PA Consulting Group

Electricity Trading Arrangements Tutorial

24 January 2003

CER
Commission for Energy Regulation
An Coimisiún um Rialáil Fuinnimh

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Electricity Trading Arrangements Tutorial

Introduction to Market Options	Ed Kee
Market Options – Comparisons	John George

- Role of contracting
- Role of balancing / spot markets
- Unit commitment
- Role of SO
- Real time price formation
- Bidding behaviour
- Aligning physical and economic
- Markets and pricing outside real time

Contracts — Stuart Curson

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Market Options – Comparisons — John George

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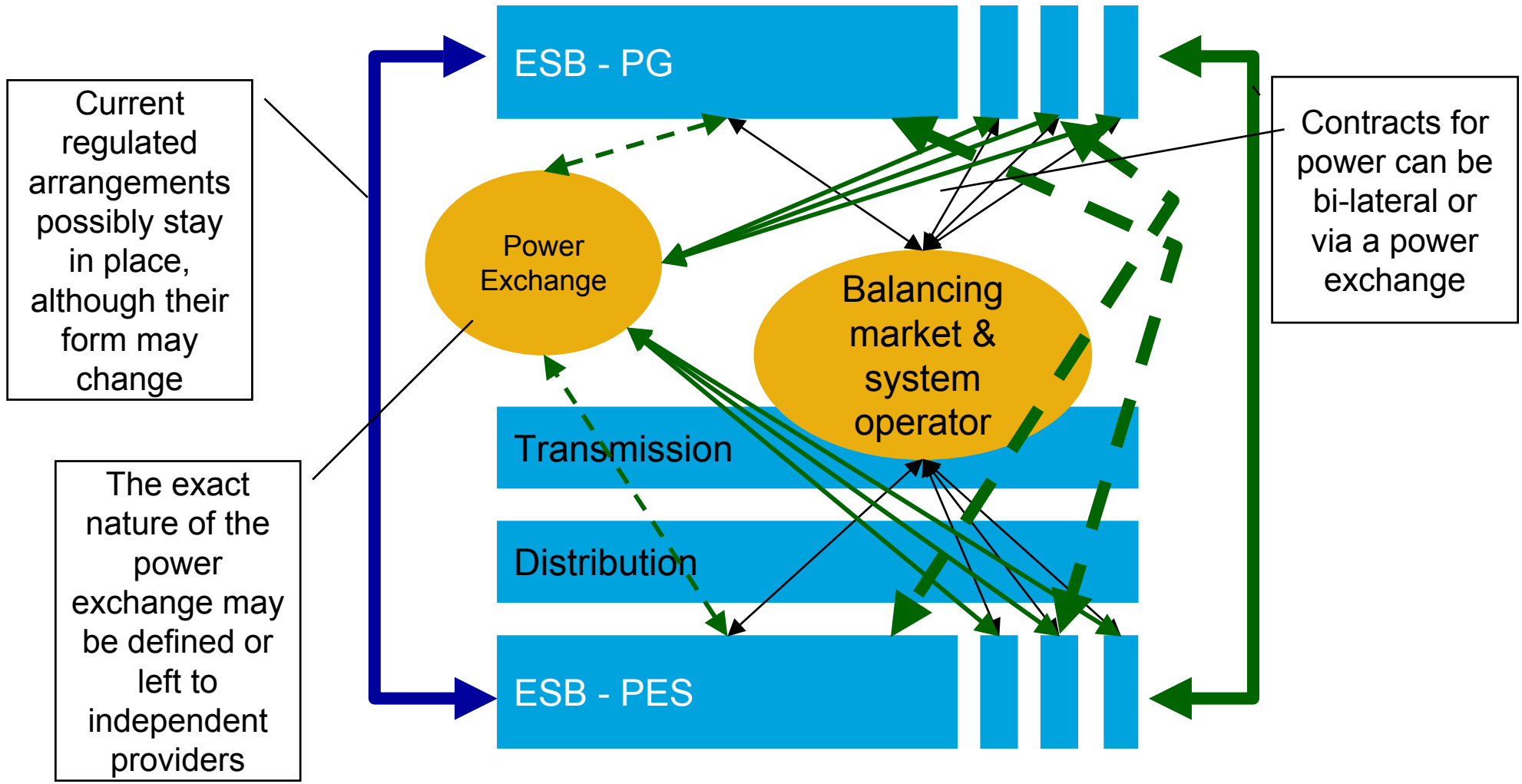
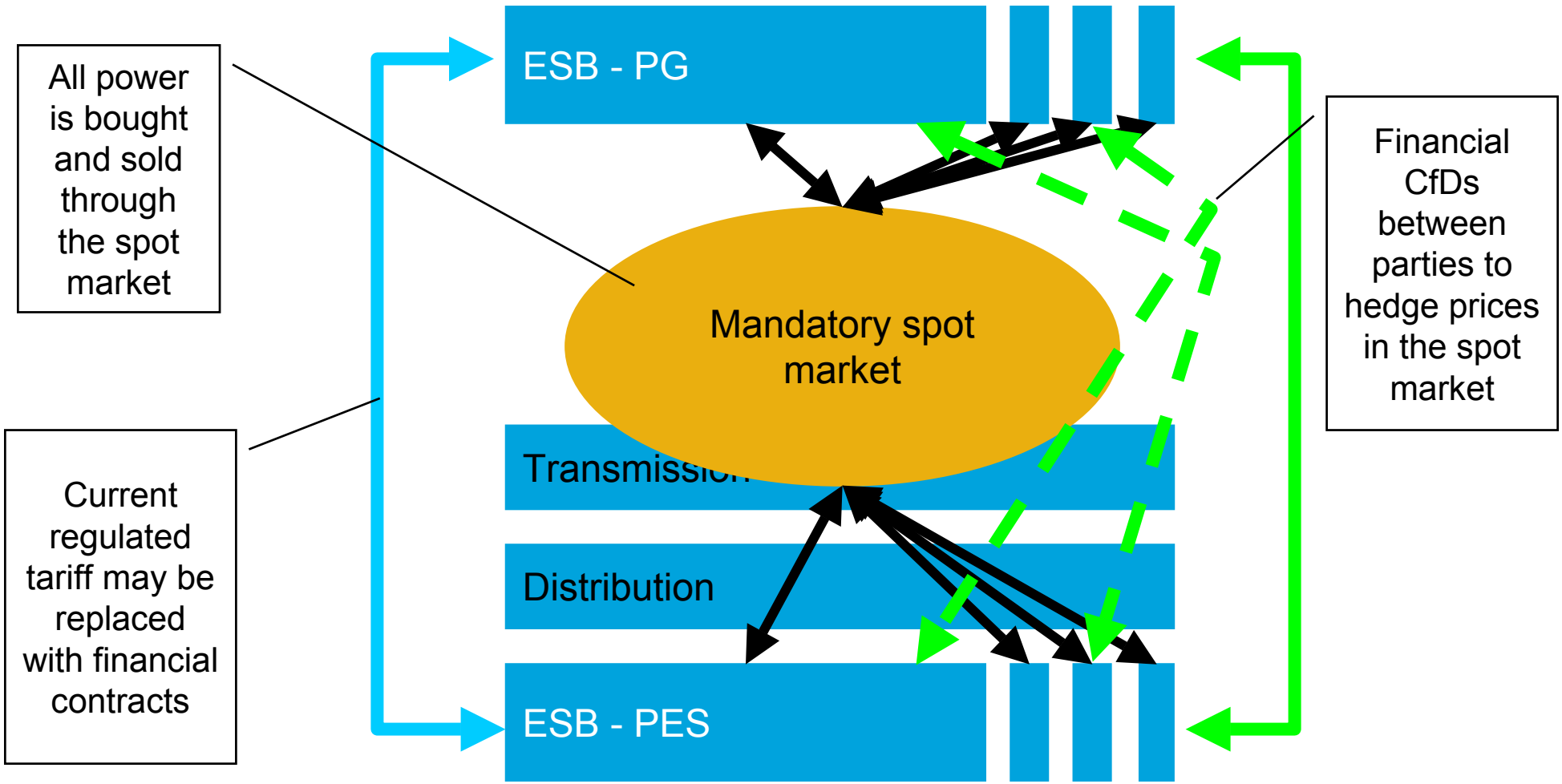
Contracts — Stuart Curson

Decentralised market for Ireland



Centralised market for Ireland



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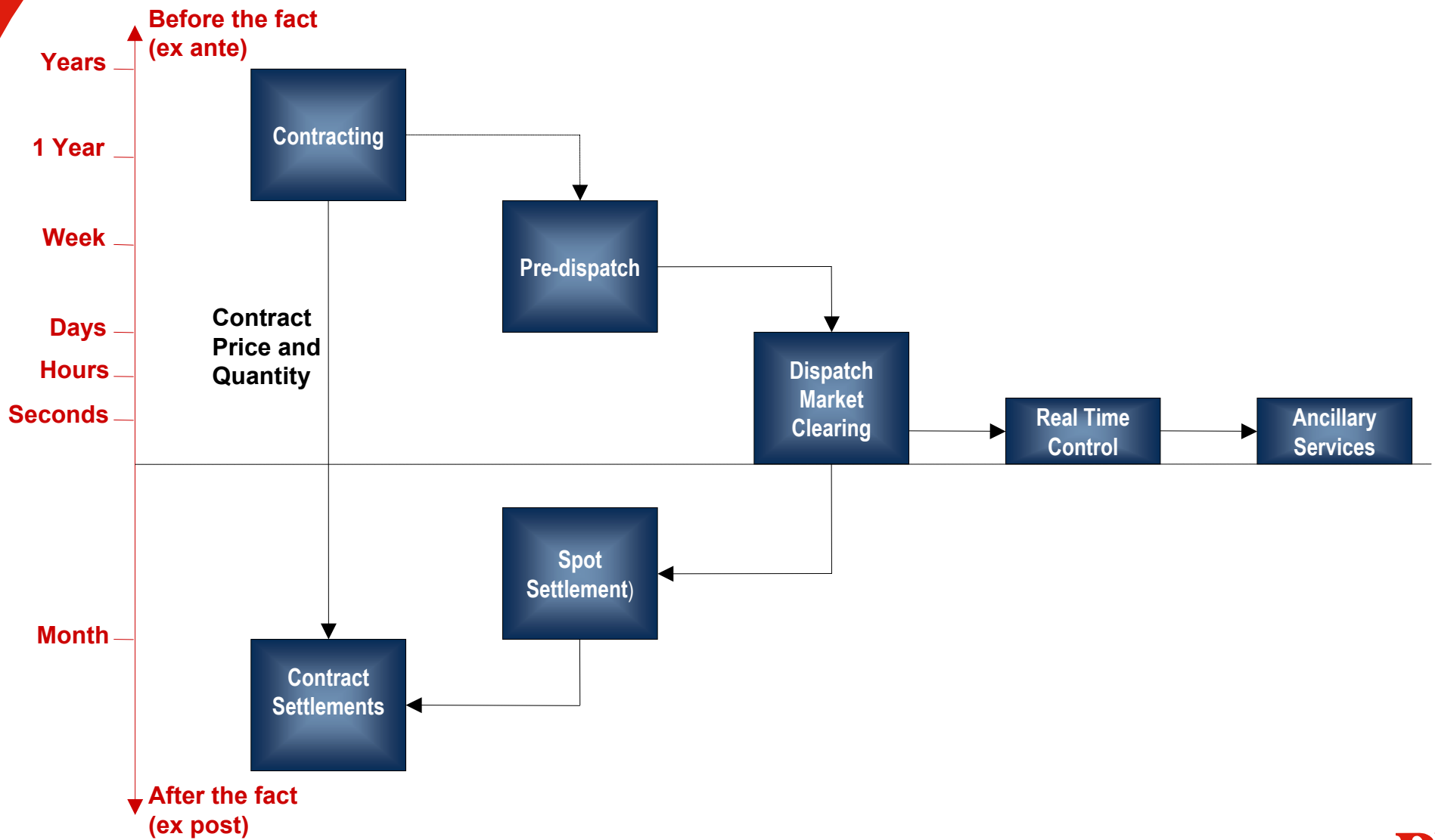
Market time-scales



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Contracts — Stuart Curson

Role of Contracting - Decentralised market

Contractual relationships are the fundamental basis of trading in the market

- **Normally physical supply contracts**
- **Drive market operations**
  - **Participants declare their market position by submitting to the SO a schedule of contracts**
  - **Participants decide contracting strategy**
- **Facilitated by market for contracts**
  - **ready availablity of contracts and**
  - **trading in contracts even in the very short term**

Role of Contracting - Centralised market

Contractual relationships support trading in the spot market

- Normally financial hedge contracts
- Participants arrange contracts for risk management - could choose to operate in the market with no contracts
- Contractual relationships have no direct role in real-time trading
  - But may affect a partcipant's bidding behaviour in the spot market

Preferable that there is a ready availability of contracts

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Role of Balancing Mechanism – Decentralised market

Balancing mechanism

- Required for SO to resolve:
  - the difference between contractual commitments and actual load and dispatch
  - dispatch infeasibility and congestion
- Trading based on “inc” and “dec” bids around contractual quantities
- May be two markets with separate “buy” and “sell” prices - can involve substantial price differences
- Probably involves trading of very small proportion of total dispatch (NETA claims 2%)

Role of the Spot Market – Centralised market

Spot market is central to trading arrangements

- **Spot market covers all dispatch**
- **All electricity is bought and sold by the market operator**
- **Market determines the price of all dispatch**
- **Generators are dispatched on the basis of their offers in the market**
  - **Price / quantity bids used to declare their desired dispatch levels and market revenue**
- **Market dispatch must be reconciled with system operations**
  - **Actual dispatch must be feasible to the power system**
  - **Market dispatch should correspond as closely as possible with the feasible system operation**
  - **Otherwise requires a reconciliation process**

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Unit Commitment - Decentralised market

Generators are responsible for deciding their plant operating levels

These are determined primarily by declared contractual commitments, as adjusted by any:

- Ancillary services accepted by SO
- Inc and decs bids accepted by the SO in the balancing markets and imposed levels by SO

Unit Commitment - Centralised market

"Self commitment" is the predominant model - generators are responsible for deciding their plant operating levels - determined by (as in Aust., NZ markets):

- "Simple" price / quantity offers made to the spot market
- Consistency with ancillary services accepted by SO

Different from "centralised commitment" model in orginal E&W pool:

- "Complex" bids that also include start up costs and plant operating characteristics
- The SO's own unit commitment optimisation method.
- Side payments for commitment

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Contracts	Stuart Curson

System Operator role for real time operations

SO's role is much like a pilot in a modern jet – to ensure that nothing goes wrong even if the controls are all on automatic.

- Manage real-time operations
- Manage contingencies
- Implement plant dispatch as decided by trading arrangements
  - Ensure dispatch is feasible
  - Restricted by commercial imperatives of market
- Purchase ancillary services
  - Contract
  - Market and auction
- Determine load and ancillary service requirements
- Ensure ancillary services are available

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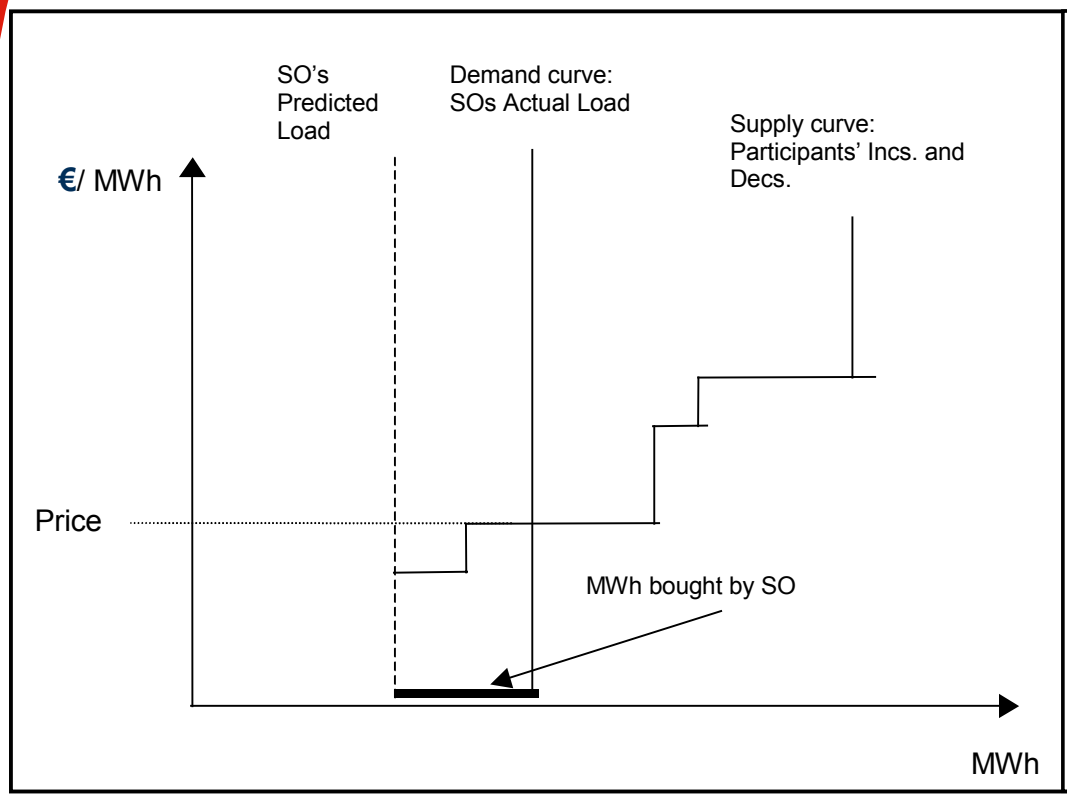
Real time Price Formation – Decentralised market

