Derivative Markets in Electricity

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Market Products

Physical Markets + **Financial Markets**

Spot
Immediate Delivery

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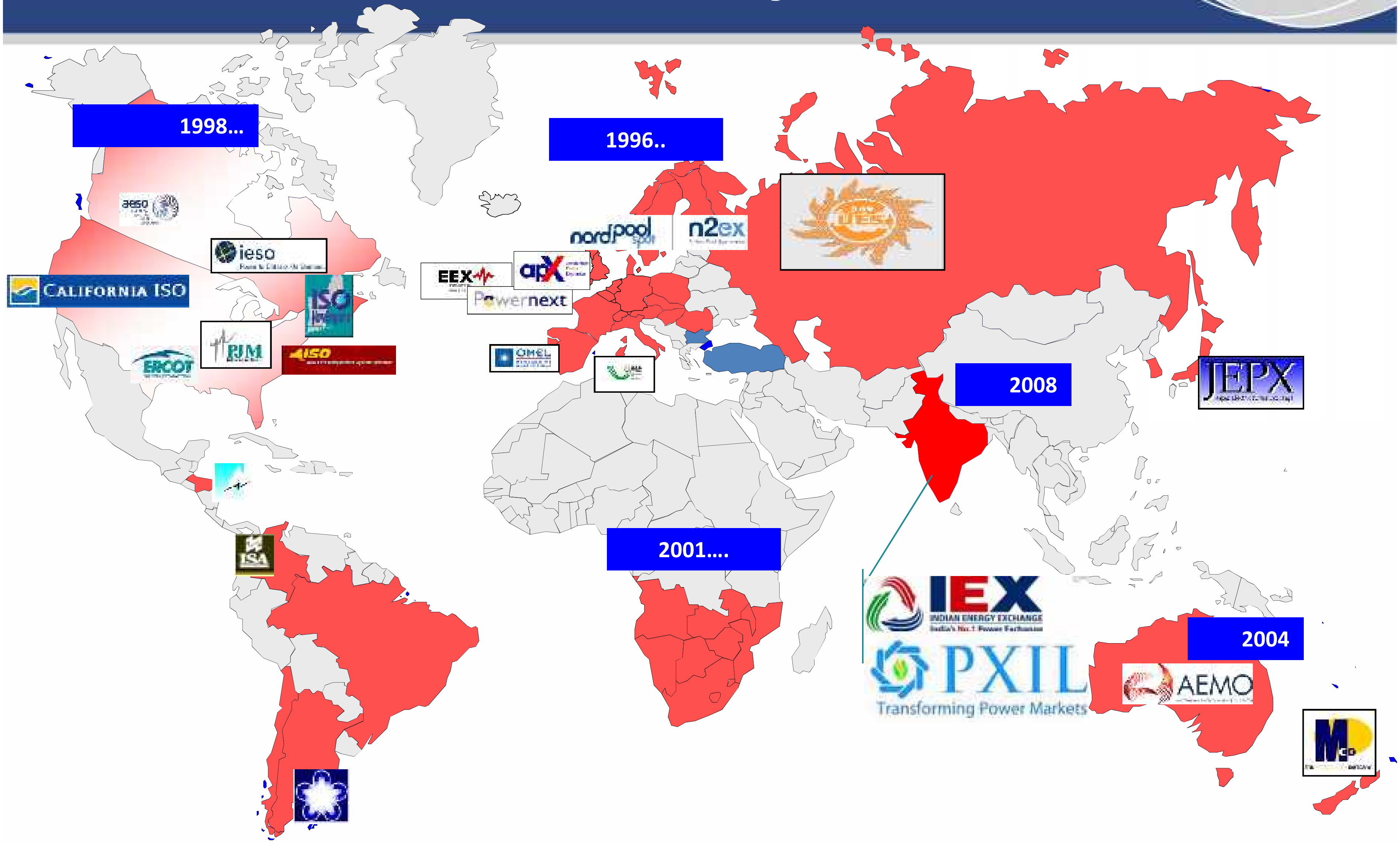
Forward
Delivery at some point in future

