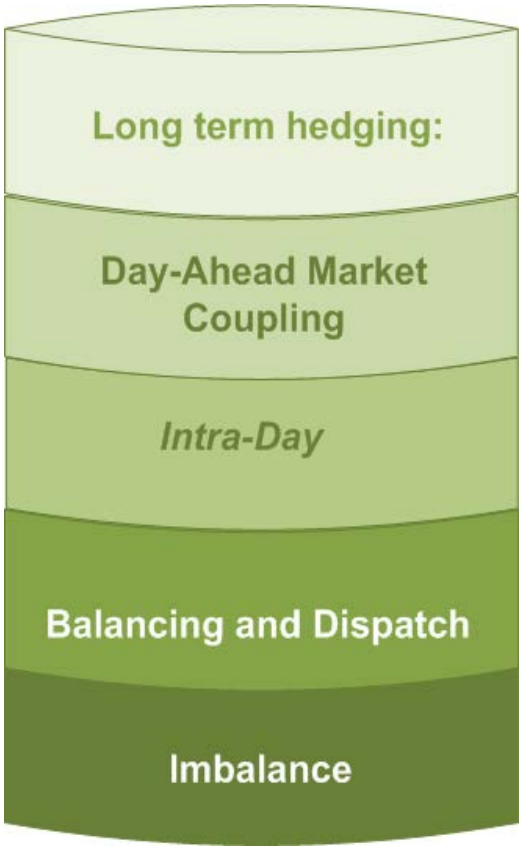
Glossary

Term	Definition
Term	Definition
Q_{FW}	Quantity in forward market
Q_{DA}	Quantity in Day-Ahead market
Q_{ID}	Quantity in intraday market
Q_{BAL}	Quantity in balancing market
$Q_{metered}$	Metered quantity (excluding non-energy balancing actions)
Q_{IMB}	Imbalance quantity ($Q_{metered}$-(Q_{FW}+Q_{DA}+Q_{ID}))
P_{FW}	Price(s) in forward market
P_{DA}	Price in Day-Ahead market
P_{ID}	Price(s) in intraday market
P_{BAL}	Price(s) in balancing market
P_{IMB}	Imbalance price(s)
Y_{FW}	Revenue or cost in forward market
Y_{DA}	Revenue or cost in day ahead market
Y_{ID}	Revenue or cost in intraday market
Y_{BAL}	Revenue or cost in balancing market
Y_{IMB}	Revenue or cost in imbalance

Overview of trading in HLD options for I-SEM



Forward Prices ($P_{FW,i}$)

Day Ahead Price (P_{DA})

Intra-Day Prices ($P_{ID,i}$)

Balancing Price(s) (P_{BAL})

Imbalance Price(s) (P_{IMB})

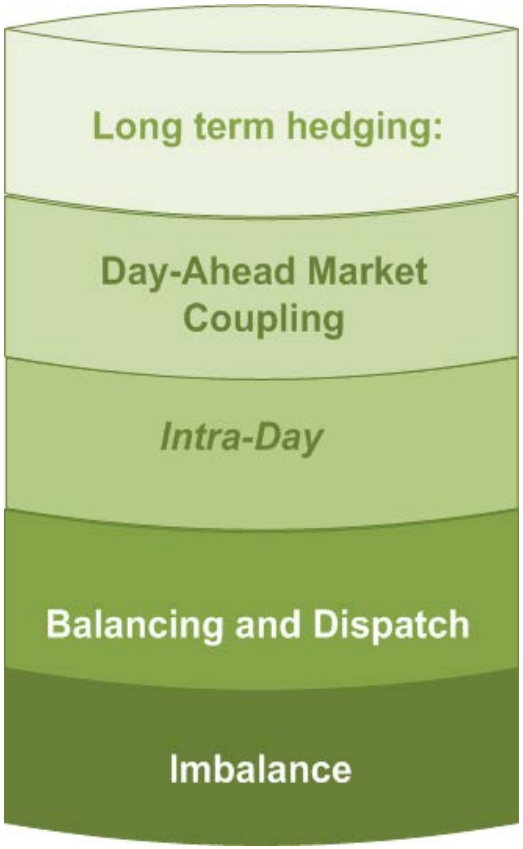
Irrespective of which I-SEM High Level Design option is selected market participants could be subject to different prices in the different market timeframes as illustrated in the blue boxes to the left