Participant costs / revenues primarily determined by bilateral contracts in advance of real time

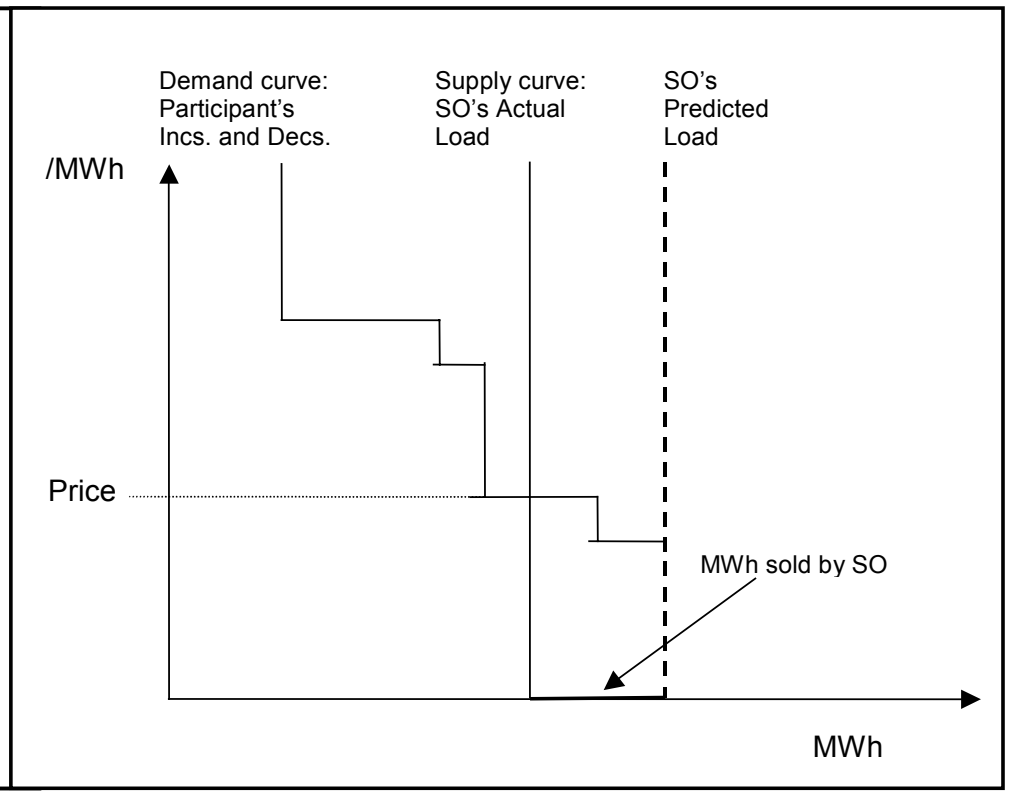
Real time prices related to the balancing mechanism may be available

Real time Price Formation: Decentralised

SO buy market



SO sell market



Participants often paid-as-bid

Real time Price Formation – Centralised market

Real time price formation is key to the centralised market

Real time price = market clearing price

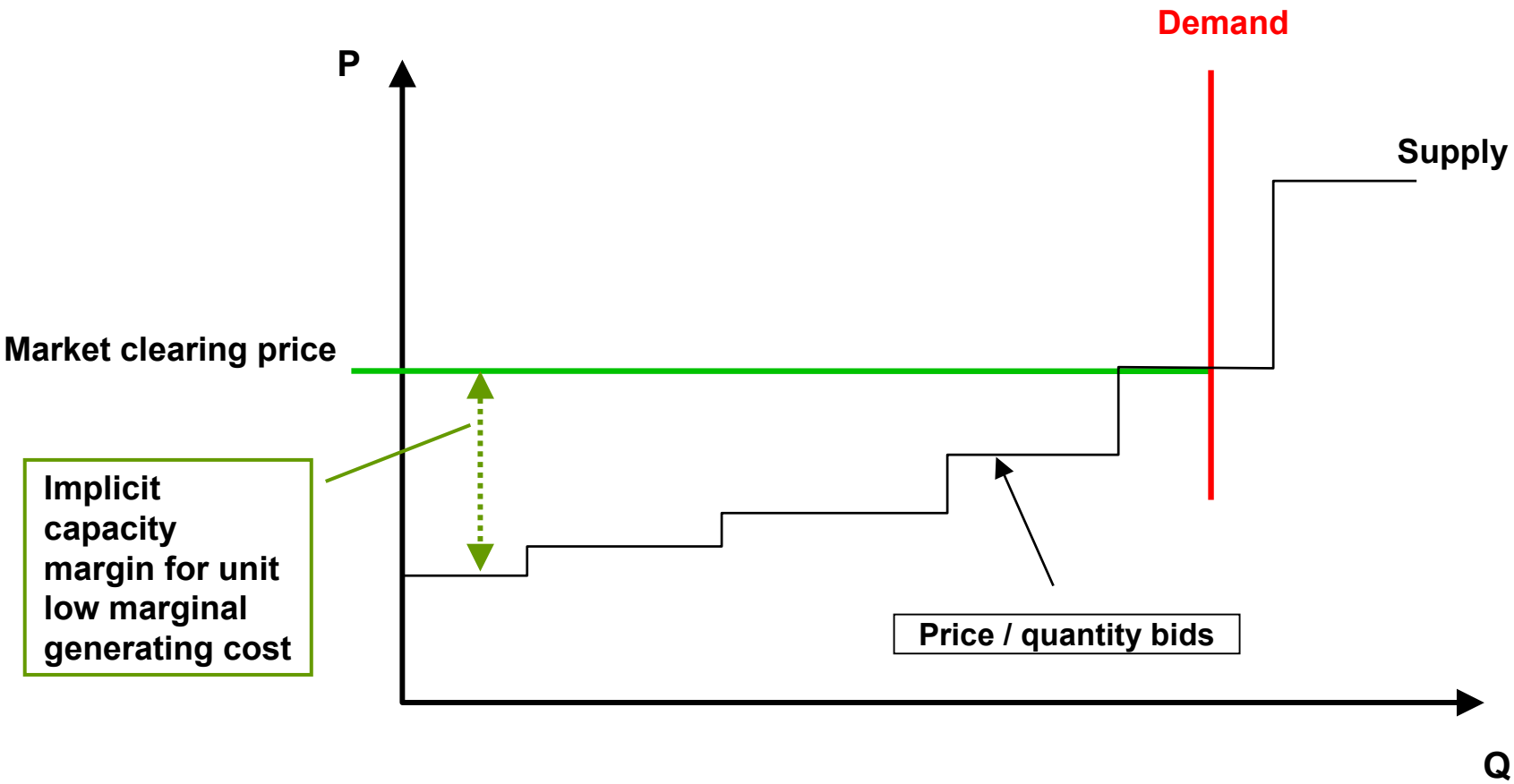
Market clearing price is paid for all dispatch irrespective of their bid

Prices may be

- Different for each location – reflect losses and congestion
- Common for defined zones
- Uniform across the whole system

Price Formation – Centralised Market

Market clearing price is paid to all accepted bids



Illustrative trading period (e.g., 1 hour)

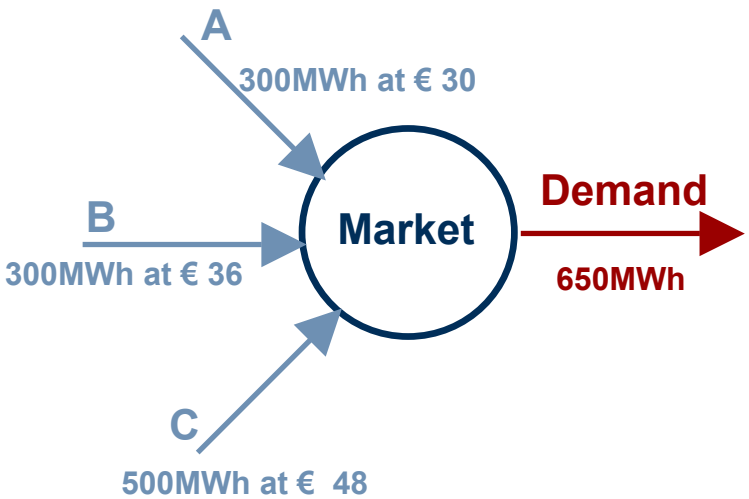
Centralised Market Example: Single Node Market

Three generating companies

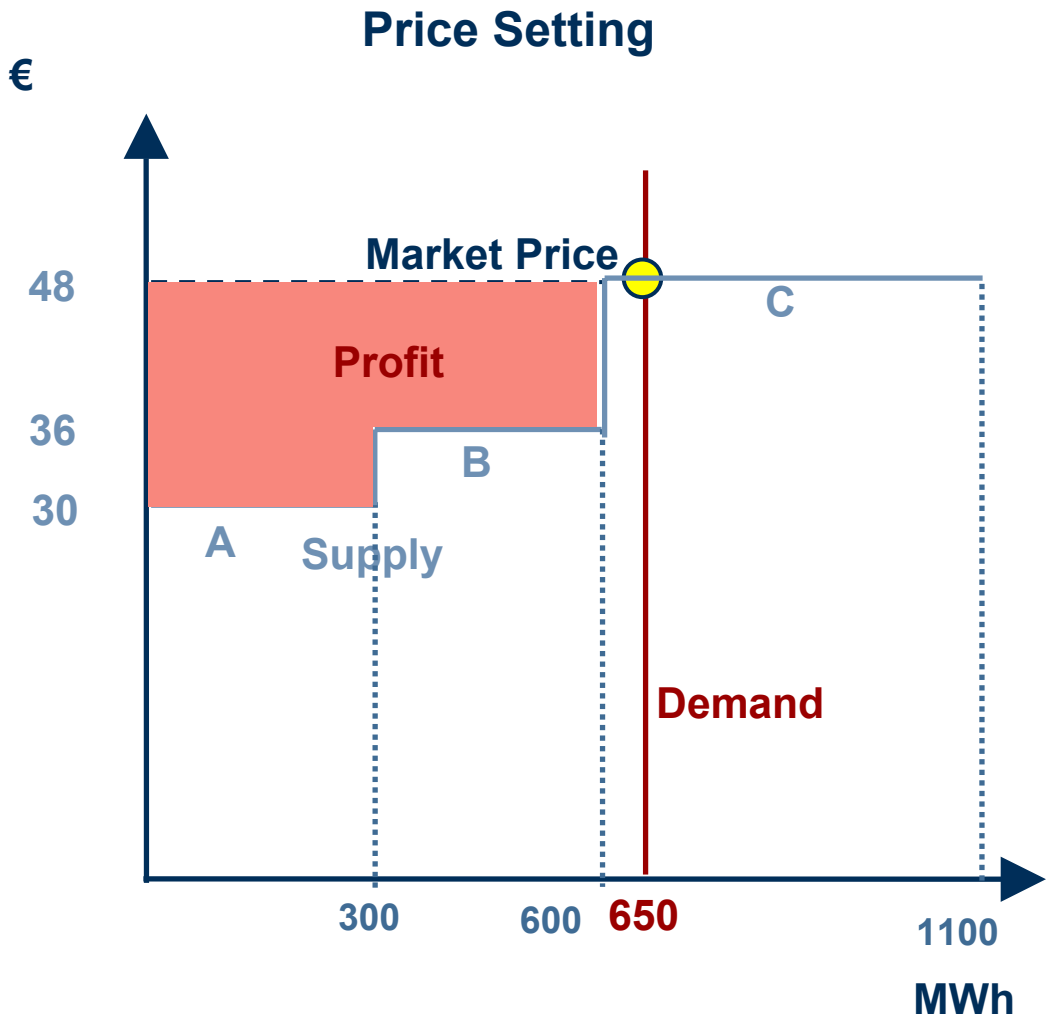
Genco	Capacity	Offer Price
A	300 MW	€ 30 / MWh
B	300 MW	€ 36 / MWh
C	500 MW	€ 48 / MWh

Demand of 650 MWh in the next 1 hour trading interval

Centralised Market Example: Single Node Market



Genco	Dispatch	Revenue	Profit
A	300 MWh	€ 14,400	€ 5,400
B	300 MWh	€ 14,400	€ 3,600
C	50 MWh	€ 2,400	€ 0



Centralised Market Example: Two Node Market without Congestion

Market split into two “nodes” and a linking transmission line

Genco	Capacity	Offer Price	Node Association
A	300 MW	€ 30 / MWh	1
B	300 MW	€ 36 / MWh	1
C	500 MW	€ 48 / MWh	2

Transmission system between the nodes:

- Capacity of 250MW with 1% linear losses

Demand for next trading interval (hour)

- Node 1: 400 MWh,
- Node 2: 250 MWh

Centralised Market Example: Two Node Market without Congestion

Genco A

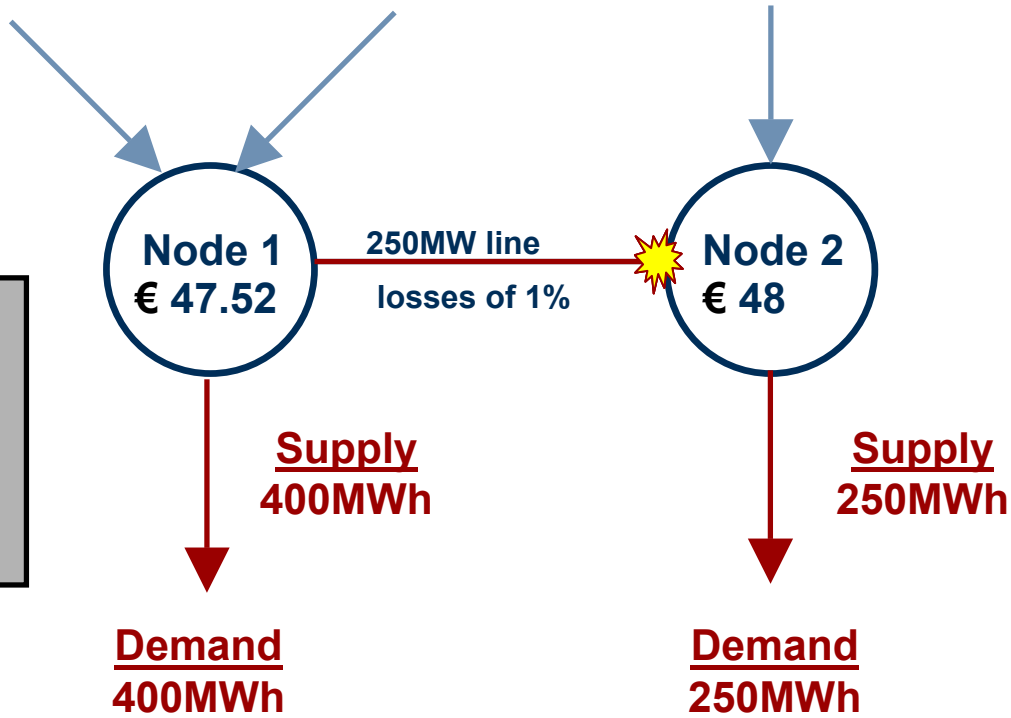
Capacity:300MWh at € 30
Generation: 300MWh

Genco B

Capacity:300MWh at € 36
Generation: 300MWh

Genco C

Capacity:500MWh at € 48
Generation: 52MWh



Nodal price difference

= € 0.48 /MWh

Cost of losses

= € 0.48 /MWh

Centralised Market Example: Two Node Market without Congestion

Genco	Dispatch MWh	Market Price € / MWh	Revenue €	Profit €
A	300	47. 52	14,256	5,256
B	300	47. 52	14,256	3,456
C	52	48	2,496	0
Total	652	Av = 47.558	31,008	8,712

Load	Supply MWh	Export (Import) MWh	Market Price € / MWh	Cost €
1	400	200	47. 52	19,008
2	250	(198)	48	12,000
Total	650		Av = 47.705	31,008

Centralised Market Example: Two Node Market with Congestion

As before but with line capacity reduced to100MW

Centralised Market Example: Two Node Market with Congestion

Genco A

Capacity:300MWh at € 30

Generation: 300MWh

Genco B

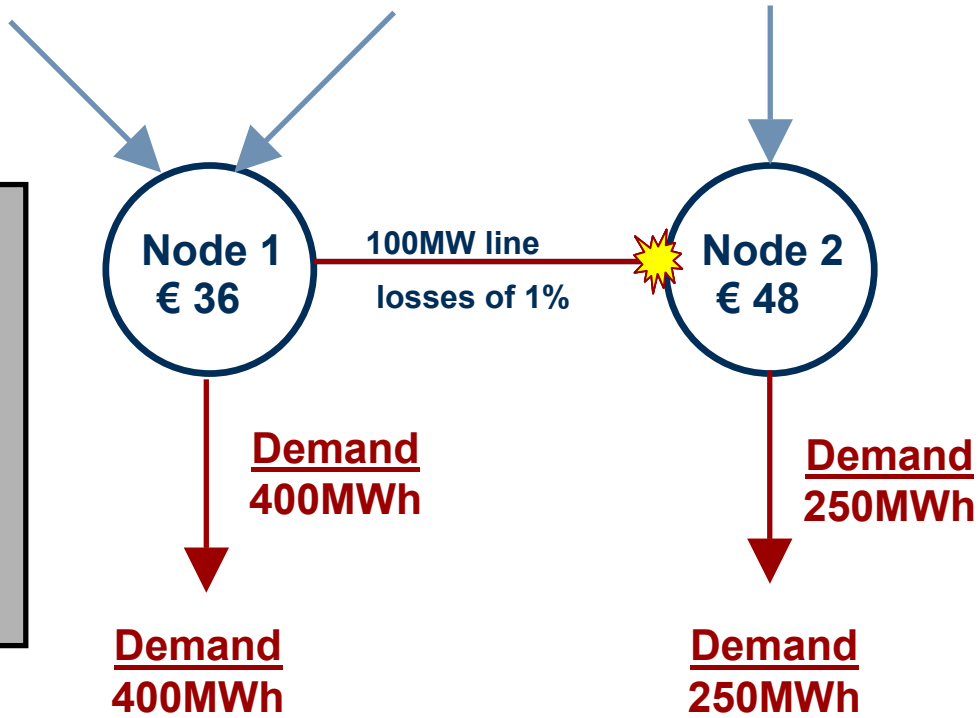
Capacity:300MWh at € 36

Generation: 200MWh

Genco C

Capacity:500MWh at € 48

Generation: 151MWh



Nodal price difference

= €12 / MWh

Cost of loss

= €0.48 / MWh

Congestion Rent

= €11.52 / MWh

Centralised Market Example: Two Node Market with Congestion

Genco	Dispatch MWh	Market Price € / MWh	Revenue €	Profit €
A	300	36	10,800	1,800
B	200	36	7,200	0
C	151	48	7,248	0
Total	651	Av = 38.78	25,248	1,800

Load	Supply MWh	Export (Import) MWh	Market Price € / MWh	Cost €
1	400	100	36	14,400
2	250	(99)	48	12,000
Total	650		Av = 40.62	26,400

Settlement surplus	€ 1,152 = 100 * 11.52

Real time Price Formation – Centralised Market

Locational energy pricing

Locational pricing uses market prices, not administrative restrictions, to manage transmission congestion.