Derivatives
Risk Mgmt. tools for product/time/place

- Forward
- Futures
- Options
- CfD

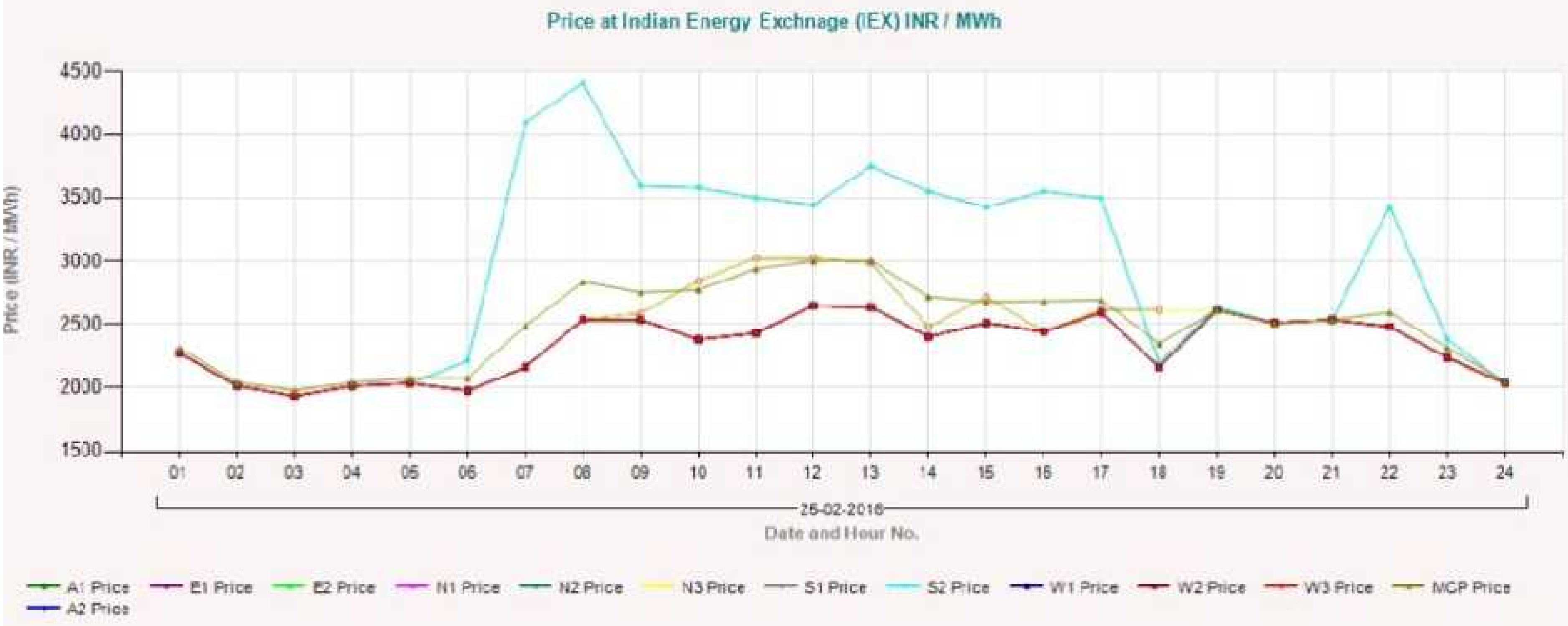
Global Evolution of Electricity Markets



Why Electricity Derivatives? Hedging?

