

	Ex ante trades	BM payments	RO diff payments	Total
E	-€10,000	€0	€0	-€10,000
F	-€10,000	-€300,000	€285,000	-€25,000
Total	-€20,000	-€300,000	€285,000	-€35,000

Supplier payment: Option 3 (DAM)

	Ex ante trades	BM payments	RO diff payments	Total
E	-€10,000	€0	€0	-€10,000
F	-€10,000	-€300,000	€0	-€310,000
Total	-€20,000	-€300,000	€0	-€320,000

Gen load following adj	82%
Supplier load following adj	1

Greater protection for Supplier in imbalance

Option 4b and two-way CfDs
Example 1- ASP in BM

- 2 way CfD payments unaffected
- Generators A, B, D have same net revenue
- Generator C BM revenue capped, used to limit Supplier BM price exposure

Assumptions

RO Strike Price	500	EAP (Day Ahead Price)	100
2 way CfD Strike Price	80	IMBP	10000

Capacity provider	Nameplate	ROQ	2 way CfD	EAQ	MQ
A (baseload)	100	90	90	100	50
B (mid-merit)	100	90	90	100	100
C (peaker)	100	90	20	10	100
D (wind)	100	10		30	30
Total	400	280	200	240	280

Supplier		Deemed ROQ	2 way CfD	EAQ	MQ
E		140	100	120	140
F		140	100	120	140
Total		280	200	240	280

Generator payment (without RO), €k

Day Ahead trades	BM	Old 2 way CfD	Total without RO
10.0	-500.0	-1.8	-491.8
10.0	0.0	-1.8	8.2
1.0	900.0	-0.4	900.6
3.0	0.0	0.0	3.0
24.0	400.0	-4.0	420.0

Generator payment (with RO under Option 4b), €k

Day Ahead trades	BM	New 2 way CfD	RO diff payments	Total with RO
10.0	-500.0	-1.8	0.0	-491.8
10.0	0.0	-1.8	0.0	8.2
1.0	900.0	-0.4	-760.0	140.6
3.0	0.0	0.0	0.0	3.0
24.0	400.0	-4.0	-760.0	-340.0

Supplier payment (without RO), €k

Day Ahead trades	BM	Old 2 way CfD	Total without RO
-12.0	-200.0	2.0	-210.0
-12.0	-200.0	2.0	-210.0
-24.0	-400.0	4.0	-420.0

Supplier payment (with RO under Option 4b), €k

Day Ahead trades	BM	New 2 way CfD	RO diff payments	Total with RO
-12.0	-200.0	2.0	190.0	-20.0
-12.0	-200.0	2.0	190.0	-20.0
-24.0	-400.0	4.0	380.0	-40.0

Option 4b and two-way CfDs
Example 2- ASP in DAM and BM

- Generators A, B have same net revenue
- Generator C,D revenue capped
- Used to limit Supplier to DAM above 2 way CfD volume and BM price exposure

Assumptions

RO Strike Price	500	EAP (Day Ahead Price)	10000
2 way CfD Strike Price	80	IMBP	10000

Capacity provid	Nameplate	ROQ	2 way CfD	EAQ	MQ
A (baseload)	100	90	90	50	50
B (mid-merit)	100	90	90	100	100
C (peaker)	100	90	20	100	100
D (wind)	100	10		30	30
Total	400	280	200	280	280

Generator payment (without RO), €k

Day Ahead trades	BM	Old 2 way CfD	Total without RO
500.0	0.0	-892.8	-392.8
1,000.0	0.0	-892.8	107.2
1,000.0	0.0	-198.4	801.6
300.0	0.0	0.0	300.0
2,800.0	0.0	-1,984.0	816.0

Generator payment (with RO under Option 4b)

Day Ahead trades	BM	New 2 way CfD	RO diff payments	Total with RO
500.0	0.0	-37.8	-855.0	-392.8
1,000.0	0.0	-37.8	-855.0	107.2
1,000.0	0.0	-8.4	-855.0	136.6
300.0	0.0	0.0	-95.0	205.0
2,800.0	0.0	-84.0	-2,660.0	56.0

Supplier		Deemed ROQ	2 way CfD	EAQ	MQ
E		140	100	140	140
F		140	100	140	140
Total		280	200	280	280

Supplier payment (without RO), €k

Day Ahead trades	BM	Old 2 way CfD	Total without RO
-1,400.0	0.0	992.0	-408.0
-1,400.0	0.0	992.0	-408.0
-2,800.0	0.0	1,984.0	-816.0