- Locational prices are determined by market participant bids.
- The cost of transmission is based on dispatch to meet required flows.
- No need for restrictions on access to transmission grid or wholesale market.

Locational price arise from dispatch to serve an increment of load at a location, calculated from dispatch data:

- After dispatch is complete, the required data are available.

Using locational pricing there is no “out-of-merit” dispatch

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Contracts	Stuart Curson

Bidding Behaviour - Decentralised market

Participants bid to balancing mechanism:

- Ensure contractual commitments are met (some markets encourage over scheduling to limit exposure to the SO buy mechanism): dec bid to cover cost reduced dispatch
- Sell uncontracted capacity; Inc bid similar to spot market bidding
- Take or pay fuel contract: inc bid at low price up to achieve desired output
- Peaking plant (to cover low utilisation): inc bid high price for available capacity

Pay-as-bid (instead of market clearing price) complicates how to determine the bid price with participants attempting to guess the market price

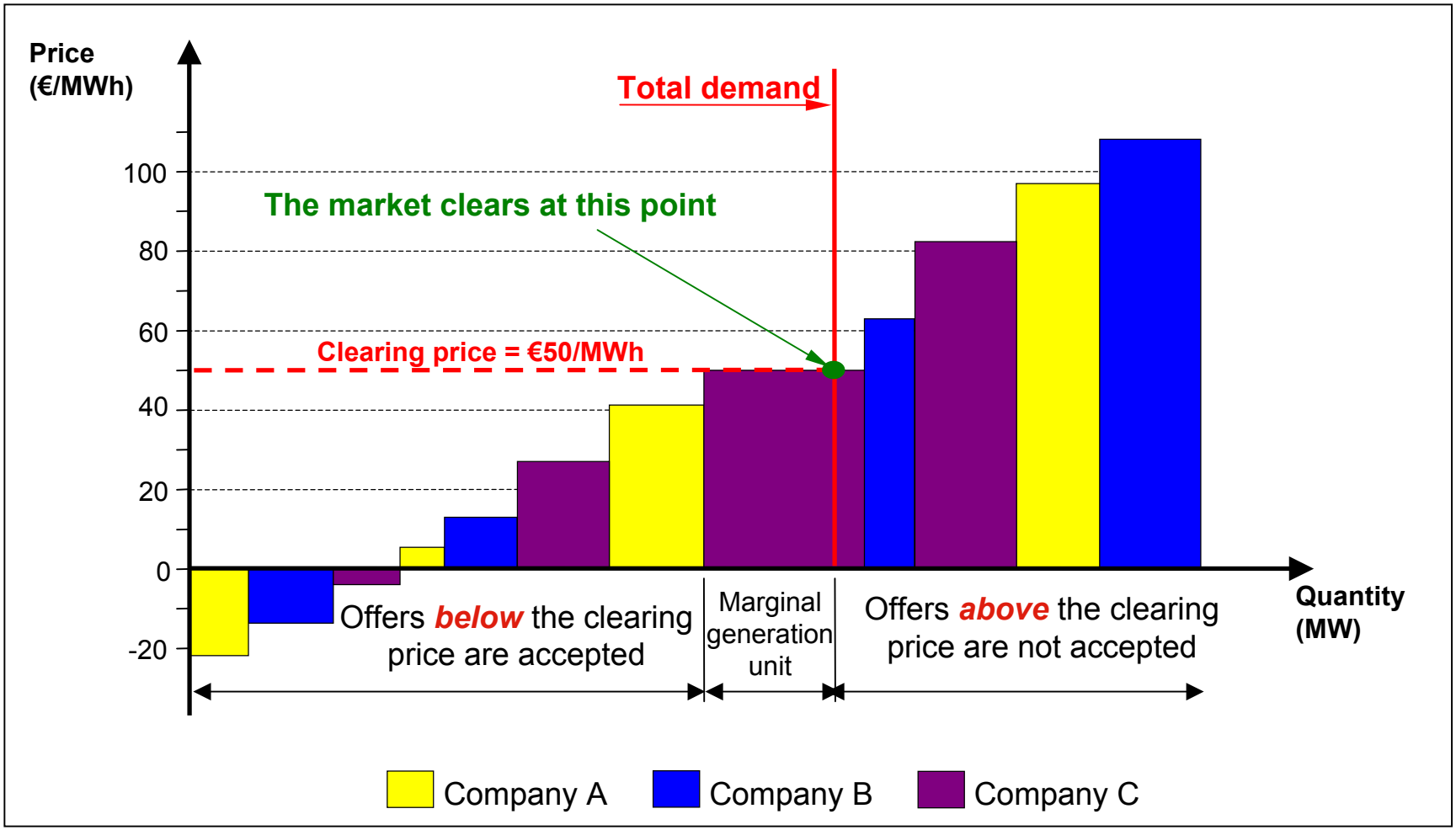
Bidding Behaviour – Centralised Market

In a self commitment centralised market generators use their bids to signal many issues – for instance

- Must-run: zero or negative price and minimum dispatch level
- Take or pay fuel: zero or negative price and ToP quantity
- Wind and small hydro: zero bid to capture the market price when operating (usually this plant is not explicitly dispatched by SO)
- Contractual incentives: price at SRMC up to contract quantity
- Reserve duty: zero price up to dispatch level to support reserve obligation
- Market share: price > SRMC for quantity up to desired dispatch level
- Price-setting (to capture return on capital): high price up to max. capacity - especially used by peaking plant

This discipline is familiar to generators operating in an “energy only” gross pool. Since all participants get the market clearing price they are encouraged to bid their SRMC.

Bidding Behaviour - Centralised Market



Note: a simple model describing energy only, with no allowance for reliability, reserve or transmission constraints

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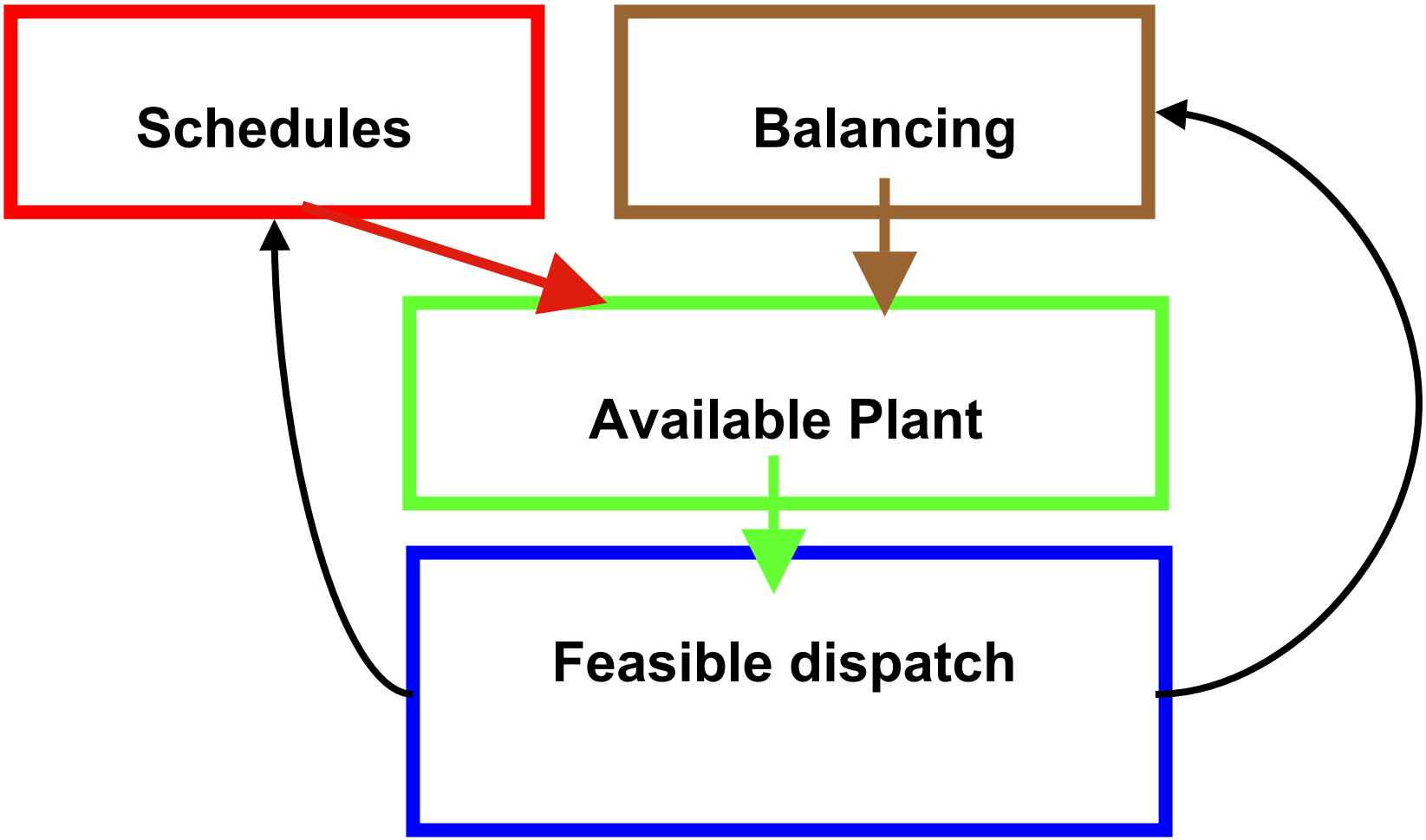
Contracts — Stuart Curson

Aligning Physical and Economic – Decentralised Market

- Declared schedules form basis of dispatch
- System security and feasible dispatch cannot be compromised
- Declared schedules may not be physically feasible for dispatch
  - Each participant acts according to their own contractual obligations
  - Infeasibility may be a significant problem in a system subject to regular congestion and system security constraints
- SO uses inc and dec bids to adjust schedules according to SO estimated load and locational needs
  - May use iterative process from day ahead to real time – may also involve increasing level of refinement
  - If no suitable bids available SO may direct plant operation
- Real time dispatch is a combination of participant schedules and SO adjustments

Aligning Physical and Economic – Decentralised Market

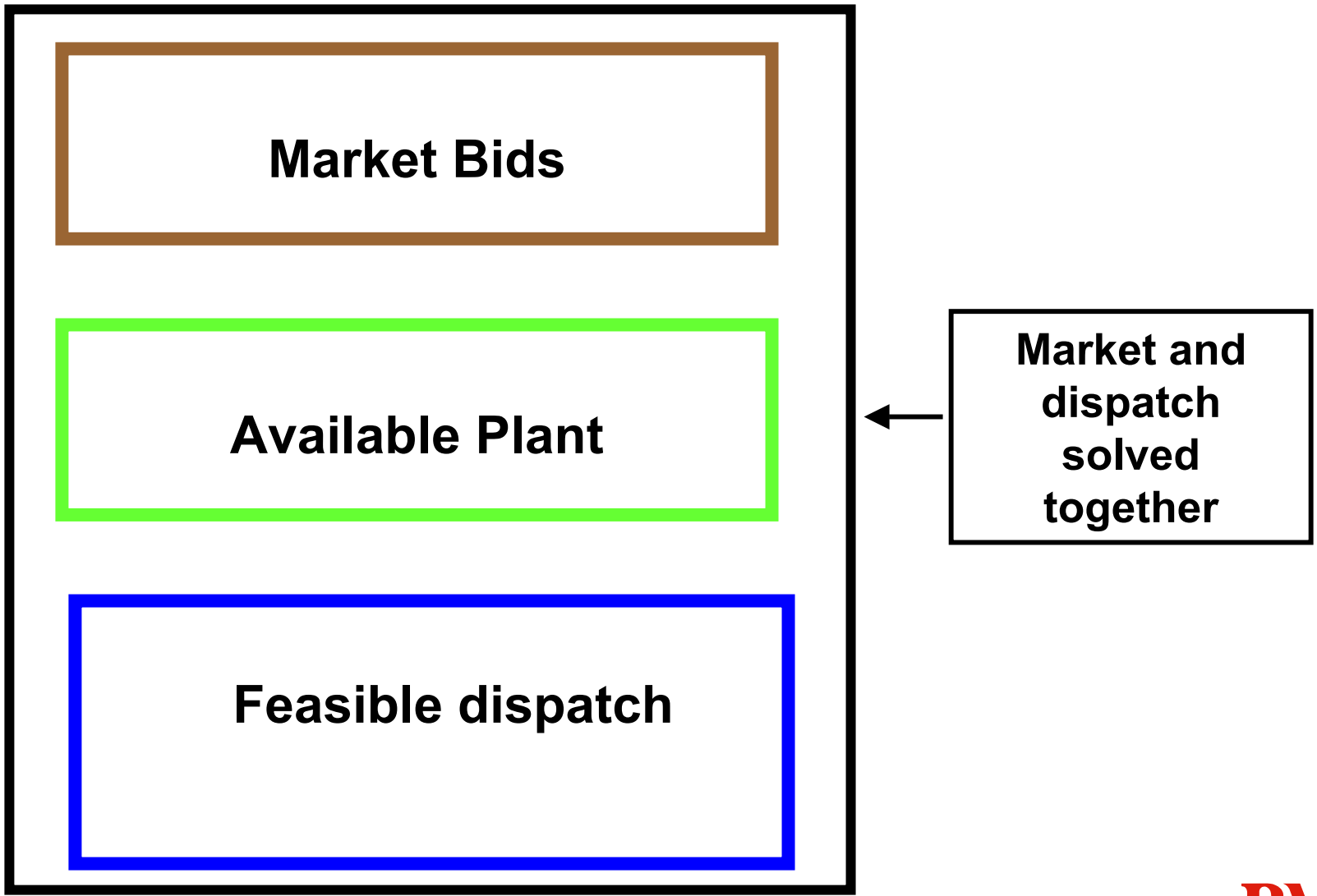


Aligning Physical and Economic – Centralised Market

Optimal Market Dispatch (Price-based dispatch)

- Market cleared simultaneously with system feasibility
  - Dispatch and market clearing contained within same algorithm
  - Simultaneously solved as a “linear programming” optimisation – market clearing engine (MCE)
- Market schedule automatically feasible for dispatch
  - Market schedule used by SO as the physical dispatch schedule
- MCE automatically produces a price for every node - LMP (locational marginal price)
- When LMP are used for pricing there is no “out of merit” dispatch
- If uniform prices used (say from average LMP’s) constrained on and possibly constrained off payments may be required

Aligning Physical and Economic Ex Ante – Centralised Market Price-based Dispatch



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Contracts — Stuart Curson

Markets and Pricing Outside Real-time: Decentralised Market

Contracts markets

- Participant revenue / cost largely set by forward contracts
- Strong requirement for “power exchanges” dealing in contracts – including very short term (daily and within-day)
- Power exchanges may provide price signals

Day ahead process

- SO initial system feasibility reconciliation
  - Buy / sell energy imbalances
  - Buy reserve imbalances
- Participants revise, update and resubmit schedules

Markets and Pricing Outside Real-time: Centralised Market

Predispatch MCE output provides projections of prices and dispatch

- Week ahead projections – rerun daily to day ahead
  - Indicate system availability and load expectations
- Day ahead projections - rerun regularly through to real-time
  - Reveal expected prices
  - Assist in planning unit commitment
- Re-bidding allowed up to “gate closure” (e.g. 1 hour before real time)
- Projection run for several load scenarios and alternative system availability scenarios
- Essential for profitable participation in real-time market

Firm ex ante market may be present

- Financially binding bids and prices
- Variations for day ahead quantities settled at real-time market price

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Contracts	**Stuart Curson**

Contracts – Decentralised market

Contracting in decentralised markets is based around contracts for physical delivery, although this delivery is contractual rather than for real electrons.

Most contracts are negotiated bi-laterally between generators and suppliers.

When contracts do not match actual delivery and demand schedules a form of balancing is required. This is usually via a spot market price for the uncommitted volumes as we have already discussed.

A version of this methodology is currently being used in Ireland.