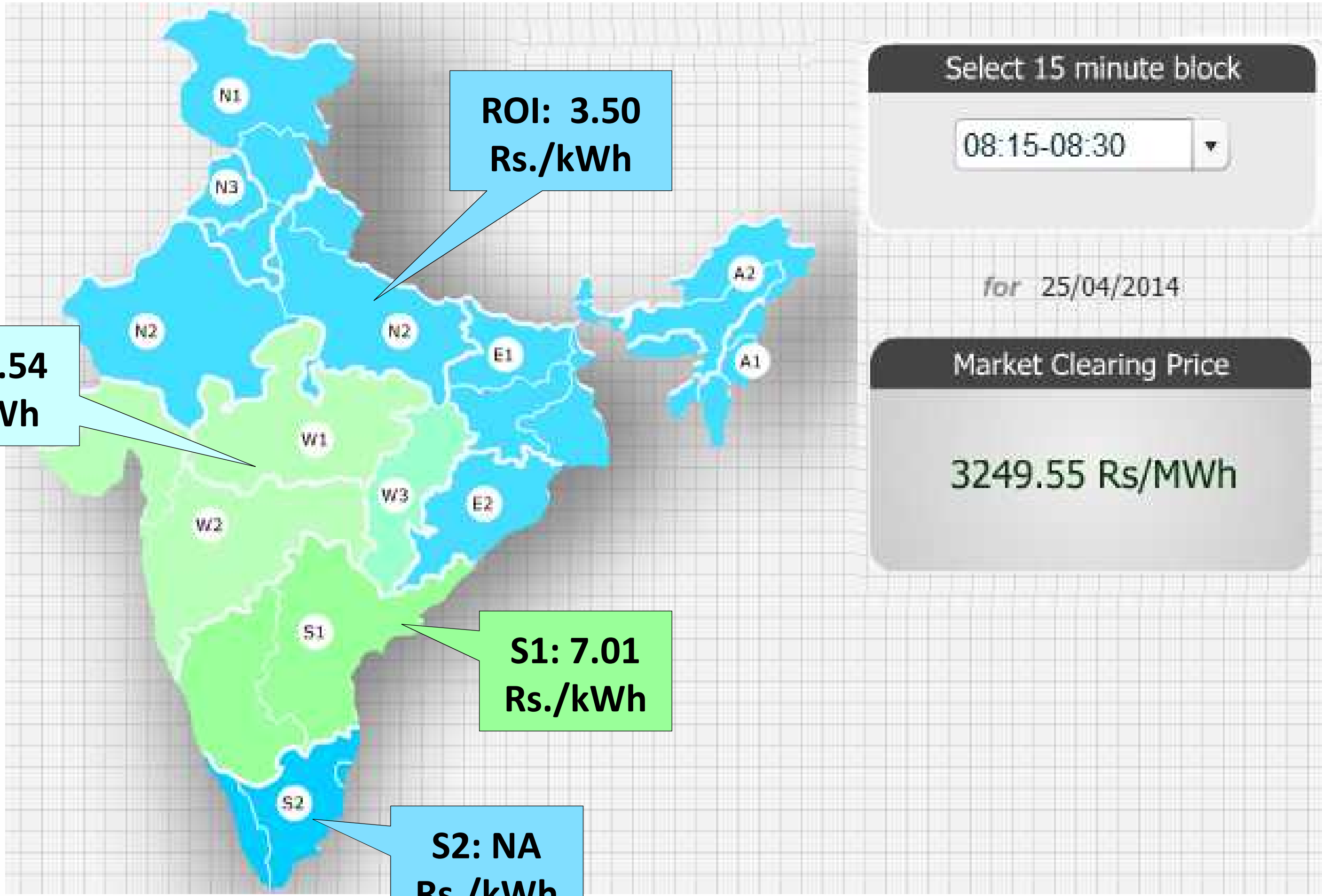
- Deregulation and competition in wholesale markets with in the past two decades has resulted in lower market driven prices, but also greater price volatility
- Spot price volatility in the electricity market can cause significant risk to wholesale market participants. While generators face a risk of low prices having an impact on earnings, Discoms/consumers face a complementary risk that prices may rise to high levels
- Market participants commonly manage their exposure to volatility by entering financial contracts that lock in firm prices for the electricity they intend to produce or buy in the future
- Derivatives can be OTC or Exchange traded

Intraday price volatility in IEX DAM



Area Prices @ IEX

Different Prices due to Congestion



ROI: 3.50 Rs./kWh

WR: 2.54 Rs./kWh

S1: 7.01 Rs./kWh

S2: NA Rs./kWh

Why Derivative Contracts contd….