Supplier payment (with RO under Option 4b)

Day Ahead trades	BM	New 2 way CfD	RO diff payments	Total with RO
-1,400.0	0.0	42.0	1,330.0	-28.0
-1,400.0	0.0	42.0	1,330.0	-28.0
-2,800.0	0.0	84.0	2,660.0	-56.0

Comparison of 4b and DAM options Summary evaluation

- Option 3 does not adequately incentivise capacity providers to be reliable
- Option 4b can serve to cap the exposure of Suppliers to high prices on unexpected volume changes.
  - Supports competition from small non-vertically integrated Suppliers;
- Two-way CfDs can be adapted appropriately

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Product: Strike Price

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Emerging thinking summary

- Floating price:
  - Tracks fuel cost, low risk of interference with energy market
- Hypothetical plant (high SRMC)
  - Low risk of interference with marginal plant
  - Can reflect hypothetical small back-up generators, not currently exporting to the transmission or distribution grids
  - May also include element for other DSU costs
- Don’t grandfather
  - Avoid multiple Strike Prices in a delivery year

Reference formula

Strike Price = Max [T% x Max [GRP, ORP], DSU]

- T% is the reference thermal efficiency for the hypothetical Peak Energy Rent unit
- GRP is the gas reference price, which will be consulted on further, but which is likely to be a gas spot reference price (e.g. an NBP spot reference price plus a transport adder)
- ORP is the oil reference price, which will be consulted on further, but which is likely to be a gas oil spot reference price (e.g. an ARA gas oil reference price plus a transport adder)
- DSU is the cost of a reference demand side unit, €/MWh which reflects the cost incurred by demand side in switching off, which may not be related to the cost of energy
- Probably also appropriate to adjust this formula to include an element of the carbon price

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Product: Other

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Emerging thinking

- **Load following**: **Yes**
  - Strongly favoured by respondents
  - Suppliers will be able to get the volume hedge they need, but will not benefit from windfall gains
  - May be feasible to use any over-recovery to set up an insurance fund to insure Suppliers against any hole in the hedge cost
- **Additional performance incentives**: **No**
  - Not required if adopt Administered Scarcity Pricing in BM, Option 4b
  - Does not apply to Implementation Agreement, availability testing failure
- **Caps on penalties and incentives**: **yes, caps on RO exposure, but can lose more than option fee.**
  - More detail to be confirmed

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Eligibility

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Emerging thinking

Issue	Emerging thinking
Supported generation	Option 3: All eligible
Renewables not receiving support	Eligible
Treatment of non-firm generation	Further consideration required
Mandatory vs discretionary bidding	Mandatory for dispatchable generators, within tolerance levels. Discretionary for intermittent, but must pre-qualify to allow adjustment of capacity requirement
Adjusting the capacity requirement for non-bidding generation	Yes, adjust
Demand Side Participation treatment options	Further consideration required
Pre-qualification criteria	Need to consider interaction with DS3 further

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Supplier and Institutional Arrangements