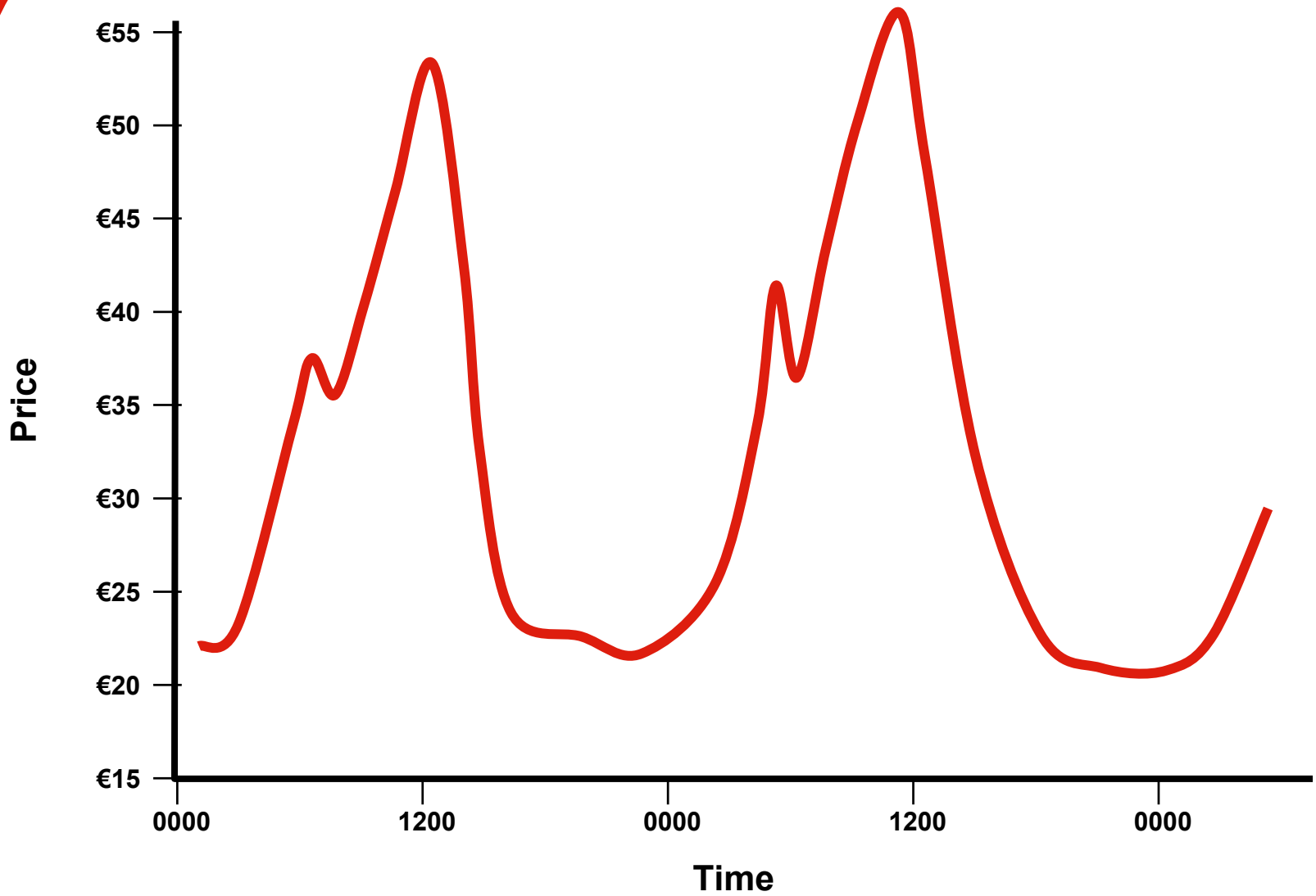
Contracts – Centralised market

While most will be familiar with physical contracts in a de-centralised market, contracts in a centralised market are quite different.

All sales and purchases of power are through the spot market. It is not possible to contract for the physical bi-lateral supply of energy.

Contracts are financial instruments that hedge the holder against the risk of volatile spot prices in the mandatory spot market.

Spot Prices can be volatile



Hedge contracts

If generators and supply companies sold to and purchased from the market operator at the spot price, their revenue or costs would be volatile and present considerable financial risk.

In order to manage this risk, sellers and buyers in spot market have developed a range of hedge contract products, including:

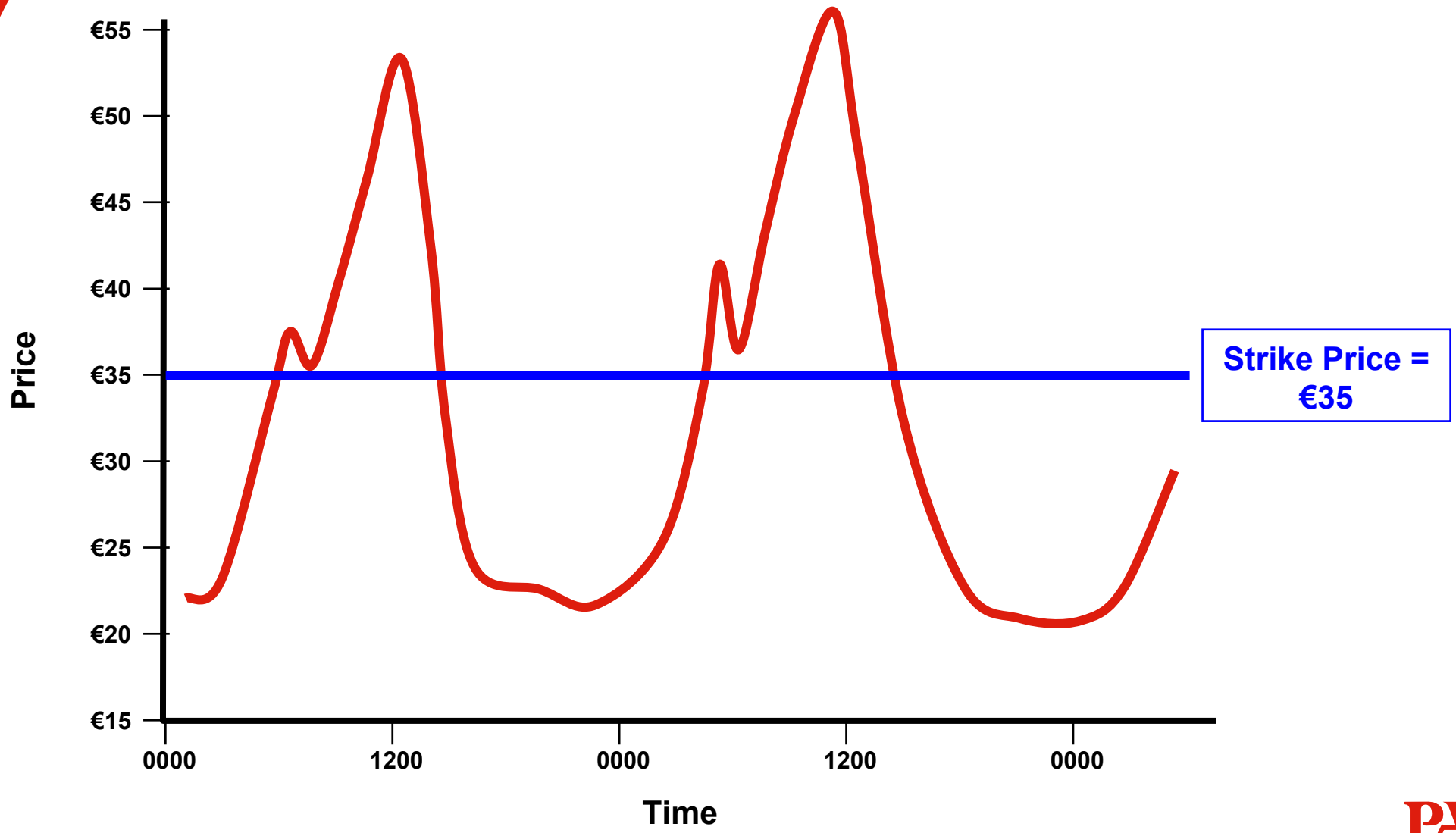
- Swaps
- Cap
- Floors
- Collars

Swap contract (2-way hedge)

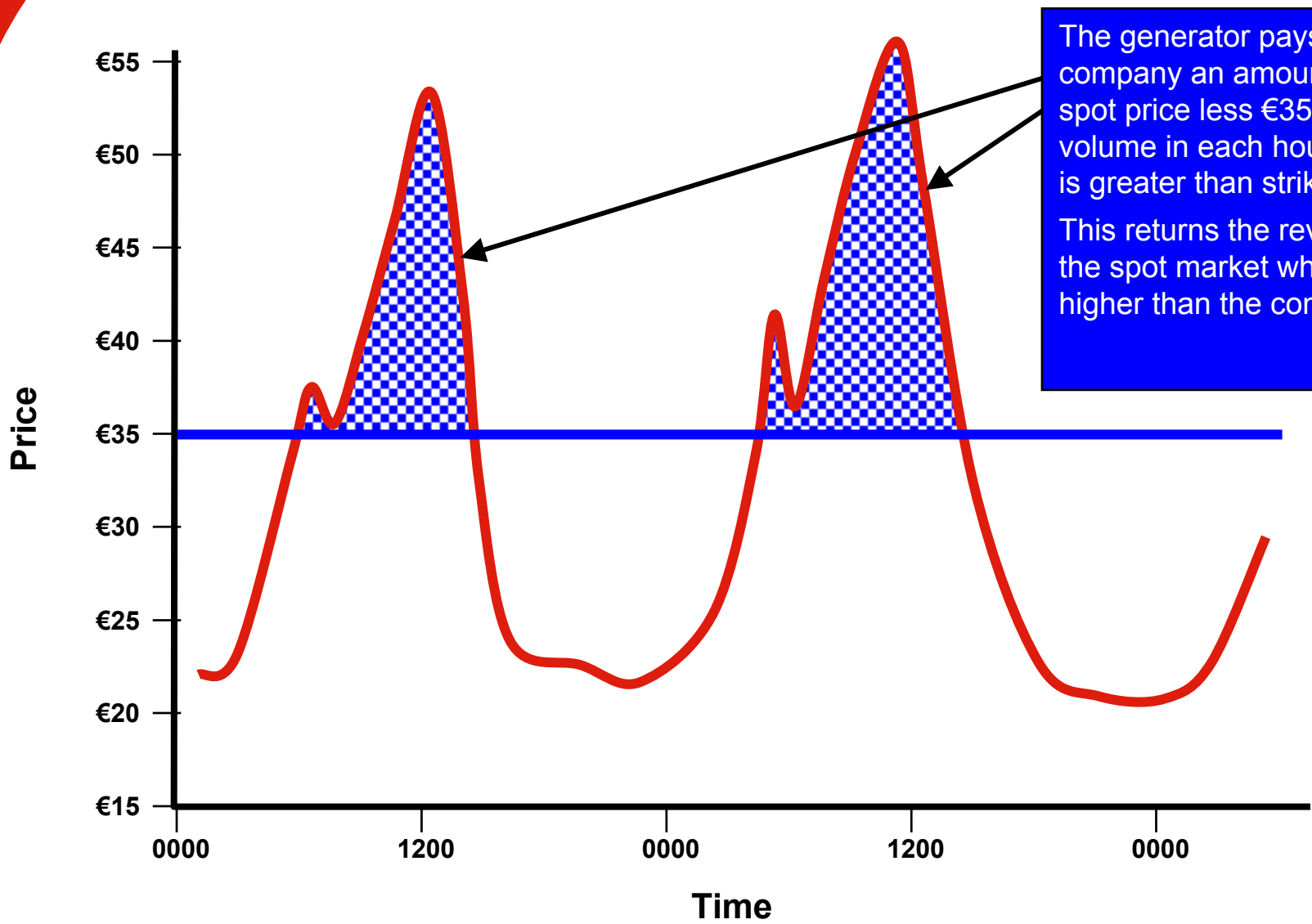
A common hedge contract is a swap, sometimes known as a 2-way hedge. In this type of contract, the parties agree on a strike price and a volume. Typically, a generator and a supply company would enter into such a contract. While both parties transact with the market operator in the spot market, they enter into such financial agreements in order to limit their exposure to spot price risk.

We assume a swap with a €35 strike price.

Swap contract (2-way hedge)



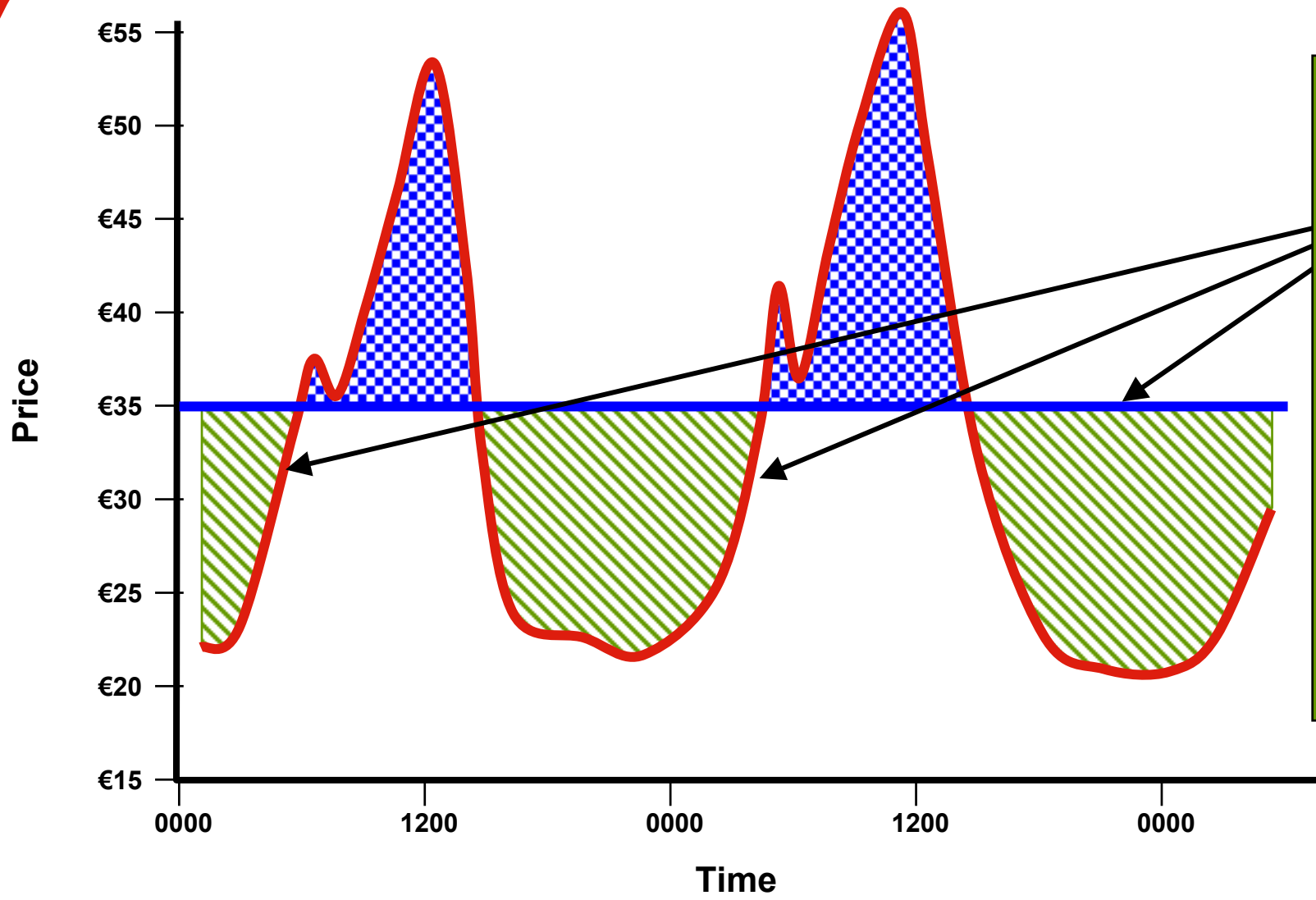
Swap contract difference payments - Generator



The generator pays the supply company an amount equal to the spot price less €35 times contract volume in each hour when spot price is greater than strike price.

This returns the revenue earned in the spot market when prices are higher than the contract strike price

Swap contract difference payments – Supplier



The supply company pays the generator an amount equal to €35 less the spot price times contract volume in each hour when spot price is less than the €35 strike price.

This returns the benefit received when spot market prices are less than the contract strike price

Swap contract (2-way hedge)

The result of a swap is that the power prices are fixed at the €35 strike price for the contract volume, no matter how high or low the spot price goes.

This provides a stable financial outcome to both parties.

There remains exposure when actual volumes are different from the contract volume

Swap Contract – worked example

Spot price lower than strike price

Spot Price	Strike Price	Contract amount
€30 per MWh	€35 per MWh	100 MW

The supplier makes purchases (and the generator makes sales) to the market operator at the €30 per MWh spot market price. Since this is lower than the Strike Price, the supplier pays the generator a difference payment of €500 (the difference between €30 and €35, times 100).

	Without Hedge		Difference Payment	With Hedge	
Party	**€**	**€/MWh**	**€**	**€**	**€/MWh**
The supplier	(3,000)	30	***(500)***	(3,500)	35
The generator	3,000	30	***500***	3,500	35

Swap Contract – worked example

Spot price higher than strike price

Spot Price	Strike Price	Contract amount
€40 per MWh	€35 per MWh	100 MW

The supplier makes purchases and the generator makes sales to the market operator at the €40 per MWh spot price. Since this is higher than the Strike Price, the supplier ***receives from*** the generator a difference payment of €500 (the difference between €35 and €40, times 100).

	Without Hedge		Difference Payment	With Hedge	
Party	**€**	**€/MWh**	**€**	**€**	**€/MWh**
The supplier	(4,000)	40	***500***	(3,500)	35
The generator	4,000	40	***(500)***	3,500	35

Uncovered swap – generator dispatched off

Spot price lower than generator marginal cost

Spot Price	Strike Price	Contract amount
€20 per MWh	€35 per MWh	100 MW

A supplier with spot volumes of 100 MW (or more) has contracted with a generator that has a marginal cost that is higher than €20 MWh. Since the spot price of €20 per MWh is lower than the Strike Price, the supplier ***pays*** the generator a difference payment of €1,500. This represents a ***pure profit*** to the generator.