- Electricity business has too many variables
- Long Term PPAs are inherently risky wherein risks are generally transferred to one party
- Nobody can forecast for such a long period
- Error in judgment can be too costly to sustain
- No easy exits available
- International trend is avoid very long term contracts
- Introduce Capacity market along-with energy market to resolve missing money problem

Derivative Markets

- A contract which derives its value from price of an underlying commodity
- All financial contracts are derivative contracts
- Can involve a degree of optionality (options)
- Could be combination of spot and/ or published forward/ contract prices
- Difficult to "value"
  - as published forward curves do not really represent the types of prices covered by contracts

Common Derivatives

1) Forwards — OTC
   - Physicals
2) Futures — Exchange
   - Essentially financial
3) Swaps — OTC
   - Financials
4) Options — OTC/Ex
   - Physical or financial

Participants of Derivative markets

- Exchanges
- Traders
- Hedgers
- Speculators
- Arbitragers
- Clearing Corporation

Forward Contract Reulation Act 1952

- Electricity is a scheduled commodity as such provisions of this act are applicable
- Contracts not regulated by this act
  - A contract which is traded and settled within 11 days period is ready delivery contract (spot contract)
  - Bilateral contracts are not regulated
  - Contracts where underlying is unscheduled under this act
- Financially settled contracts are not permitted
- Options in Commodities are not permitted

1) Forwards

- Obligation to buy or sell a fixed amount of electricity at a pre-specified contract price(the forward price), at certain time in the future (called maturity or expiration time)

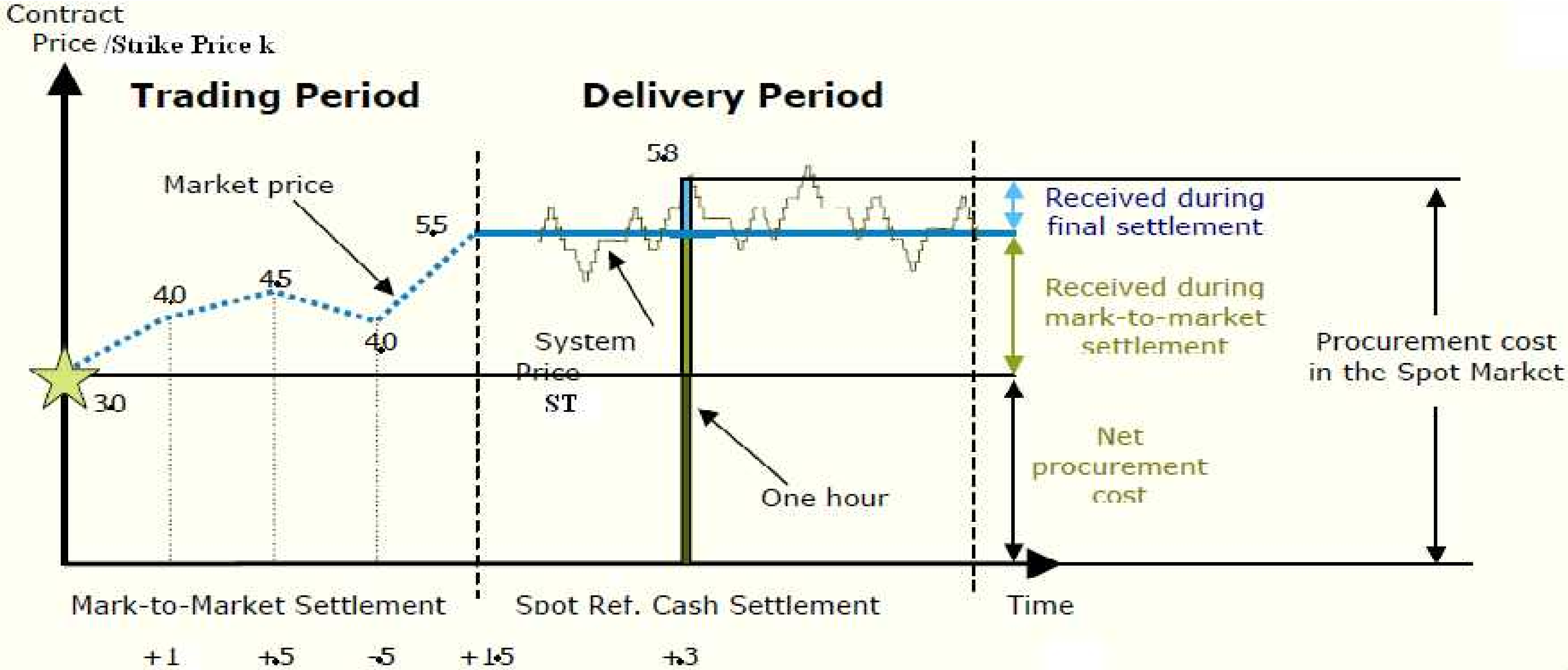
- Electricity forwards are custom tailored supply contracts between a buyer and a seller,
  - Buyer is obligated to take power
  - Seller is obligated to supply