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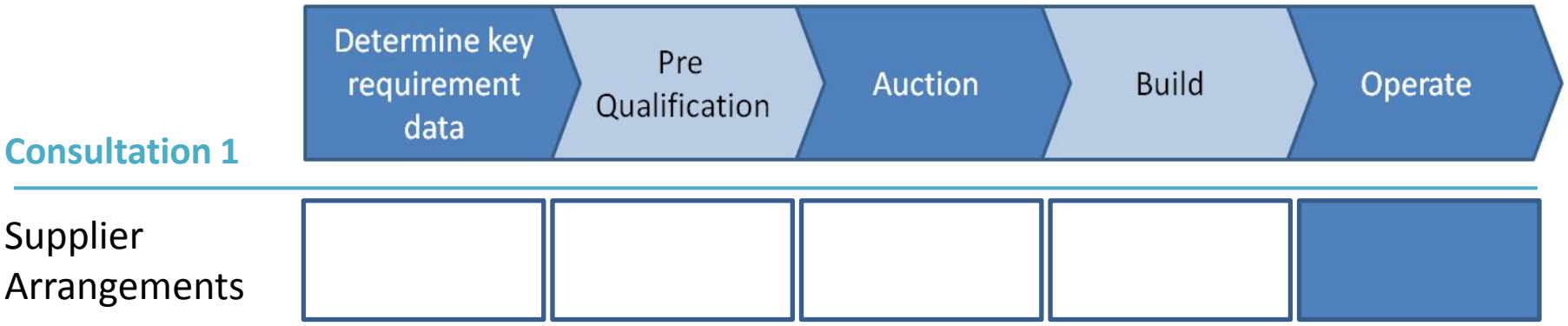
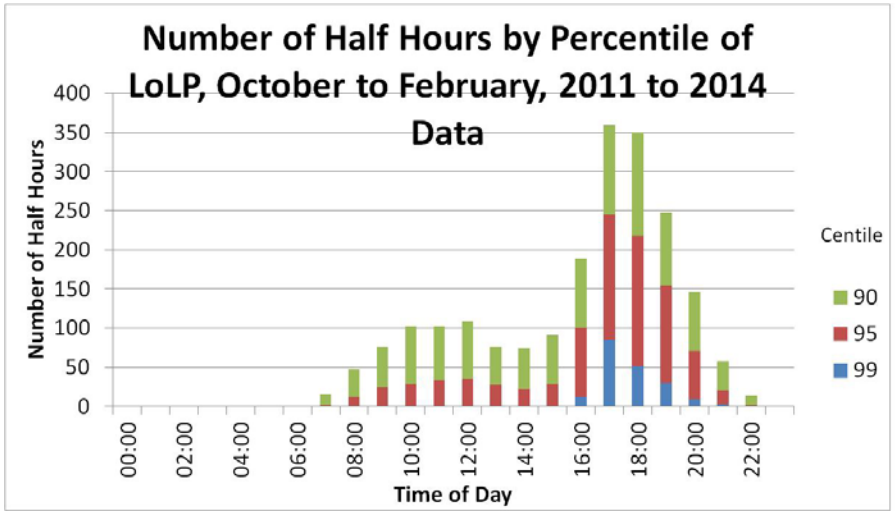
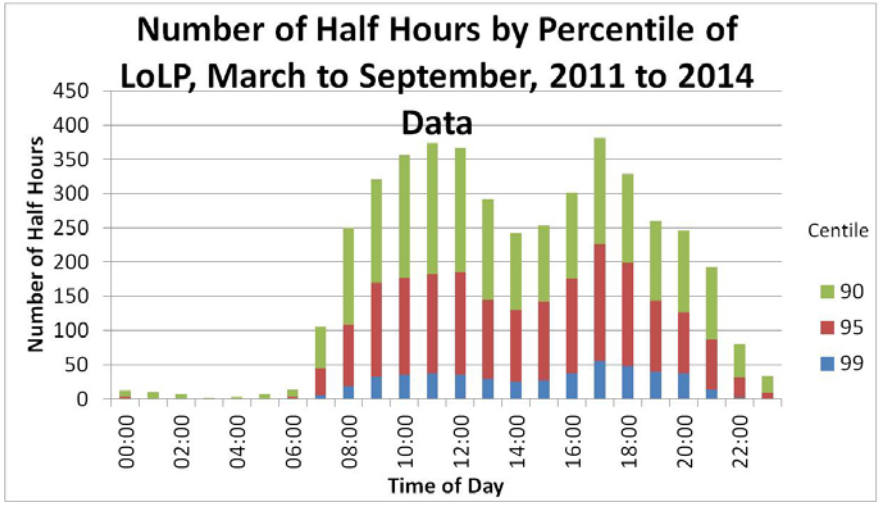
Supplier Arrangements



Topics Covered	Decision
1) Recovery of Admin Costs	With other I-SEM admin costs
2) Flat ‘v’ Profiled ‘v’ Focused	Appropriately Focused
3) Option Fee Cash flow	Match with Generators
4) Credit Cover Level	Level set at maximum indebtedness Applies to both Generators and Suppliers
5) Treatment of Exchange Rate	Mutualised