In the forward and intraday (unlike the Day-Ahead based on a single auction through Euphemia), this could be a stream of prices (possibly from different trading platforms)

Participants provide a balancing bid/offer to the TSO (Energy balancing actions are assumed to be Pay-as-cleared and non-energy balancing actions are assumed to be settled as Pay-as bid)

An imbalance price is the marginal cost of balancing energy actions

Trading opportunities across different timeframes in new HLD options for I-SEM



$Y_{FW} = \Sigma(Q_{FW,i} * P_{FW,i})$

$Y_{DA} = Q_{DA} * P_{DA}$

$Y_{ID} = \Sigma(Q_{ID,i} * P_{ID,i})$

$Y_{BAL} = Q_{BAL} * P_{BAL}$

$Y_{IMB} = Q_{IMB} * P_{IMB}$

The subscript i denotes a trade that has been struck in the particular timeframe.
A market participant could, for example, sell different quantities, at different times and different prices in the forward timeframe

Simplifying assumptions for worked examples

- The following worked examples are designed to be purely illustrative of possible trading outcomes across different timeframes
- We describe one worked example from the perspective of a wind generator one worked example from the perspective of a supplier for each of the 4 HLD options for I-SEM. To facilitate comparison between the options for each worked example, we assume the same trading strategy is followed in each option.
- For both worked examples, we assume that the effective prices in each timeframe are the same in each HLD option. Changes in price between timeframes can be driven by a range of factors, including but not limited to changes in aggregate forecasts and/or associated trading volumes for wind and demand.
- In these worked examples, the overall (net) revenue/cost for the particular trading period is the same for each market participant across all options.
- For simplicity, forward trading in HLD options 1 and 2 is shown as physical, although it is possible to also trade forward financially in those options
- These examples are static (one-off). In any of the HLD options, the relationship between prices in the different timeframes will change dynamically through opportunities for arbitrage, and changes in forecasts and availability

Worked example 1 - Wind Generator with 100MW capacity

There can be several trades in the forward timeframe. For simplicity in the worked examples, we show only one trade (for 10MW).

Wind generator forecasts output at Day-Ahead stage
Forecast @ DA = 50MW

Wind generator updates forecast several times throughout the day and the wind generator can strike several trades intraday. For simplicity in the worked examples, we show only one forecast and one trade intraday.
Forecast @ ID 60MW **(10MW increase from DA forecast)**

For simplicity, we assume that the wind generator is either not called in the balancing mechanism or s a price-taker in the ex-post pool. Each HLD option will need to respect absolute priority dispatch

Actual volume is lower than the final forecasted position
$Q_{metered}$ = 50MW
(10MW decrease from ID forecast)

Worked Example 1 (Wind Generator with 100MW capacity)
HLD Option 1 (Adapted Decentralised Market)

Legend

Physical trading

Financial trading

Sells 10MW forward
@P_{FW} = €60/MWh
Y_{FW} = €600

There can be several trades in the forward timeframe. For simplicity in the worked examples, we show only one trade.

Wind generator forecasts output at Day-Ahead stage

Forecast @ DA 50MW
Sells 40MW Day-Ahead
@P_{DA} = €50/MWh
Y_{DA} = €2000

Forecast @ ID 60MW
Sells 10MW intraday
@P_{ID} = €40/MWh
Y_{ID} = €400

Wind generator updates forecast several times throughout the day and the wind generator can strike several trades intraday. For simplicity in the worked examples, we show only one forecast and one trade intraday.

May submit a (downwards) balancing bid as forecast output is fully contracted

For simplicity, we assume that the wind generator is not called in the balancing mechanism

$Q_{metered}$ = 50MW
Buys 10MW imbalance
@P_{IMB} = €50/MWh
Y_{IMB} = -€500

Actual volume is lower than the final forecasted position

Net Revenue = €600 + €2000 + €400 + €0 - €500 = €2500

Worked Example 1 (Wind Generator with 100MW capacity) HLD Option 2 (Mandatory Ex-Post Pool for Net Volumes)

Legend

Physical trading

Financial trading

Sells 10MW forward
@P_{FW} = €60/MWh
Y_{FW} = €600

There can be several trades in the forward timeframe. For simplicity in the worked examples, we show only one trade.