2) Futures

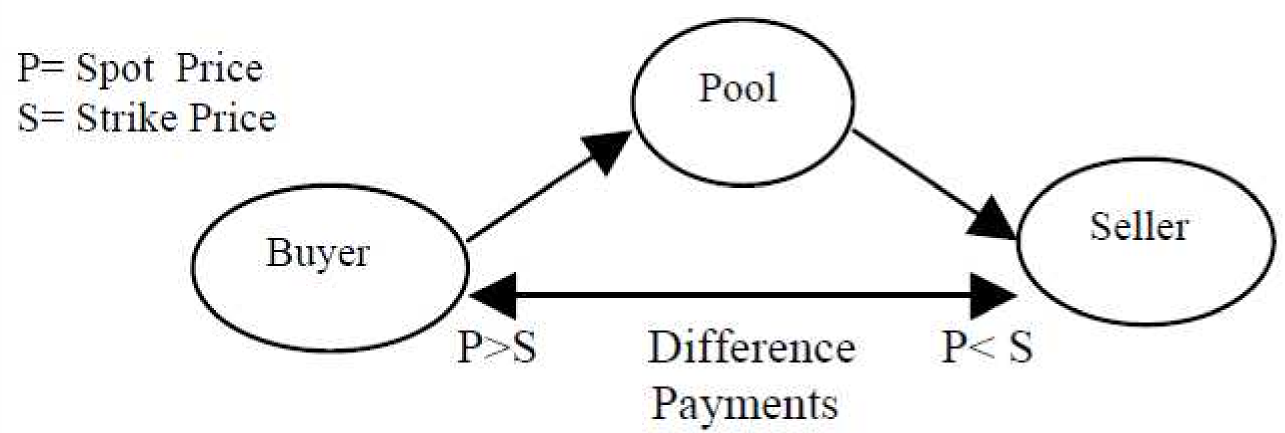
- Traded on organized Exchanges
- Majority of electricity futures contracts are settled by financial payments (cash settlement) rather than physical delivery, which lower the transaction costs.
- Futures contracts are highly standardized:
  - Contract specifications,
  - Trading locations,
  - Transaction requirements,
  - Settlement procedures
- Contract for Differences (CfD) is widely used in mature electricity markets to help hedge the exposure to spot prices

Operation of futures market

- Settlement of futures contracts involves both a daily mark-to-market settlement and a final spot reference cash settlement, after the contract reaches its due date.
- Mark-to-market settlement covers gains or losses from day-to-day changes in the market price of each contract.
- Final settlement, which begins at maturity, covers the difference between the final closing price of the futures contract and the System Price in the delivery period.



Hedging with CfD



- when spot price is above the strike price, the seller pays buyer an amount equal to difference between the spot price and strike price
- when the spot price is below the strike price, buyer pays the seller an amount equal to the difference between strike price and spot price

Pros and Cons: Futures

- Pros
  - Market consensus
  - Price transparency
  - Trading liquidity
  - Reduced transaction and monitoring costs
- Cons
  - Limited transaction quantities specified in the contracts

Futures Vs Forwards

- Credit risks and monitoring costs in Futures much lower than for Forwards
- Exchanges have strict margin requirements
- OTC transactions are vulnerable to financial non-performance due to counterparty defaults
- Futures lower credit risk
  – Gains and losses of futures are paid out daily
  – Forwards are cumulated and paid out in a lump sum at maturity time

3) Swaps

- Financial contracts
- Holders pays fixed price for electricity, regardless of floating electricity price, or vice versa, over the contracted time period.
- Established for fixed quantity of power referenced to a variable spot price at either a generator's or a consumer's location.
- For short- to medium-term price certainty up to a couple of years.
- Strip of electricity forwards with multiple settlement dates and identical forward price for each settlement.