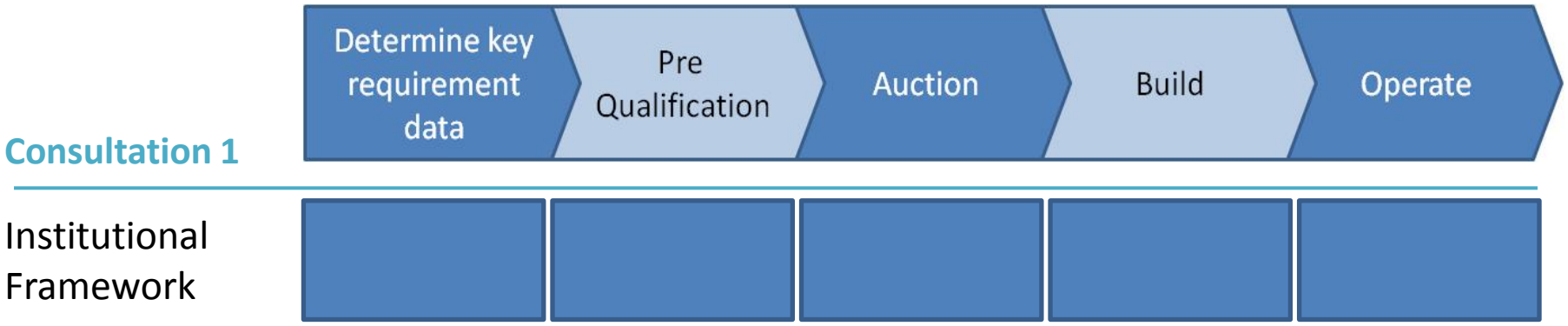
“Focused” Cost Recovery





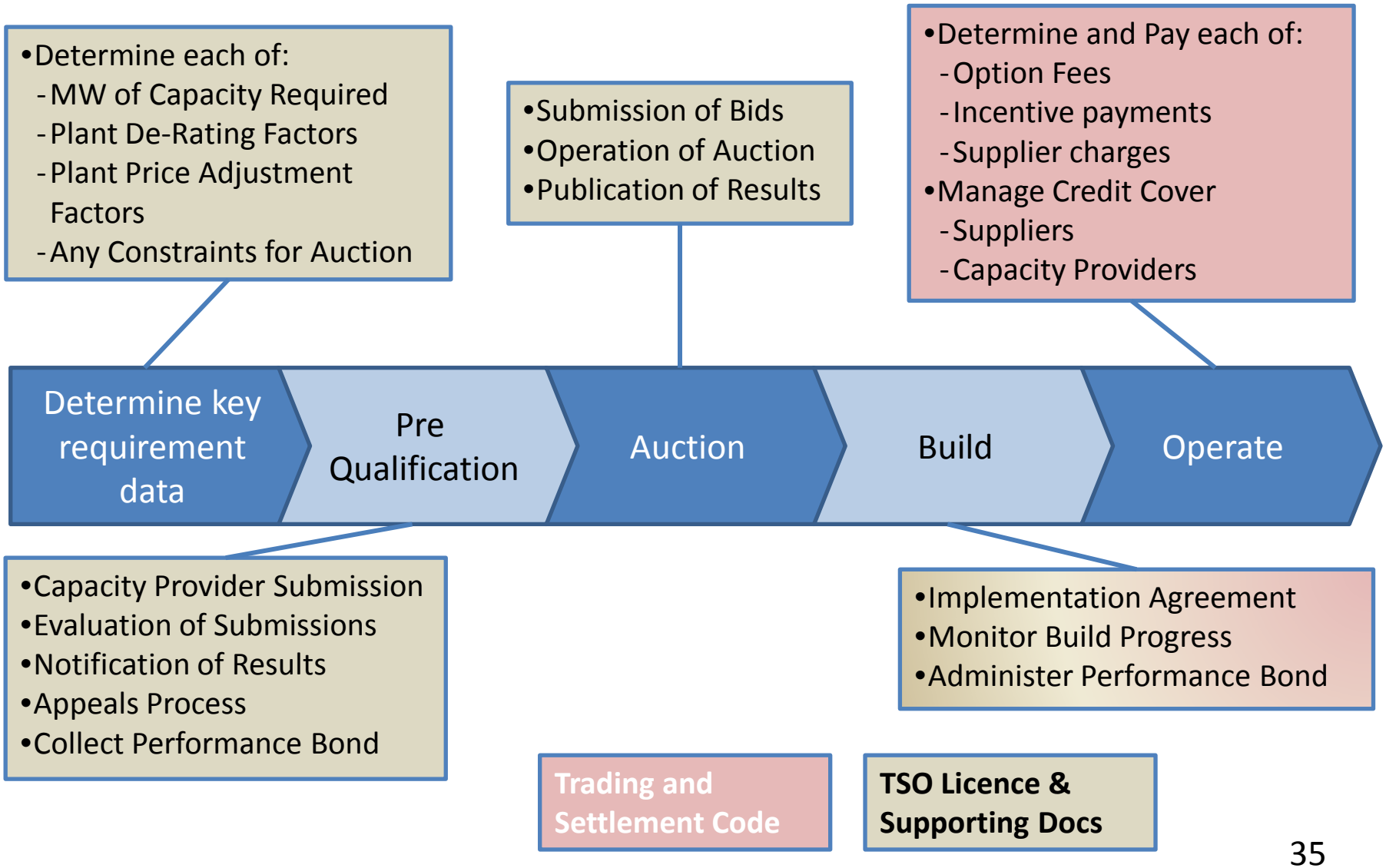
- Focus charges on times when LoLP likely to be high
- Set profile ex-ante – e.g. 4 months ahead
- Keep under periodic review
- Example
  - Between 16:00 and 21:00, October to February
  - Between 08:00 and 21:00 March to September
  - Captures
    - 99% of top percentile LoLP
    - 90% of top 5 percentile of LoLP
    - 85% of top decile of LoLP