	Without Hedge		Difference Payment	With Hedge	
Party	**€**	**€/MWh**	**€**	**€**	**€/MWh**
The supplier	(2,000)	20	***(1,500)***	(3,500)	35
The generator	0	20	***1,500***	1,500	

This example assumes that the spot price is below the marginal cost of the generator, so that the generator is dispatched off (assumes a marginal cost based bid) and has no output.

Uncovered swap – generator outage

Spot price much higher than strike price

Spot Price	Strike Price	Contract amount
€5,000 per MWh	€35 per MWh	100 MW

The generator is not operating. The supplier makes purchases from the spot market at €5,000 per MWh. Since this is higher than the Strike Price, the supplier ***receives from*** the generator a difference payment of €496,500 (the difference between €5,000 and €35, times 100).

	Without Hedge		Difference Payment	With Hedge	
	€	€/MWh	€	€	€/MWh
The supplier	(500,000)	5,000	***496,500***	(3,500)	35
The generator	0	5,000	***(496,500)***	(496,500)	

The financial risk for an uncovered generator with a swap contract presents a powerful incentive to have power plants operating when spot prices are expected to be high. Since it is not possible to predict exactly when prices will be high (i.e., price spikes occur due to unplanned outages of other power plants or interconnectors), this means that generator will ensure that the power plant is available a lot of the time.

Supplier with swap - interruptible load

Spot price much higher than strike price

Spot Price	Strike Price	Contract amount
€5,000 per MWh	€35 per MWh	100 MW

The supplier makes purchases from the spot market at €5,000 per MWh. Since this is higher than the Strike Price, the supplier ***receives from*** the generator a difference payment of € 496,500 (the difference between €5,000 and €35, times 100). However, the supplier purchases only ***90 MW*** from the spot market due to interruptible load.

	Without Hedge		Difference Payment	With Hedge	
	€	€/MWh	€	€	€/MWh
The supplier	(450,000)	5,000	***496,500***	46,500	
The generator	500,000	5,000	***(496,500)***	3,500	35

The supplier makes a net profit of €46,500 for the hour, the result of only purchasing 90% (and interrupting the other 10%) of the contract volume. A swap contract provides a supplier with a powerful financial incentive to locate and use interruptible load at times of high prices. This incentive exists regardless of end-use customer real-time metering or other features.

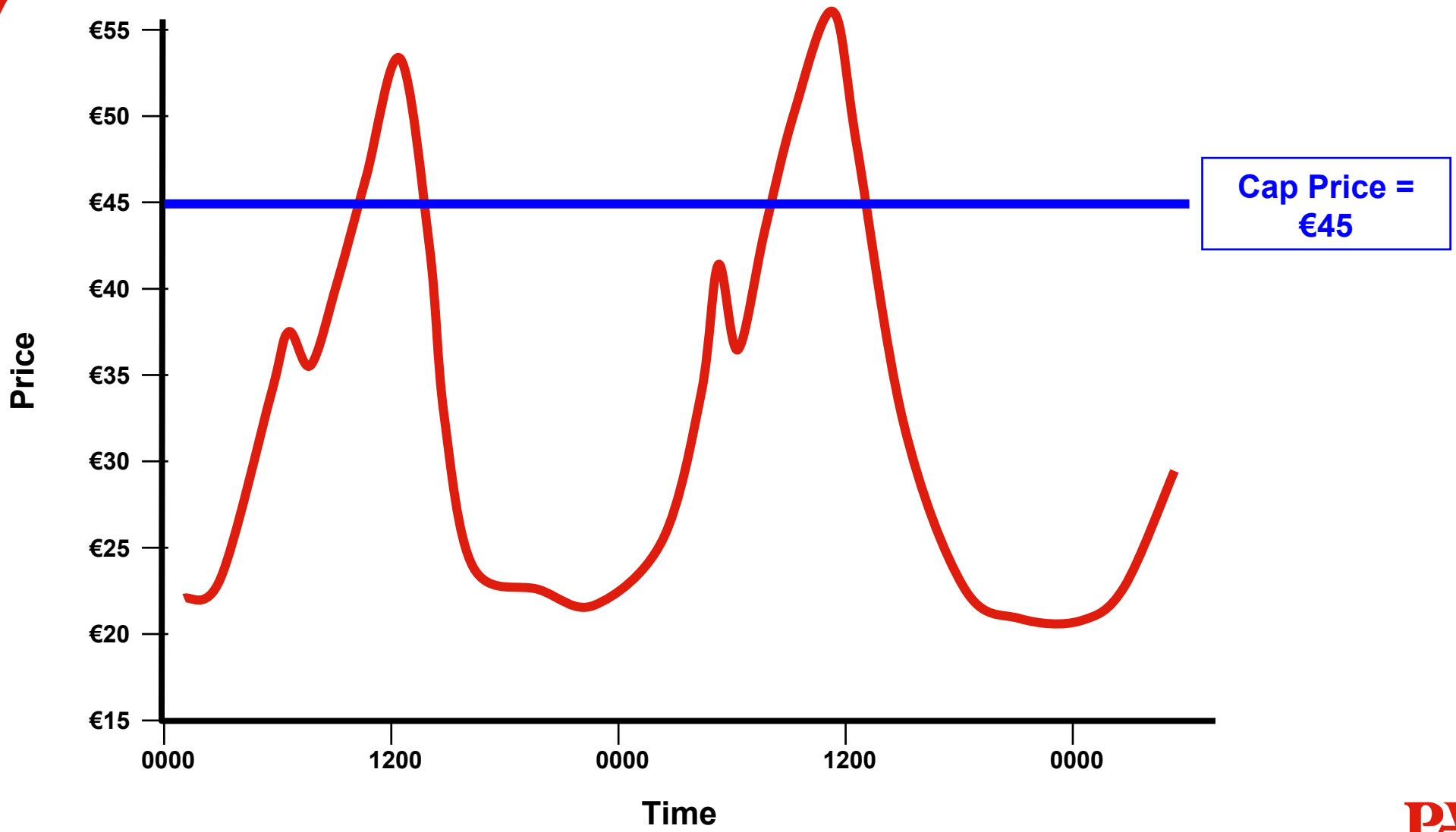
Cap contract (1-way hedge)

Another common hedge contract is a cap contract, one of several types of 1-way hedges. As in a swap, the parties agree on a strike price and a volume. Typically, a generator and a supply company would enter into such a contract.

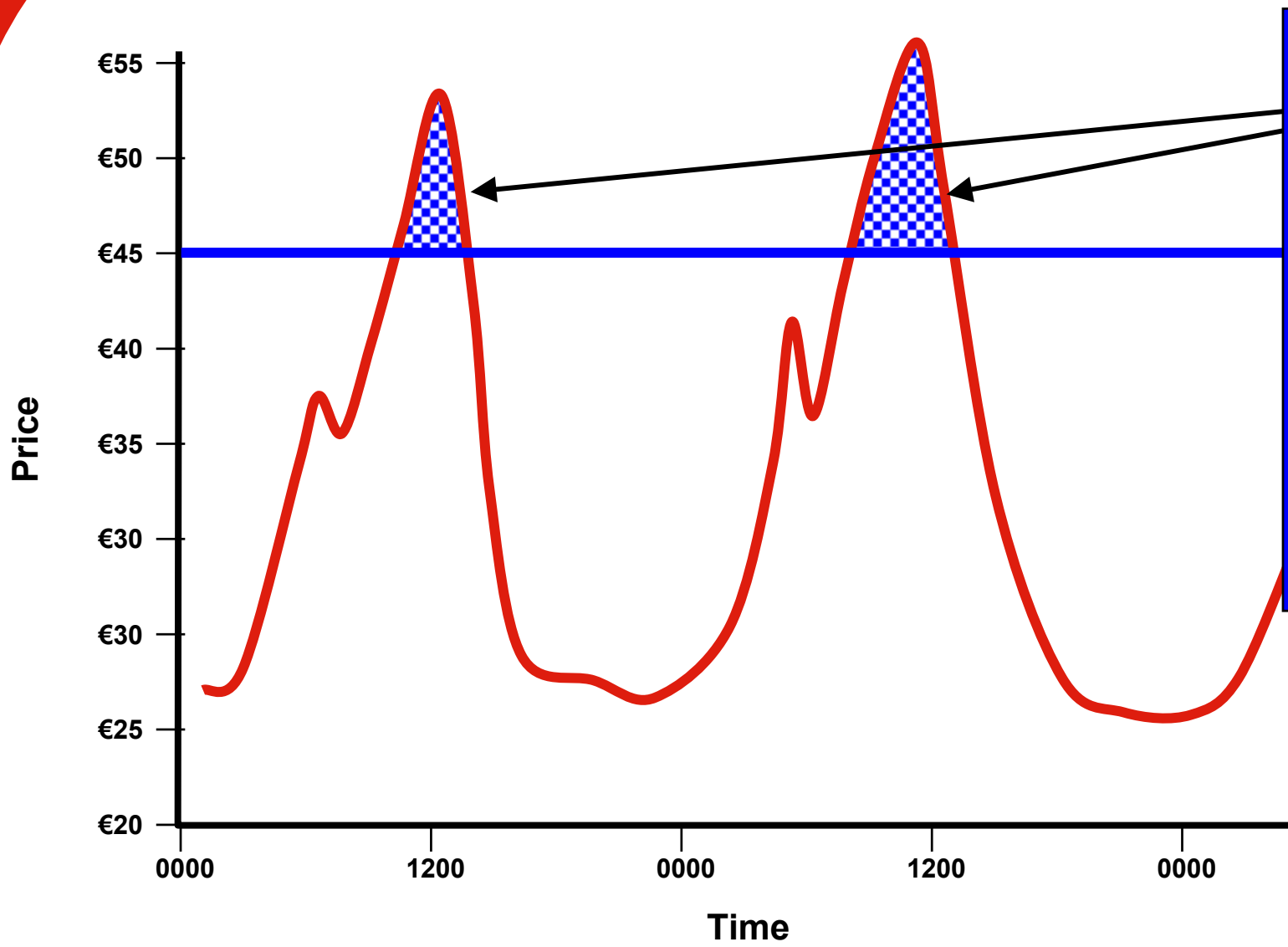
Unlike a swap contract, a cap contract only has payments from the generator to the supply company

We assume a swap with a €45 strike price.

Cap contract



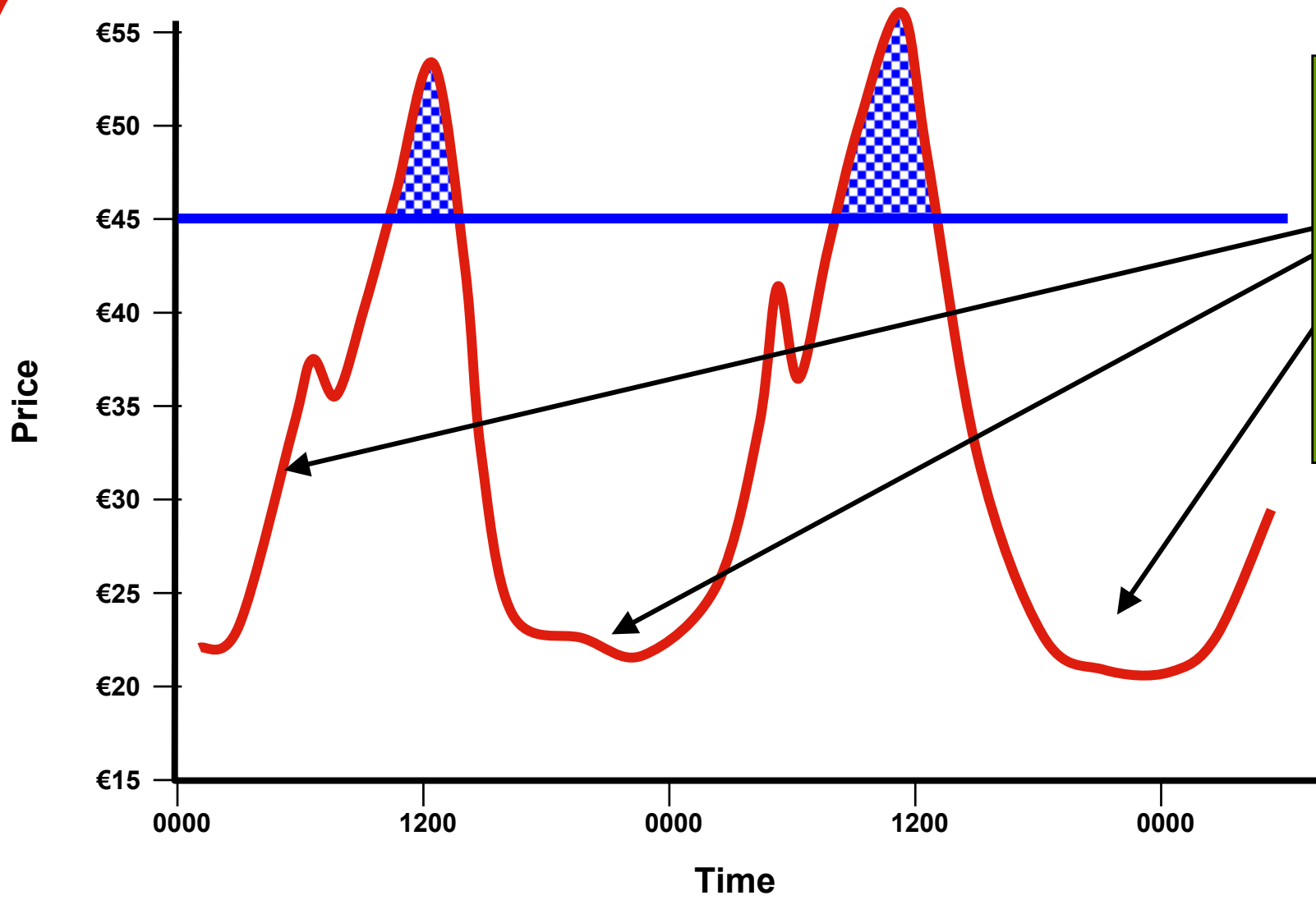
Cap contract difference payments - Generator



The generator pays the supply company an amount equal to the spot price less €45 times contract volume in each hour when spot price is greater than strike price.

This returns the revenue earned in the spot market when prices are higher than the contract strike price

Cap contract – no payments when spot < strike



When the spot price is less than the strike price, both parties have NO hedge, so that the volumes are transacted at the spot price with no offsetting financial adjustments.

Cap contract – option fees

The effect of a cap contract is to limit the upside revenue to a generator, while providing no protection to the generator against low spot prices. Such a cap contract will usually be accompanied by a payment of an option fee to the generator.

One potential arrangement is for a peaking plant to provide a cap contract that limits the supply company exposure to high spot prices, with an option fee that provides coverage of the peaking unit's fixed costs.

Cap Contract – worked example

Spot price lower than strike price

Spot Price	Cap Price	Contract amount
€20 per MWh	€45 per MWh	100 MW

Since the spot price is lower than the Cap price, there are no difference payments. The supplier makes purchases from (and the generator makes sales to) market operator at €20 per MWh.

	Without Hedge		Difference Payment	With Hedge	
Party	**€**	**€/MWh**	**€**	**€**	**€/MWh**
The supplier	(2,000)	20	***(0)***	(2,000)	20
The generator	2,000	20	***0***	2,000	20

Cap Contract – worked example

Spot price higher than strike price

Spot Price	Cap Price	Contract amount
€50 per MWh	€45 per MWh	100 MW

The supplier makes purchases from (and the generator makes sales to), market operator at €50 per MWh. Since this is higher than the Cap Price, the supplier ***receives from*** the generator a difference payment of €500 (the difference between €45 and €50, times 100).