4) Options

- Optionality needed to react to fluctuations in consumption, transmission interruption or plant outages
- Buyer has the right but not the obligation to buy or sell the asset at the previously agreed price.
- Seller has the obligation to deliver or take.
- Similar to insurance
  - buyer pays premium every year
  - insurance pays any damages
- In case of futures/forwards, contract is either held for delivery or liquidity, but option contracts may be held for liquidity, delivery or expire worthlessly
- Option contracts are tradable, the holders have the flexibility to sell the contract in secondary market
- Financial Transmission Rights (FTR) are instruments to hedge congestion risk with payouts based on the difference between two locational/zonal prices (Sink & Source)

Standard Options

- Call: gives the option holder the right to *buy* at a predetermined price
- Put: gives the holder the right to *sell* at a predetermined price
  - European, American and Asian style

    European option can be exercised only on its expiry date

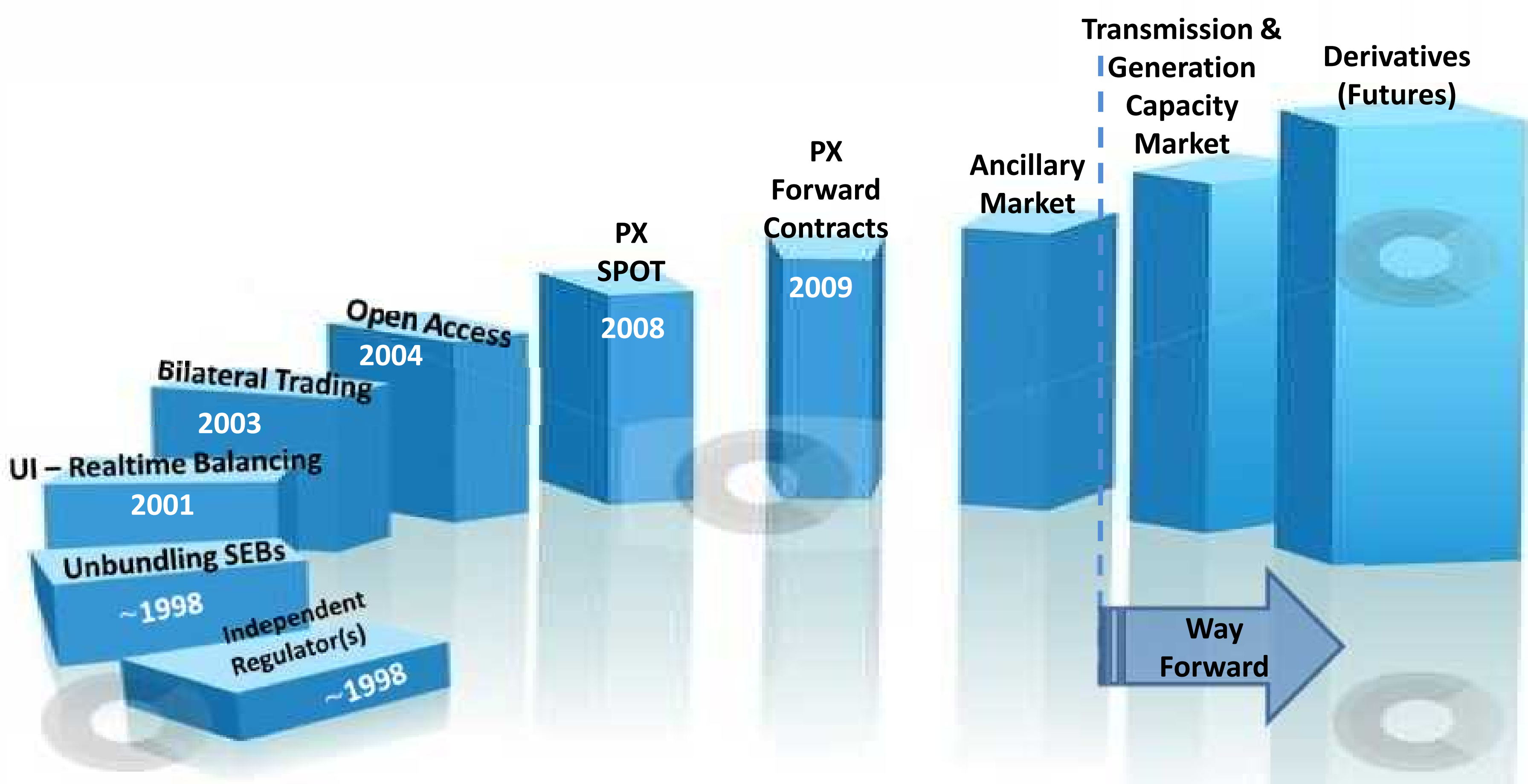
    American option can be exercised at any time before the expiry date