Institutional Framework

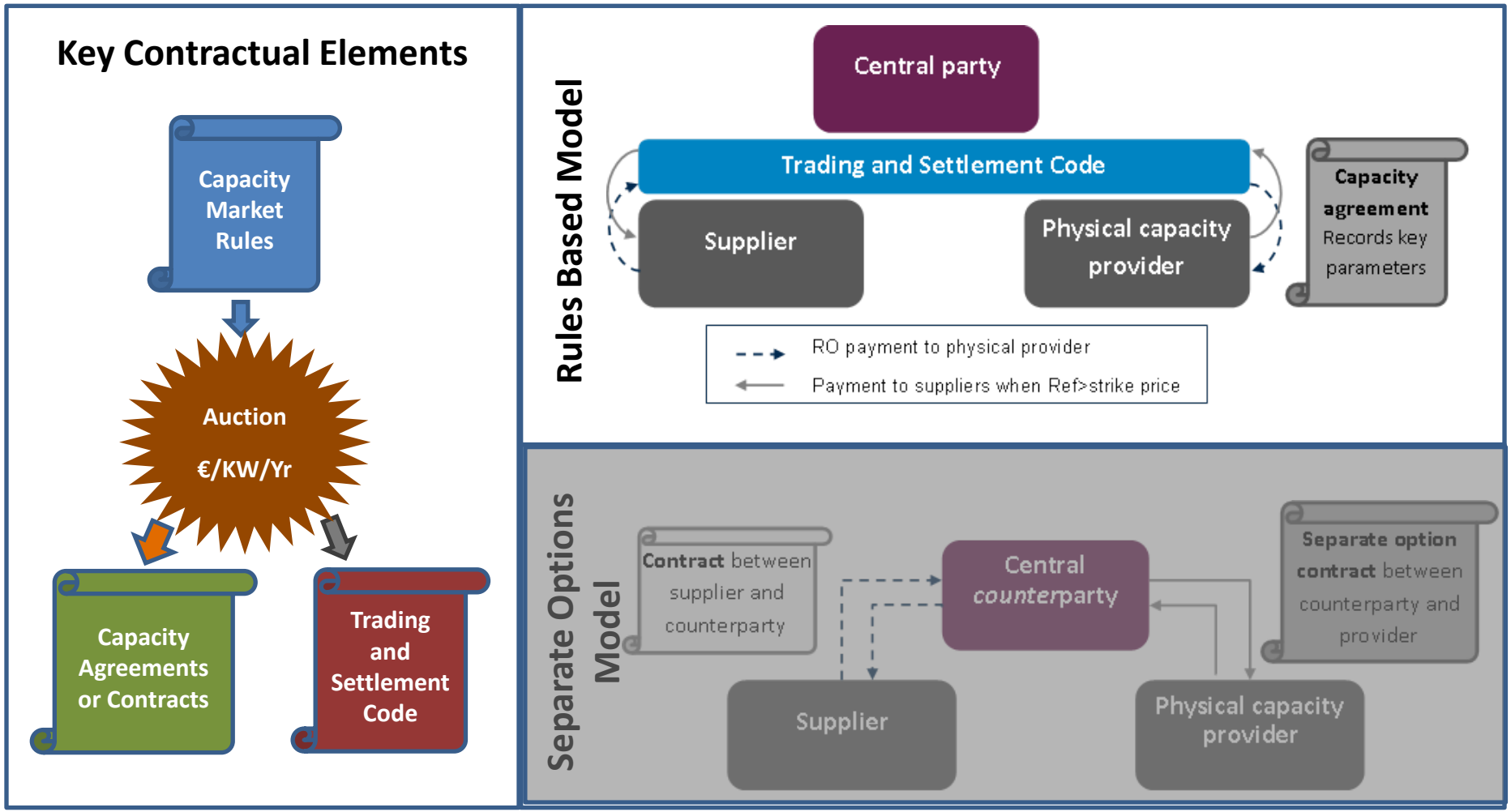


Topics Covered	Decision
1) Proposed Governance OK?	Yes
2) Contractual Model: Rules Based ‘v’ Separate Options ‘v’ Hybrid	Rules Based
3) Need Implementation Agreements?	Yes – use generic milestones