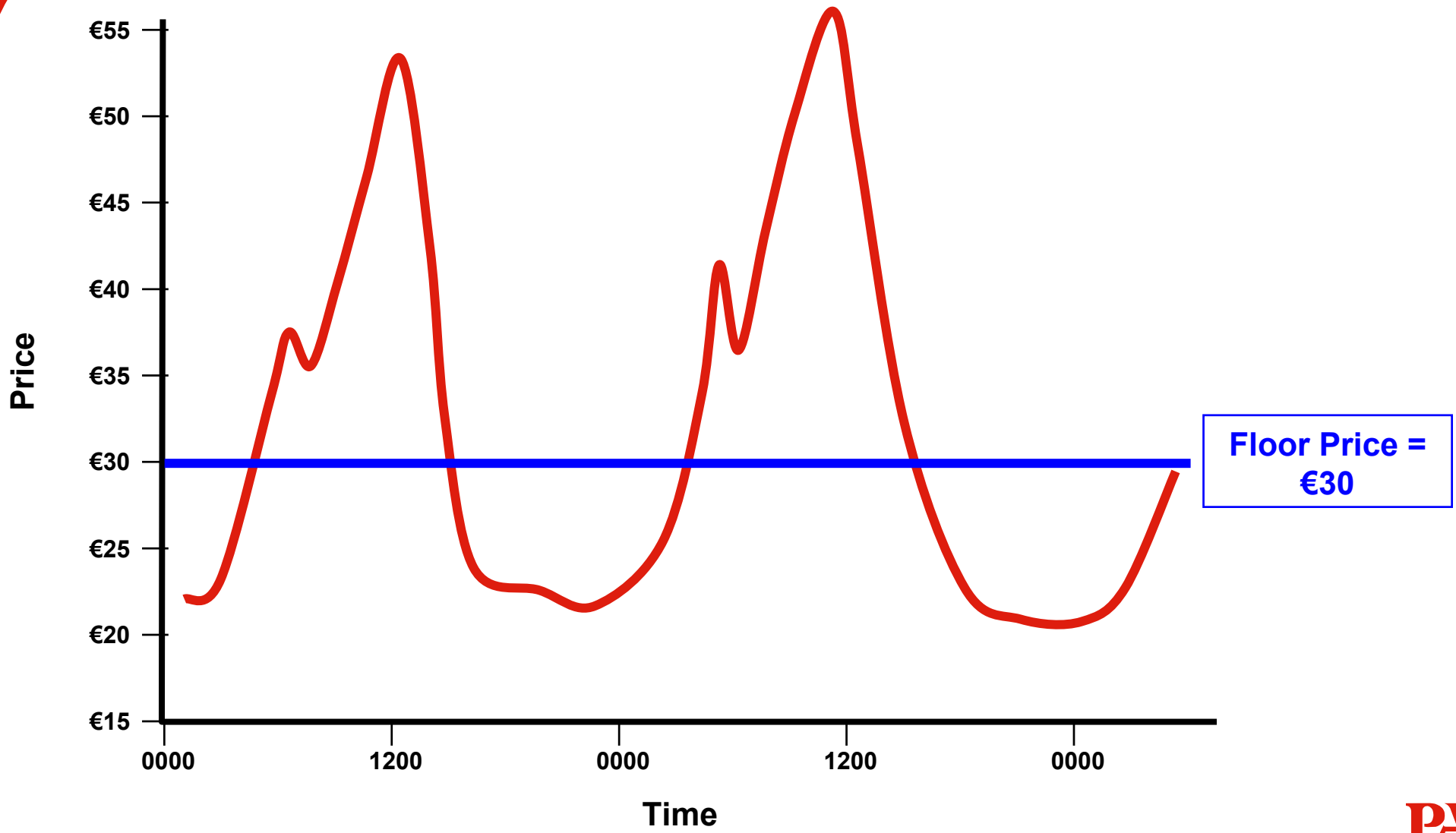
	Without Hedge		Difference Payment	With Hedge	
Party	**€**	**€/MWh**	**€**	**€**	**€/MWh**
The supplier	(5,000)	50	***500***	(4,500)	45
The generator	5,000	50	***(500)***	4,500	45

Floor contract (another 1-way hedge)

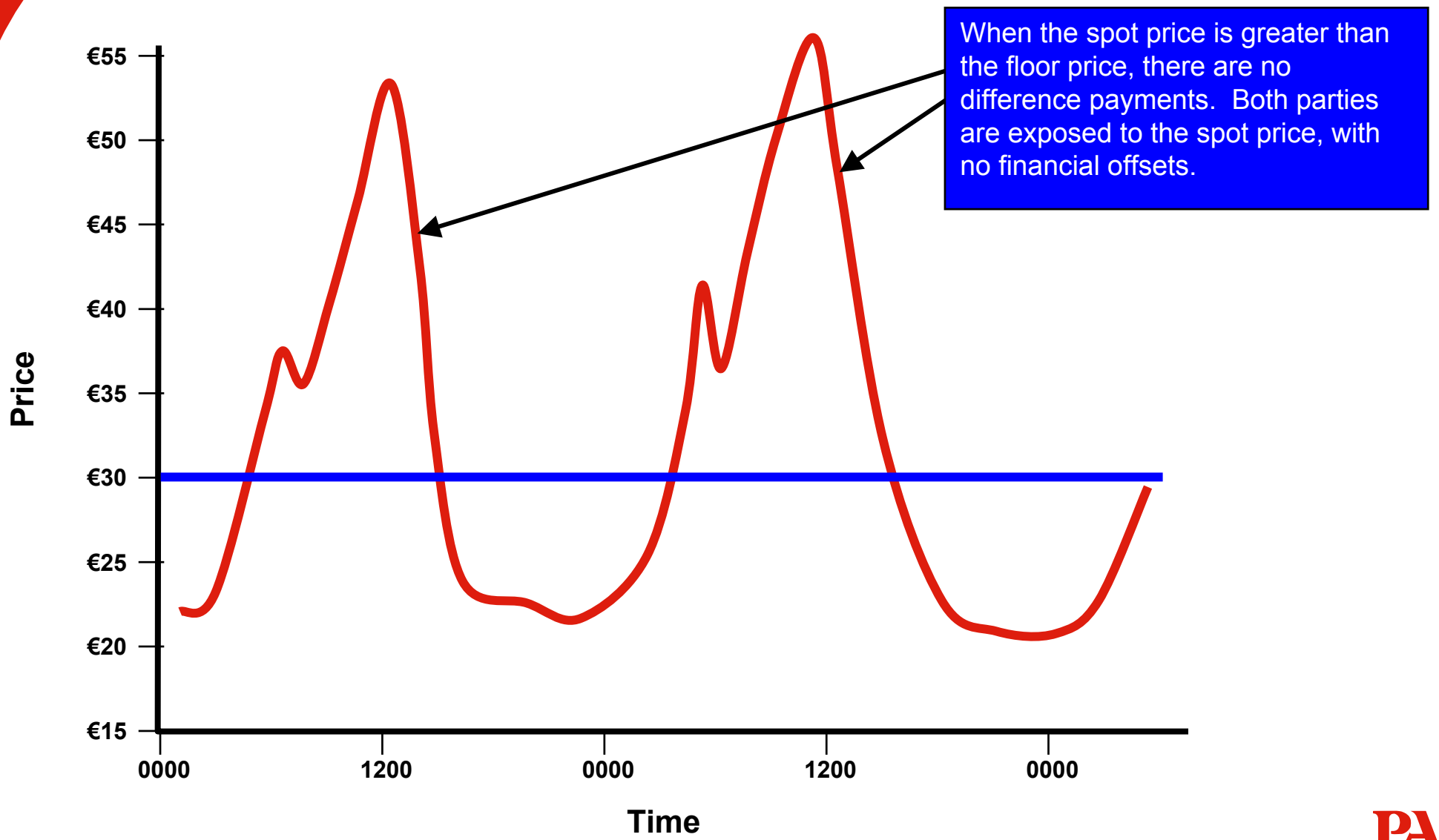
Another hedge contract, less common, is a floor contract. In this type of contract, the parties agree on a floor (strike) price and a volume.

We assume a floor contract with a €30 strike price.

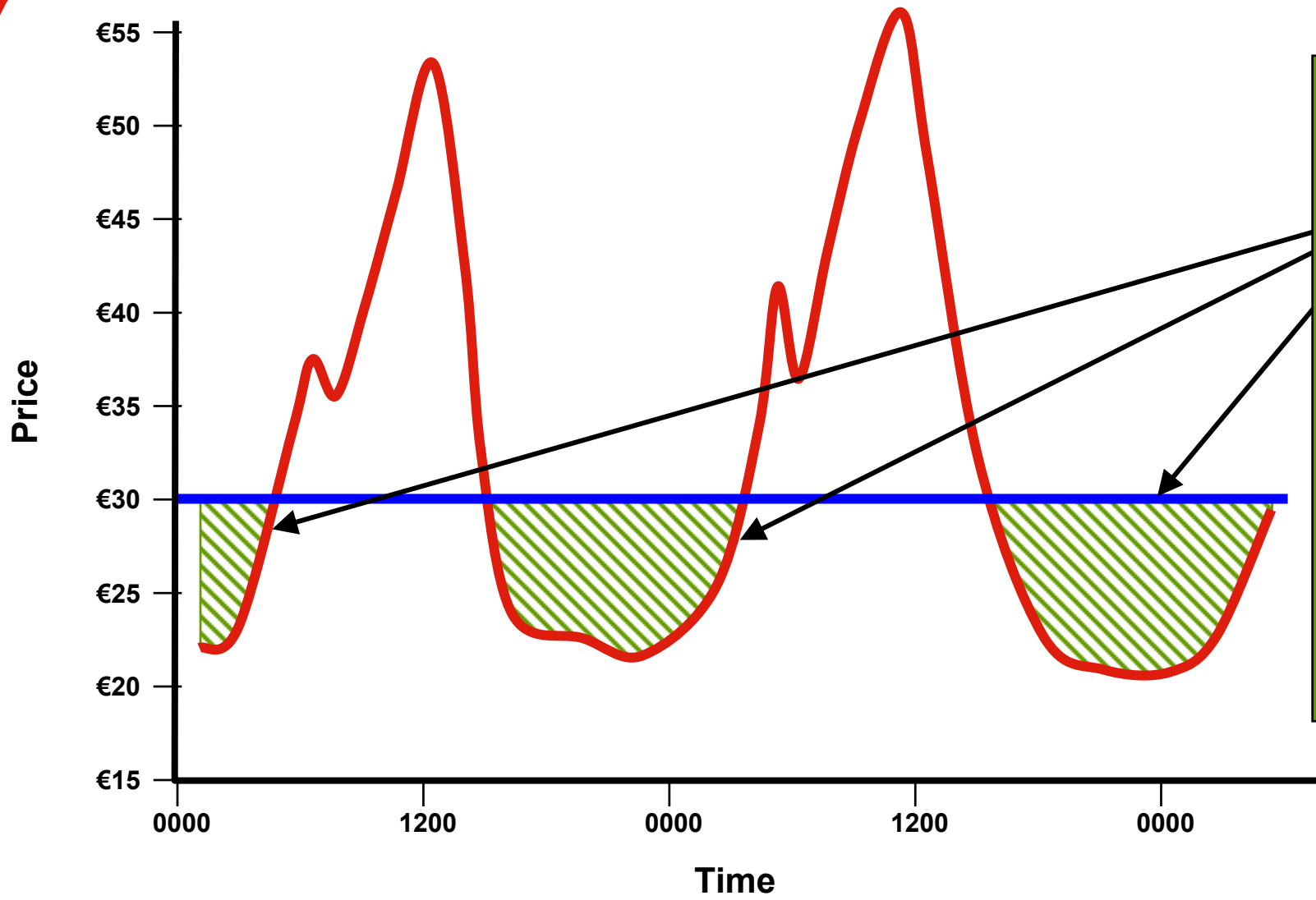
Floor contract



Floor contract – no payments when spot > strike



Floor contract difference payments – Supplier



The supply company pays the generator an amount equal to €30 less the spot price times contract volume in each hour when spot price is less than the €30 strike price.

This returns the benefit received when spot market prices are less than the contract strike price

Floor contract

The result of a floor contract is that the generator is protected against very low spot prices. These contracts are rarely seen, except as a part of a more complicated arrangement (i.e., a collar arrangement).

Such a contract, if it existed, might well be accompanied by the payment of an option fee to the supply company.

In actual practice, the ability of the generator to purchase power in the spot market means that a power plant would shut down and purchase power in the spot market for resale when the spot price is lower than the power plant's variable cost.

Floor Contract – worked example

Spot price lower than strike price

Spot Price	Floor Price	Contract amount
€25 per MWh	€30 per MWh	100 MW

The supplier makes purchases from (and the generator makes sales to) market operator at €25 per MWh. Since this is lower than the Floor Price, the supplier ***pays*** the generator a difference payment of €500 (the difference between €25 and €30, times 100).

	Without Hedge		Difference Payment	With Hedge	
Party	**€**	**€/MWh**	**€**	**€**	**€/MWh**
The supplier	(2,500)	25	***(500)***	(3,000)	30
The generator	2,500	25	***500***	3,000	30

Floor Contract – worked example

Spot price higher than strike price

Spot Price	Floor Price	Contract amount
€35 per MWh	€30 per MWh	100 MW

Since the spot price is greater than the Floor Price, there are no difference payments.

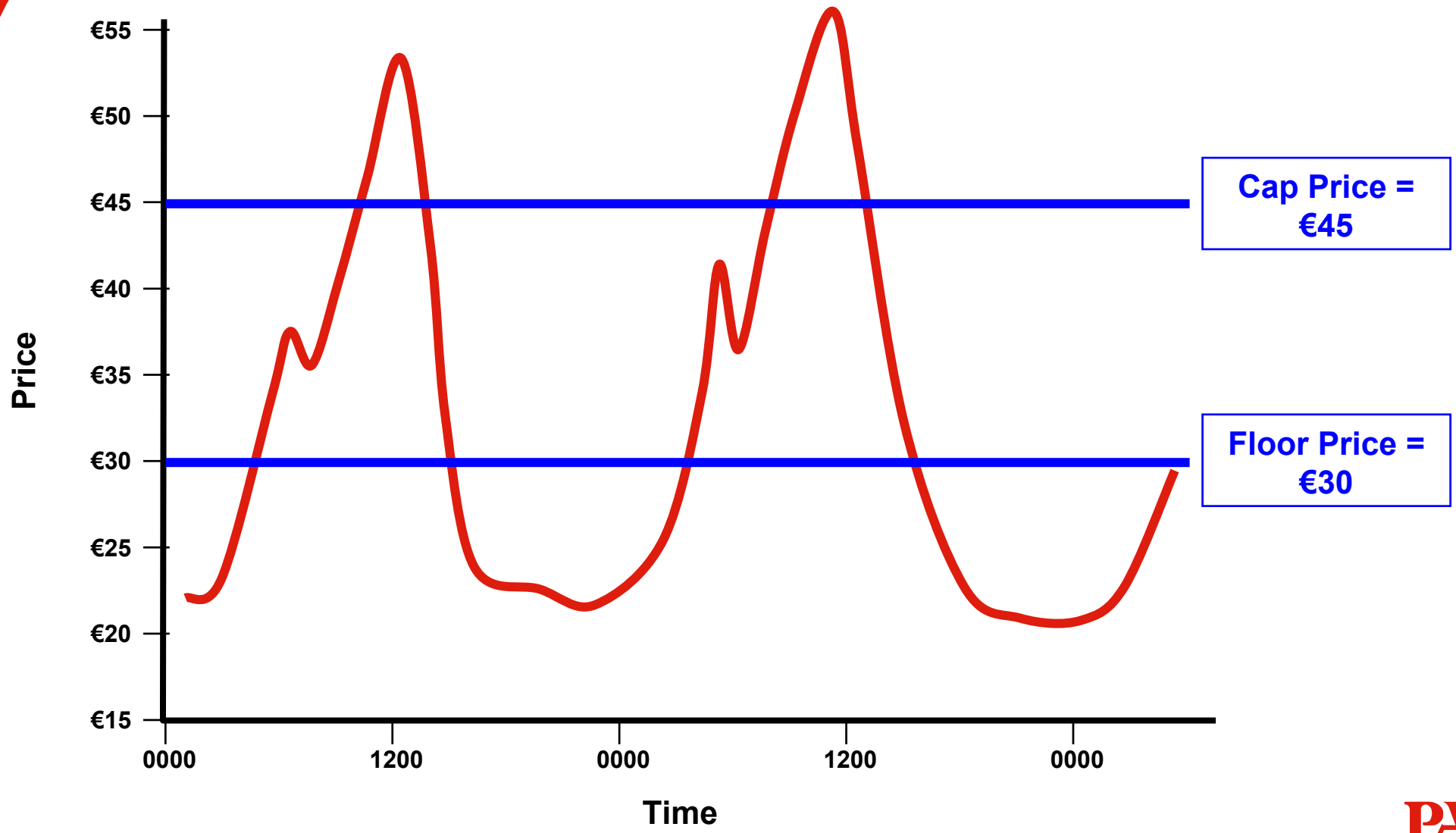
	Without Hedge		Difference Payment	With Hedge	
Party	**€**	**€/MWh**	**€**	**€**	**€/MWh**
The supplier	(3,500)	35	***0***	(3,500)	35
The generator	3,500	35	***(0)***	3,500	35

Collar contract

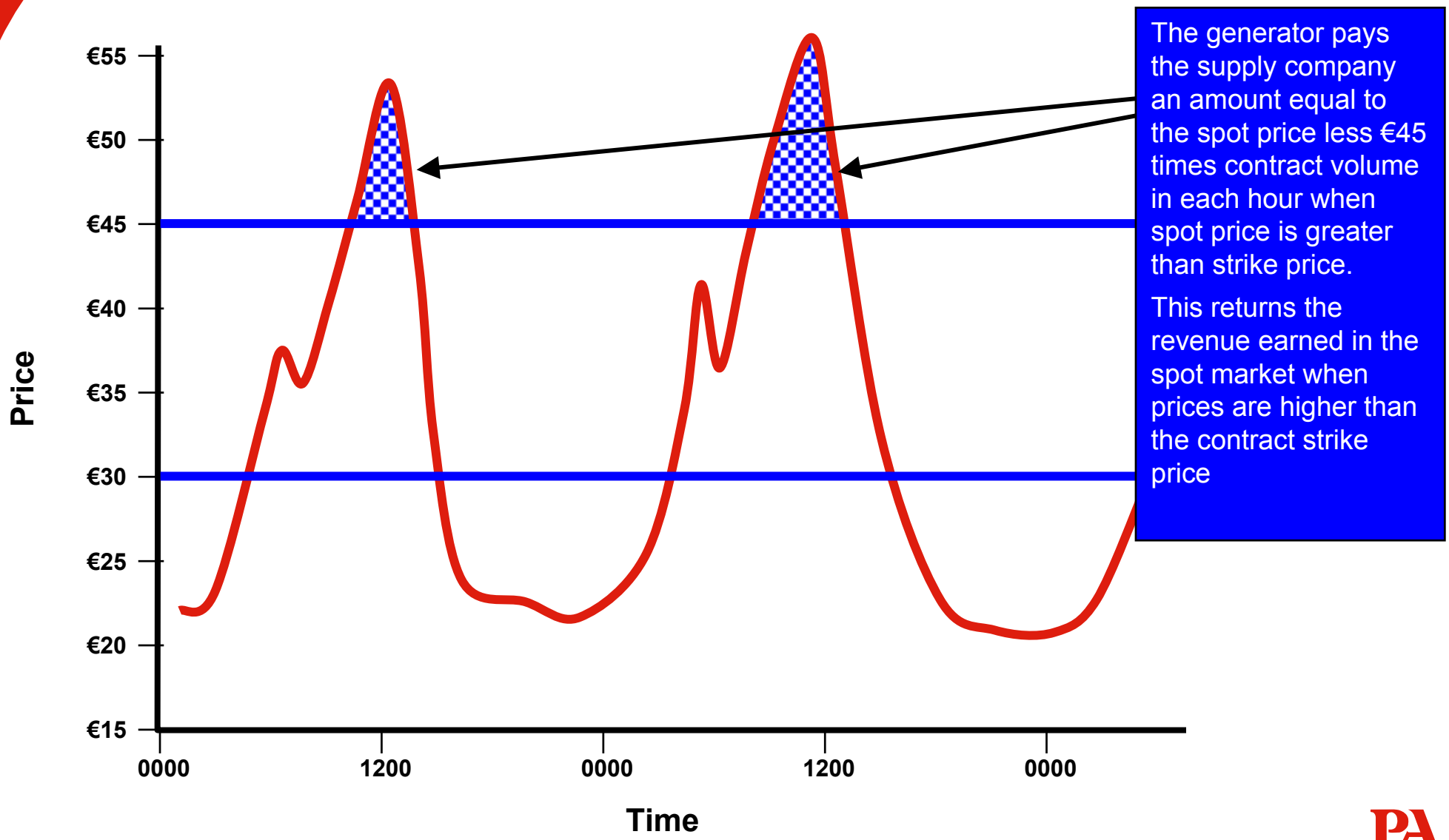
A collar contract is a combination of a cap contract and a floor contract.