Wind generator forecasts output at Day-Ahead stage

Forecast @ DA 50MW
Sells 40MW Day-Ahead
@P_{DA} = €50/MWh
Y_{DA} = €2000

Forecast @ ID 60MW
Sells 10MW intraday
@P_{ID} = €40/MWh
Y_{ID} = €400

Wind generator updates forecast several times throughout the day and the wind generator can strike several trades intraday. For simplicity in the worked examples, we show only one forecast and one trade intraday.

Assumed to be a price-taker in the ex-post pool

$Q_{metered}$ = 50MW
Buys 10MW in ex-post pool (because had sold 60MW in earlier timescales)
@P_{IMB} = €50/MWh
Y_{IMB} = -€500

Actual volume is lower than the final forecasted position

Net Revenue = €600 + €2000 + €400 + €0 - €500 = €2500

Worked Example 1 (Wind Generator with 100MW capacity) HLD Option 3 (Mandatory Centralised Market)

Legend

Physical trading

Financial trading

Sells 10MW forward
@P_{FW} = €60/MWh
As CFD against P_{DA}

There can be several trades in the forward timeframe. For simplicity in the worked examples, we show only one trade.

Wind generator forecasts output at Day-Ahead stage

Forecast @ DA 50MW
Sells 50MW Day-Ahead
@P_{DA} = €50/MWh,
Y_{DA} = €2500; Y_{FW} = €100 (receives CFD payment for 10MW@€10/MWh)

Forecast @ ID 60MW
Sells 10MW intraday
@P_{ID} = €40/MWh
Y_{ID} = €400

Wind generator updates forecast several times throughout the day and the wind generator can strike several trades intraday. For simplicity in the worked examples, we show only one forecast and one trade intraday.

May submit a (downwards) balancing bid as forecast output is fully contracted

For simplicity, we assume that the wind generator is not called in the balancing mechanism

$Q_{metered}$ = 50MW
Buys 10MW imbalance
@P_{IMB} = €50/MWh
Y_{IMB} = -€500

Actual volume is lower than the final forecasted position

Net Revenue = €100 + €2500 + €400 + €0 - €500 = €2500

Worked Example 1 (Wind Generator with 100MW capacity) HLD Option 4 (Gross Pool – Net Settlement Market)

Legend

Physical trading

Financial trading

Sells 10MW forward
@P_{FW} = €60/MWh
As CFD against P_{DA}

There can be several trades in the forward timeframe. For simplicity in the worked examples, we show only one trade.

Wind generator forecasts output at Day-Ahead stage

Forecast @ DA 50MW
Sells 50MW Day-Ahead
@P_{DA} = €50/MWh,
Y_{DA} = €2500; Y_{FW} = €100 (receives CFD payment for 10MW@€10/MWh)

Forecast @ ID 60MW
Sells 10MW intraday
@P_{ID} = €40/MWh
Y_{ID} = €400

Wind generator updates forecast several times throughout the day and the wind generator can strike several trades intraday. For simplicity in the worked examples, we show only one forecast and one trade intraday.

Assumed to be a price-taker in the ex-post pool

$Q_{metered}$ = 50MW
Net settlement in pool of volumes not previously contracted = buys 10MW
@P_{IMB} = €50/MWh
Y_{IMB} = -€500

Actual volume is lower than the final forecasted position

Net Revenue = €100 + €2500 + €400 + €0 - €500 = €2500

Worked example 2 – Supplier (with no active demand)

There can be several trades in the forward timeframe. For simplicity in the worked examples, we show only one trade (for 400MW of demand).

Supplier forecasts demand at Day-Ahead stage
Forecast @ DA = 450MW

Supplier updates demand forecast several times throughout the day and the supplier can strike several trades intraday. For simplicity in the worked examples, we show only one forecast and one trade intraday.
Forecast @ ID 460MW **(10MW increase from DA forecast)**

As the supplier is assumed to have no access to active demand, it does not participate in the balancing mechanism and is a price-taker in the ex-post pool

Actual volume is lower than the final forecasted position
$Q_{metered}$ = 450MW
(10MW decrease from ID forecast)

Worked Example 2 (Supplier with no active demand)
HLD Option 1 (Adapted Decentralised Market)

Buys 400MW forward
@P_{FW} = €60/MWh
Y_{FW} = -€24000

There can be several trades in the forward timeframe. For simplicity in the worked examples, we show only one trade.