Governance Arrangements



Contractual Framework



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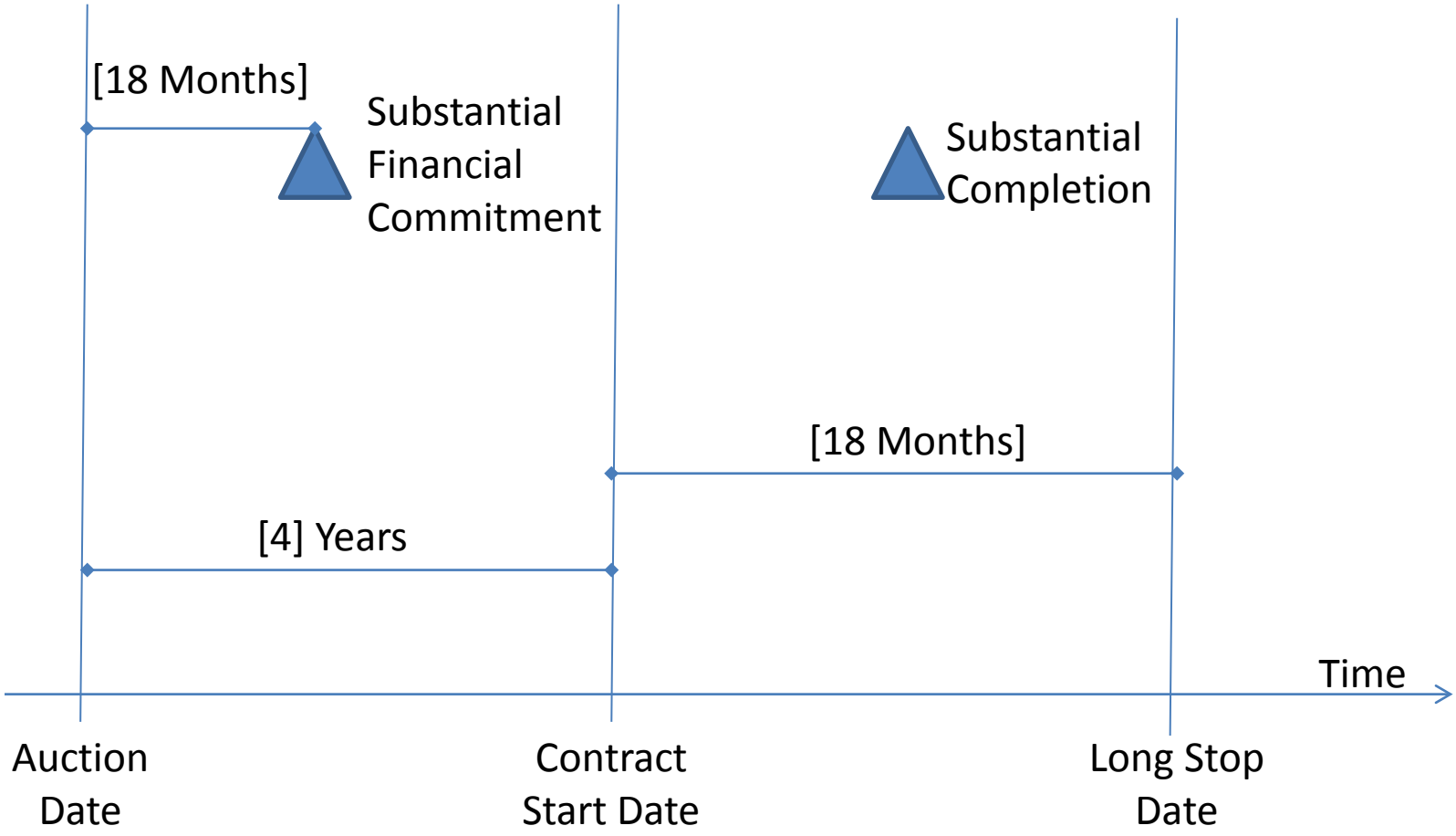
Need for Implementation Agreements



Timescales and milestones to be considered in Consultation 2