A swap can be thought of as a special collar contract where the cap price is equal to the floor price.

Collar contract



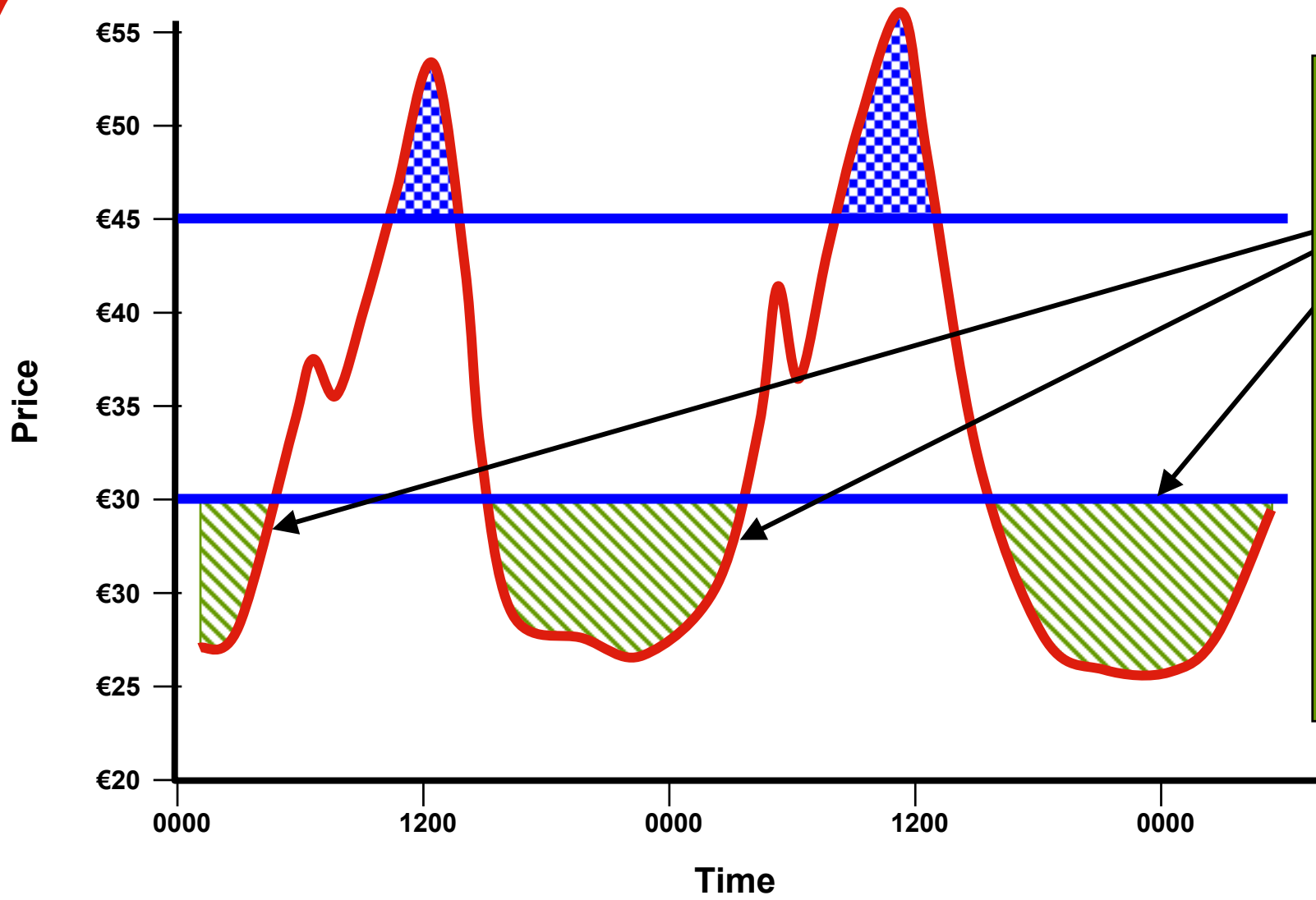
Collar contract difference payments - Generator



The generator pays the supply company an amount equal to the spot price less €45 times contract volume in each hour when spot price is greater than strike price.

This returns the revenue earned in the spot market when prices are higher than the contract strike price

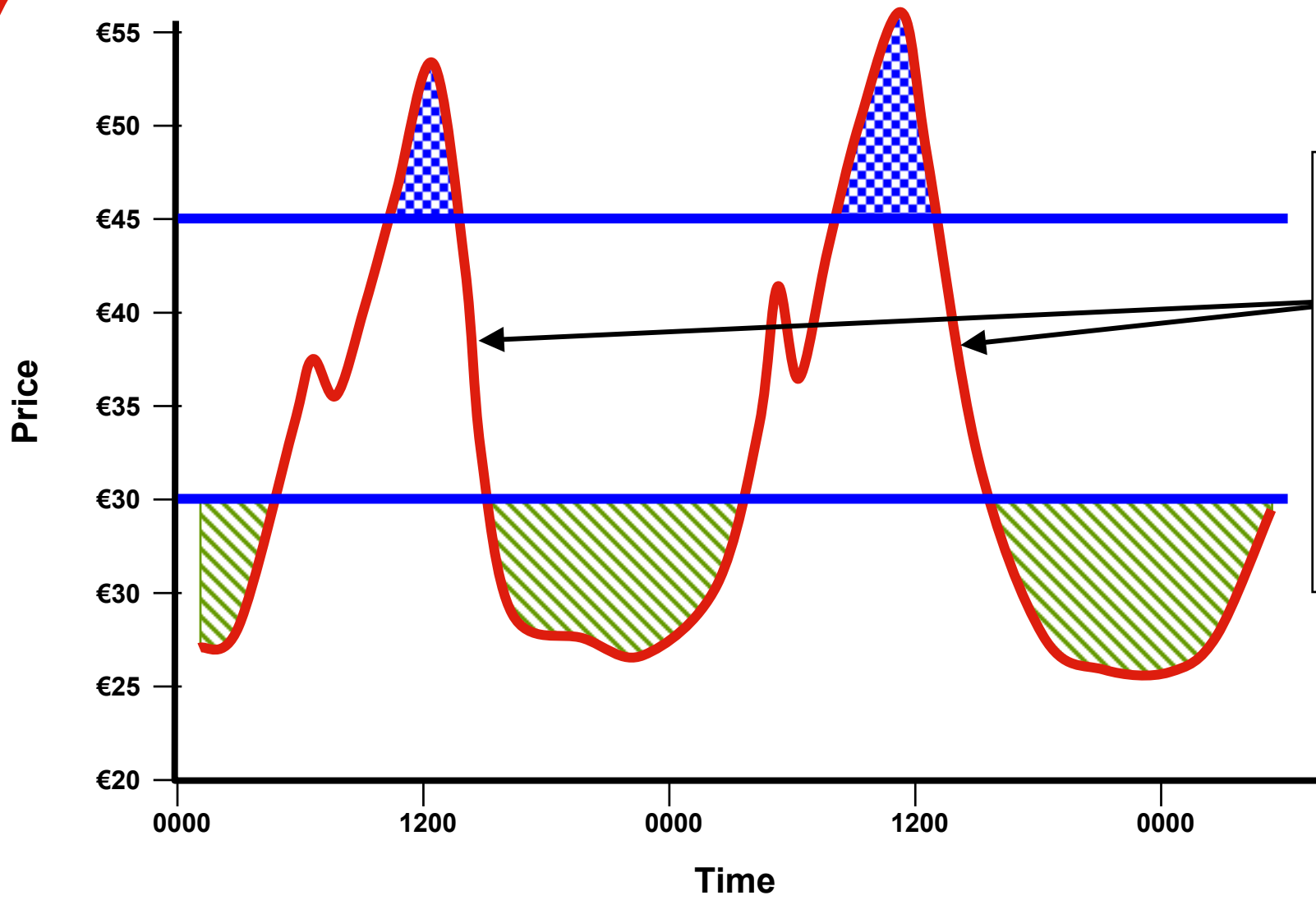
Collar contract difference payments - Supplier



The supply company pays the generator an amount equal to €30 less the spot price times contract volume in each hour when spot price is less than the €30 strike price.

This returns the benefit received when spot market prices are less than the contract strike price

Collar contract cap>spot>floor – no payments



When the spot price is less than the cap price, but greater than the floor price, there are no difference payments.

In this range, the parties are exposed to spot prices.

Hedge contract issues

To supplement the simple examples above, the following slides provide some additional detail on issues related to:

- **Volume**
- **Strike prices**
- **Counterparties**
- **Link between financial hedges and physical output**

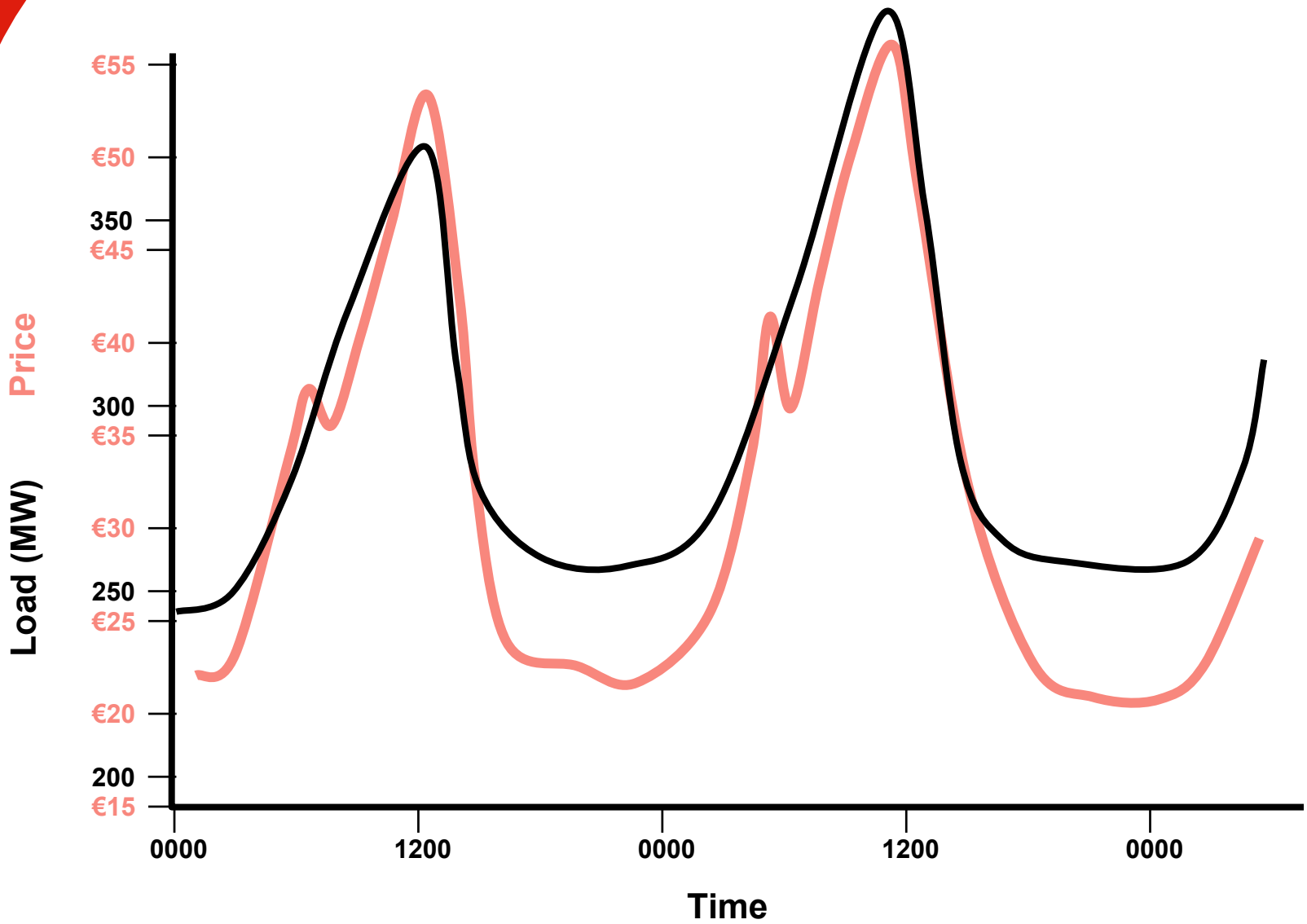
Volume issues

The volume in a hedge contract is unrelated to actual physical volumes. This can result in residual risk even when hedges are present.

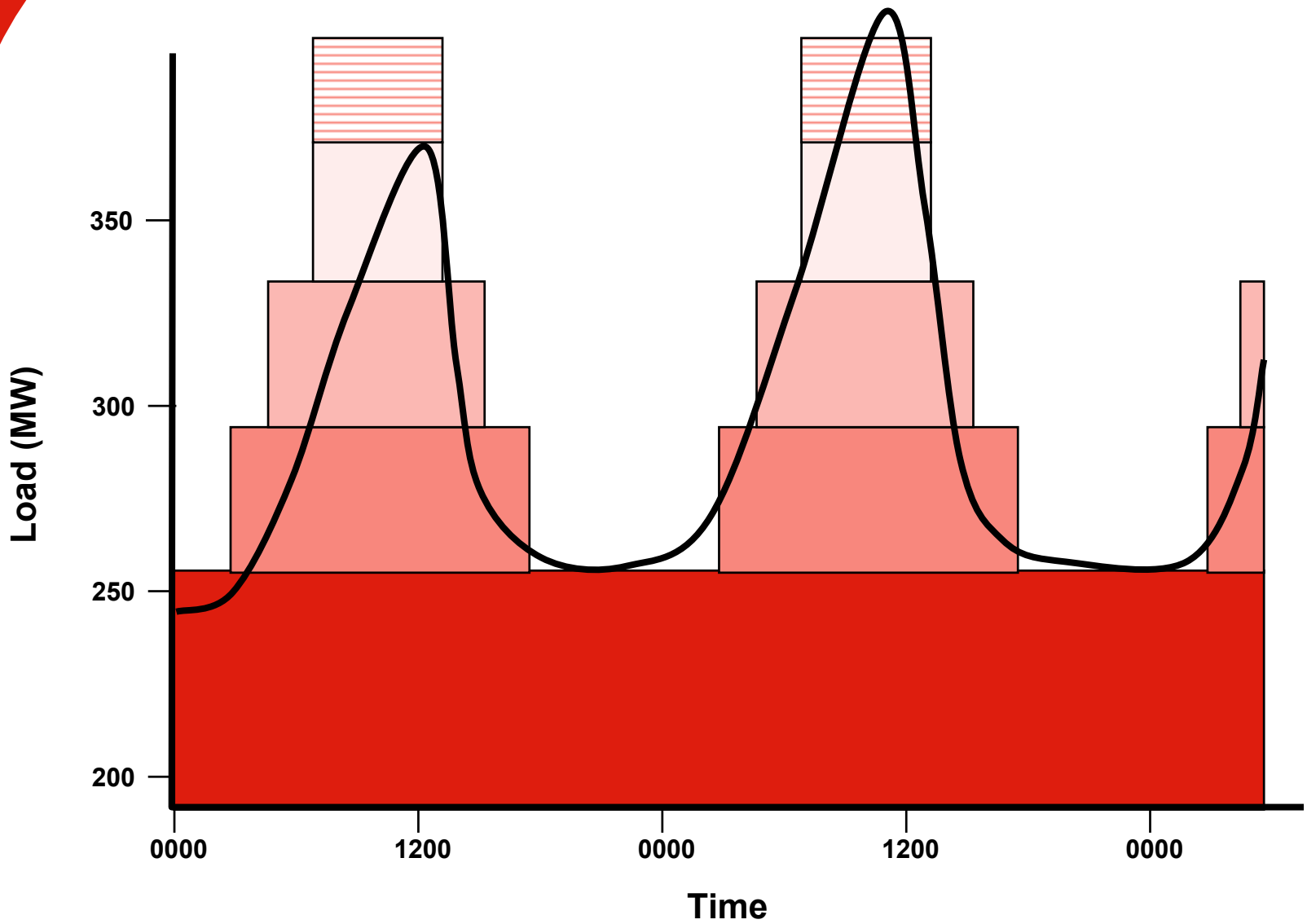
A supplier that is hedging spot purchases may decide that the risk of high spot prices is great enough that it warrants being over-contracted.