    Asian option's payoff depends on average price of underlying asset over a period of time

Strike Price

- Strike price
  - price for which underlying commodity can be bought or sold
- Value option contract is relative to strike price
- Option contract can be:
  - At the Money (ATM)
  - In-the Money (ITM)
  - Out-of-the Money (OTM)

Milestones & Way Forward for India



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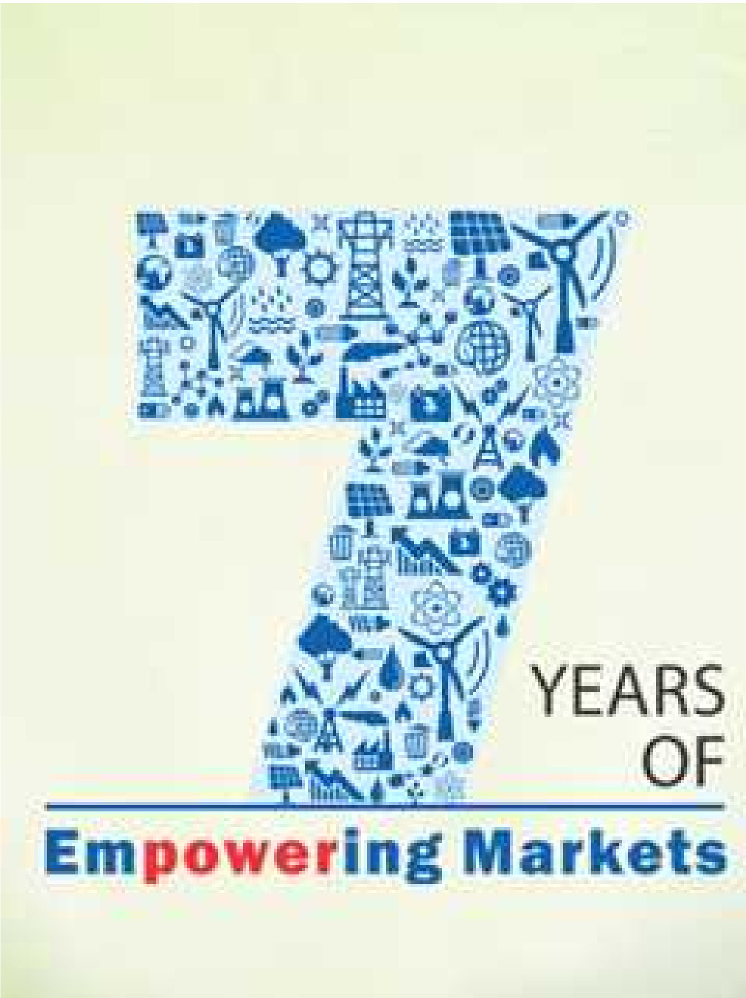

Best Power Exchange in India

– Enertia Awards ’14, ’13 &’12

– India Power Award 2014

– Power Business View 2014

Inc India Innovative 100 Award for ‘Innovation in Product and Technology’

Best Performing Power Exchange –
Power Line Awards ’13 & ‘12

India Power Awards ‘15 & ‘09