Legend
Physical trading
Financial trading

Supplier forecasts demand at Day-Ahead stage

Forecast @ DA 450MW
Buys 50MW Day-Ahead
@P_{DA} = €50/MWh
Y_{DA} = -€2500

Forecast @ ID 460MW
Buys 10MW intraday
@P_{ID} = €40/MWh
Y_{ID} = -€400

Supplier updates forecast several times throughout the day and supplier can strike several trades intraday. For simplicity in the worked examples, we show only one forecast and one trade intraday.

As the supplier is assumed to have no access to active demand, it does not participate in the balancing mechanism

$Q_{metered}$ = 450MW
Sells 10MW imbalance
@P_{IMB} = €50/MWh
Y_{IMB} = €500

Actual volume is lower than the final forecasted position

Net Revenue = -€24000 - €2500 - €400 + €0 + €500 = -€26400

Worked Example 2 (Supplier with no active demand)
HLD Option 2 (Mandatory Ex-Post Pool for Net Volumes)

Legend

Physical trading

Financial trading

Buys 400MW forward
@P_{FW} = €60/MWh
Y_{FW} = -€24000

There can be several trades in the forward timeframe. For simplicity in the worked examples, we show only one trade.

Supplier forecasts demand at Day-Ahead stage

Forecast @ DA 450MW
Buys 50MW Day-Ahead
@P_{DA} = €50/MWh
Y_{DA} = -€2500

Forecast @ ID 460MW
Buys 10MW intraday
@P_{ID} = €40/MWh
Y_{ID} = -€400

Supplier updates forecast several times throughout the day and supplier can strike several trades intraday. For simplicity in the worked examples, we show only one forecast and one trade intraday.

As the supplier is assumed to have no access to active demand, it is assumed to be a price-taker in the ex-post pool

$Q_{metered}$ = 450MW
Sells 10MW imbalance
@P_{IMB} = €50/MWh
Y_{IMB} = €500

Actual volume is lower than the final forecasted position

Net Revenue = -€24000 - €2500 - €400 + €0 + €500 = -€26400

Worked Example 2 (Supplier with no active demand)
HLD Option 3 (Mandatory Centralised Market)

Legend

Physical trading

Financial trading

Buys 400MW forward
@P_{FW} = €60/MWh
As CFD against P_{DA}

There can be several trades in the forward timeframe. For simplicity in the worked examples, we show only one trade.

Supplier forecasts demand at Day-Ahead stage

Forecast @ DA 450MW
Buys 450MW Day-Ahead
@P_{DA} = €50/MWh
Y_{DA} = -€22500; Y_{FW} = -€4000 (makes CFD payment for 400MW@€10/MWh)

Forecast @ ID 460MW
Buys 10MW intraday
@P_{ID} = €40/MWh
Y_{ID} = -€400

Supplier updates forecast several times throughout the day and supplier can strike several trades intraday. For simplicity in the worked examples, we show only one forecast and one trade intraday.

As the supplier is assumed to have no access to active demand, it does not participate in the balancing mechanism

$Q_{metered}$ = 450MW
Sells 10MW imbalance
@P_{IMB} = €50/MWh
Y_{IMB} = €500

Actual volume is lower than the final forecasted position

Net Revenue = -€4000 - €22500 - €400 + €0 + €500 = -€26400

Worked Example 2 (Supplier with no active demand) HLD Option 4 (Gross Pool – Net Settlement Market)

Legend

Physical trading

Financial trading

Buys 400MW forward
@P_{FW} = €60/MWh
As CFD against P_{DA}

There can be several trades in the forward timeframe. For simplicity in the worked examples, we show only one trade.

Supplier forecasts demand at Day-Ahead stage

Forecast @ DA 450MW
Buys 450MW Day-Ahead
@P_{DA} = €50/MWh
Y_{DA} = -€22500; Y_{FW} = -€4000 (makes CFD payment for 400MW@€10/MWh)

Forecast @ ID 460MW
Buys 10MW intraday
@P_{ID} = €40/MWh
Y_{ID} = -€400

Supplier updates forecast several times throughout the day and supplier can strike several trades intraday. For simplicity in the worked examples, we show only one forecast and one trade intraday.

As the supplier is assumed to have no access to active demand, it is assumed to be a price-taker in the ex-post pool

$Q_{metered}$ = 450MW
Net settlement in pool of volumes not previously contracted = Sells 10MW
@P_{IMB} = €50/MWh
Y_{IMB} = €500

Actual volume is lower than the final forecasted position

Net Revenue = -€4000 - €22500 - €400 + €0 + €500 = -€26400