In this situation, with a swap contract, when spot prices are low, the supplier would be buying any volumes in excess of end-user volumes in the spot market at low prices and re-selling it to the generator at the strike price in order to avoid the risk of being un-hedged when spot prices are high.

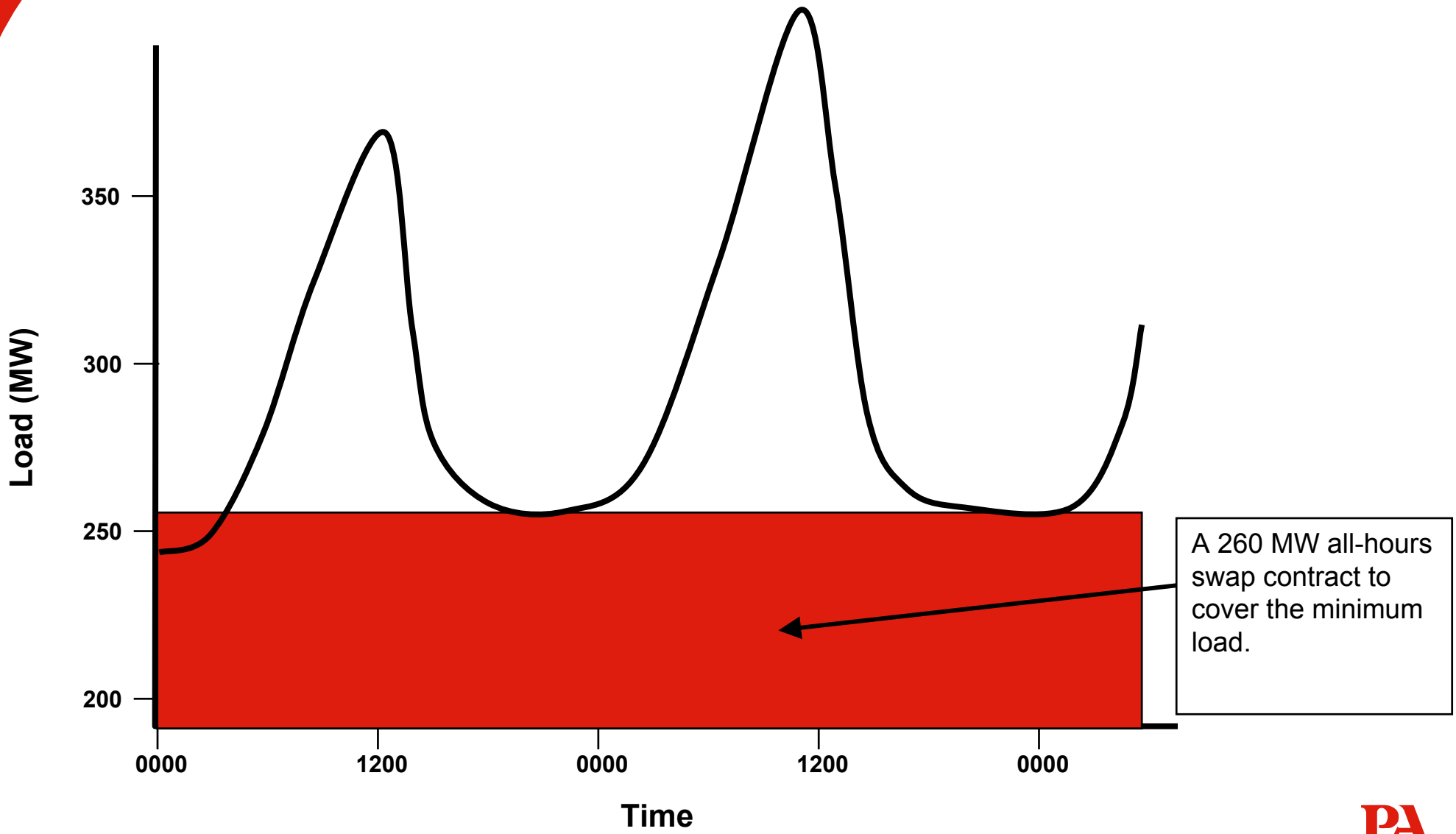
Volume varies over time



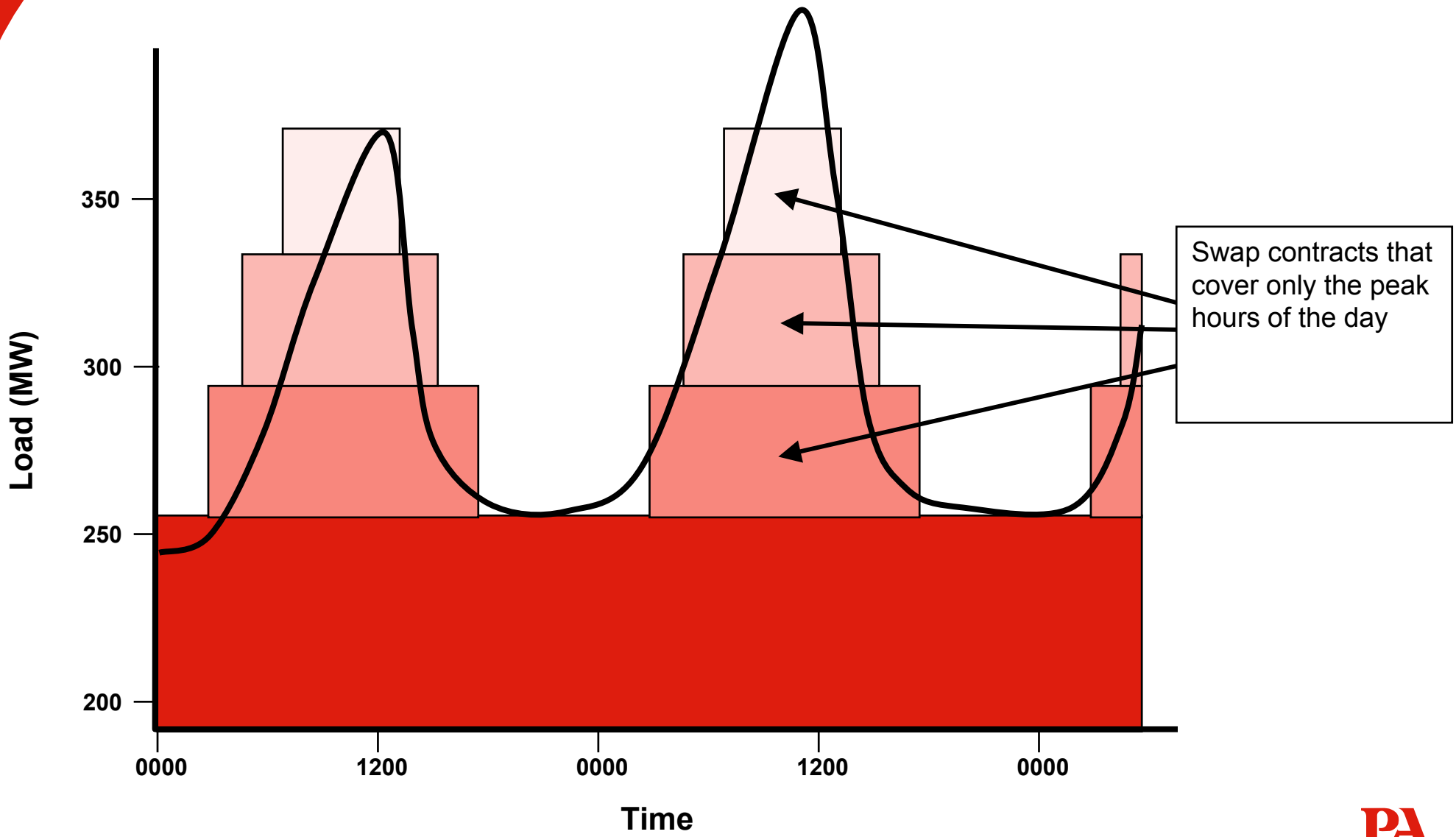
Volume – a hedge portfolio may be used



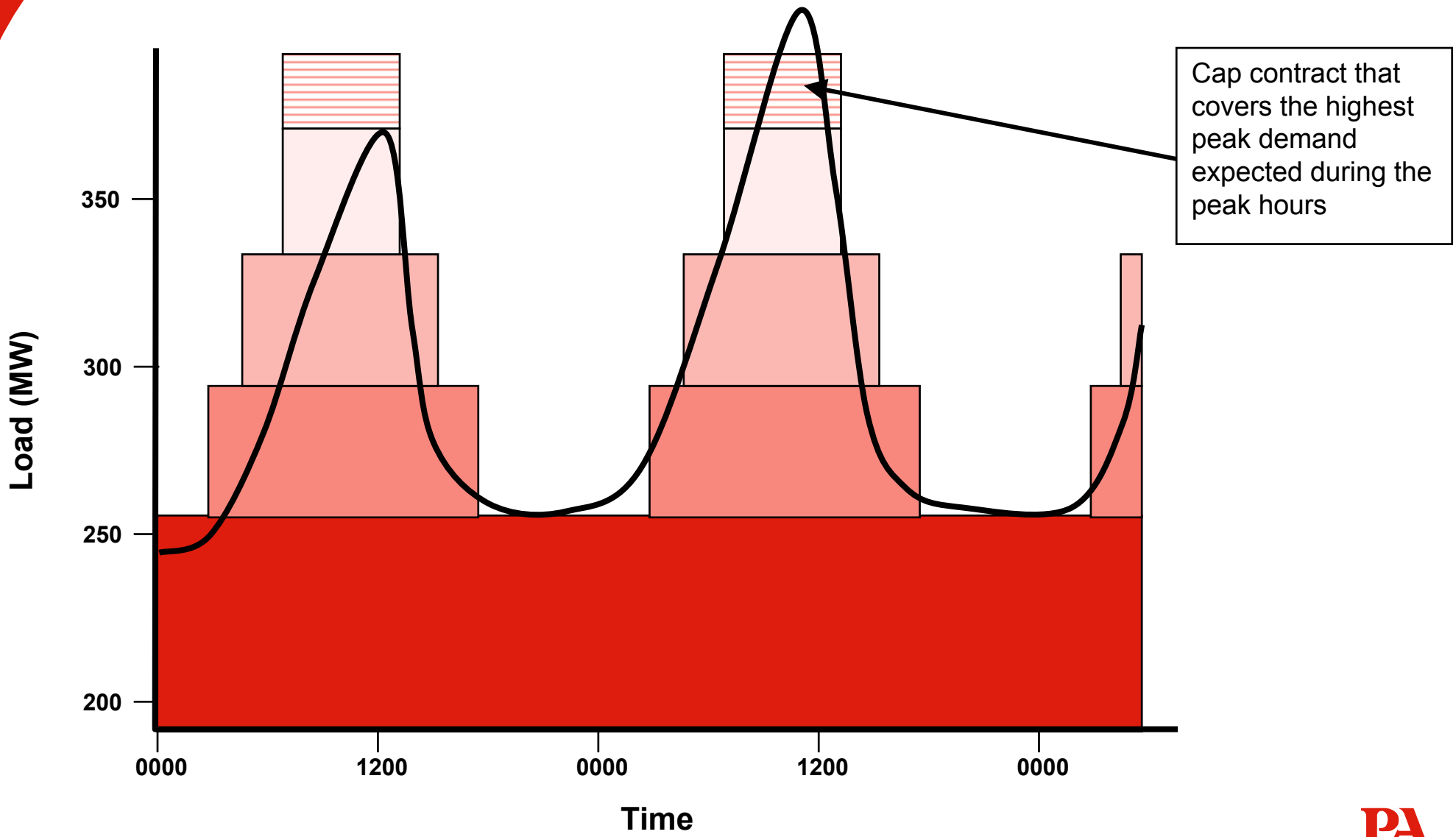
Volume - all-hours swap / base load



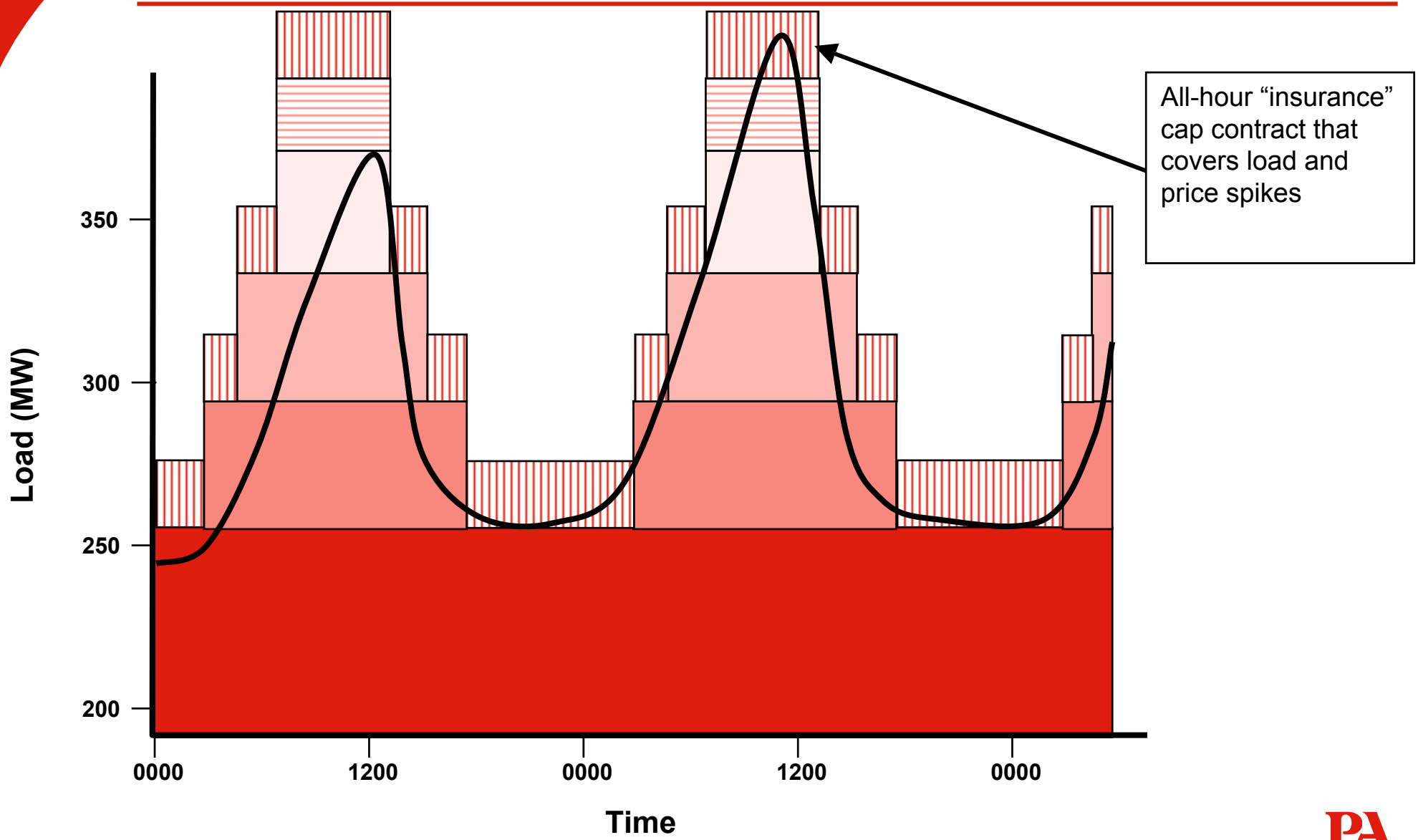
Volume - Peak hour swaps / intermediate



Volume - Peak hour caps / peakers



Volume - all-hour “insurance” caps



Volume - other tools to reflect variance

Other techniques that may be used to hedge uncertain loads include:

- Swaps with volume amounts that change over time to reflect the daily, weekly, and annual variations in load
  - Based on ex ante load profiles
  - Based on actual metered (or total system) demand in prior hours
- Caps triggered when system peak demand (or other agreed public measure, e.g. temperature) exceeds a trigger level
- Additional cap contracts that are triggered only in special situations, such as the failure of a power plant or an interconnector

Strike prices

The simple examples here show a strike price that is a single number. Other techniques that have been used to set strike prices include:

- Strike price that is different in every hour, perhaps reflecting a simulation of a competitive market (used in some vesting contracts to avoid unnecessary damping of market prices)
- Strike prices that are conditional upon agreed and publicly measurable events (e.g., the failure of a power plant or an interconnector)
- Strike prices that are linked to historical spot prices (e.g., last month's average off-peak spot price)
- Strike prices that are linked to market fuel prices, to more closely follow a generator's marginal fuel cost

Counterparties

The examples assume a single co-located generator and supply company as counterparties. Other possibilities include:

- A generator might have multiple power plants and offer a variety of hedge products to multiple suppliers
- A large supply company might arrange contracts with multiple generators
- Traders and middlemen might assemble portfolios of hedges in dealing with both generators and suppliers
- Interruptible load could offer cap contracts
- Locational hedges, such as FTRs or firm transmission sights, might be a part of a hedge portfolio when generators and supply companies are not co-located

Link between financial hedges and physical output

These hedges are financial only. However, the financial exposure of a hedge contract will provide powerful incentives for physical output.

- A generator holding a hedge contract will face considerable financial loss if spot prices are high and the generator is not selling to the spot market – essentially buying at high prices and selling at the hedge price
- A supplier with un-hedged volume will face considerable financial loss if spot prices are high – there are powerful incentives to pay customers to reduce load
- The portfolio of hedges held by a generator will likely cause changes in bidding behaviour

Closing

Thank you very much for attending.

There are a lot more detailed issues that we do not have time to cover.

If you would like to ask more questions contact CER.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