KPMG

Pricing Energy Services

Workshop on Strategic Energy Sector Policies

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“Keep your thinking as simple as possible and only as complex as necessary”

Albert Einstein

Outline

1. Key Considerations in Pricing
2. Allowable Cost Determination
3. Approaches to Transmission Tariff Design
4. Ancillary Services
5. Nepal : Implications and Insights

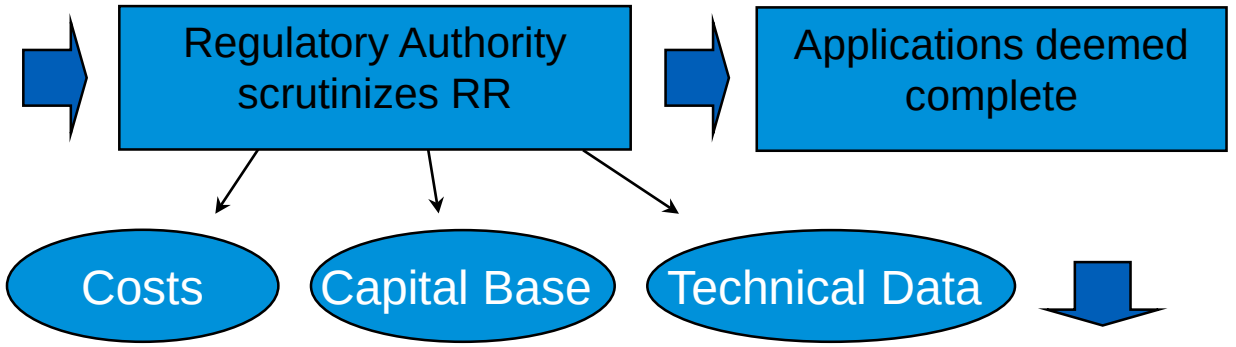
Key considerations in tariff design

1. Providing appropriate incentives to timely and efficient investments and ensuring system security
2. Addressing specific features of the system on which it applies
3. Reflecting the use of network
4. Not discriminating among similar network users
5. Facilitating trade and competitive markets
6. Being cost-reflective
7. Giving relevant locational signals (i.e. mainly long term signals)
8. Addressing transition issues like impact on incumbent and future system users
9. Ensuring transparency, simplicity and avoidance of ambiguity

Cost Determination: Basic Requirement of any Rate Design

Submission of Revenue Requirements (RR) by Utility

- Financial Information
- Technical Information

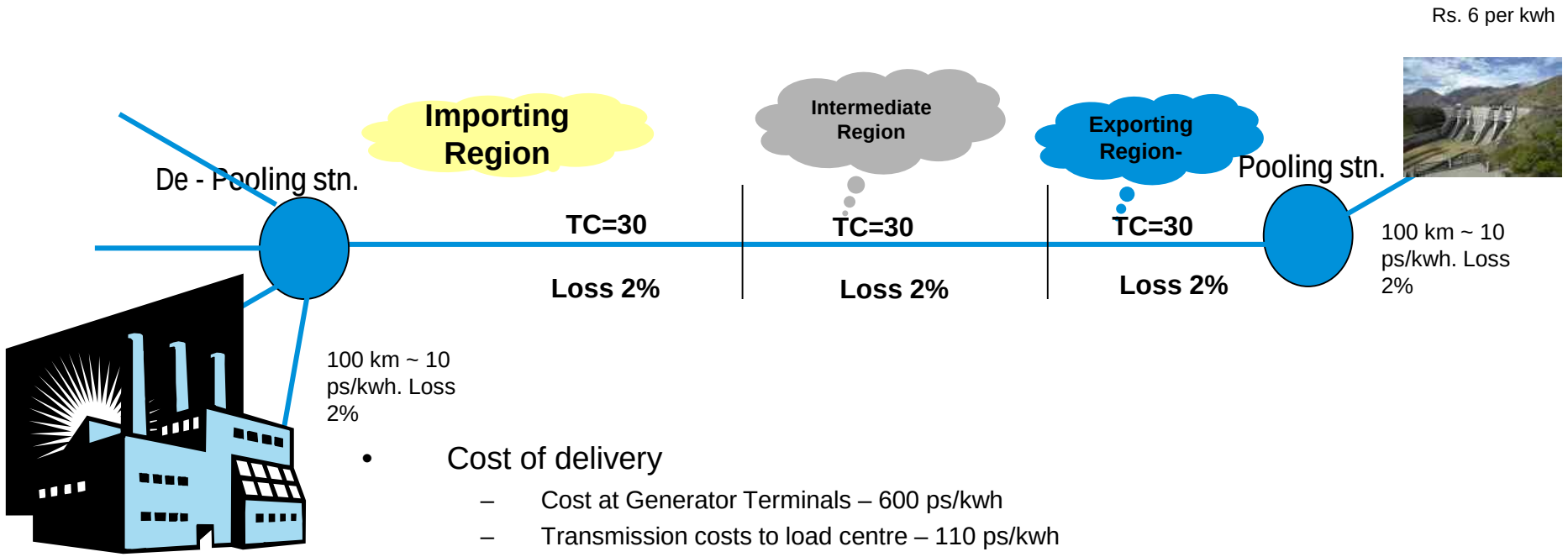


Focus on supportability of information provided in the RR applications and long term implications of the positions taken is important

Network Pricing: Two philosophical approaches covering the basic pricing options

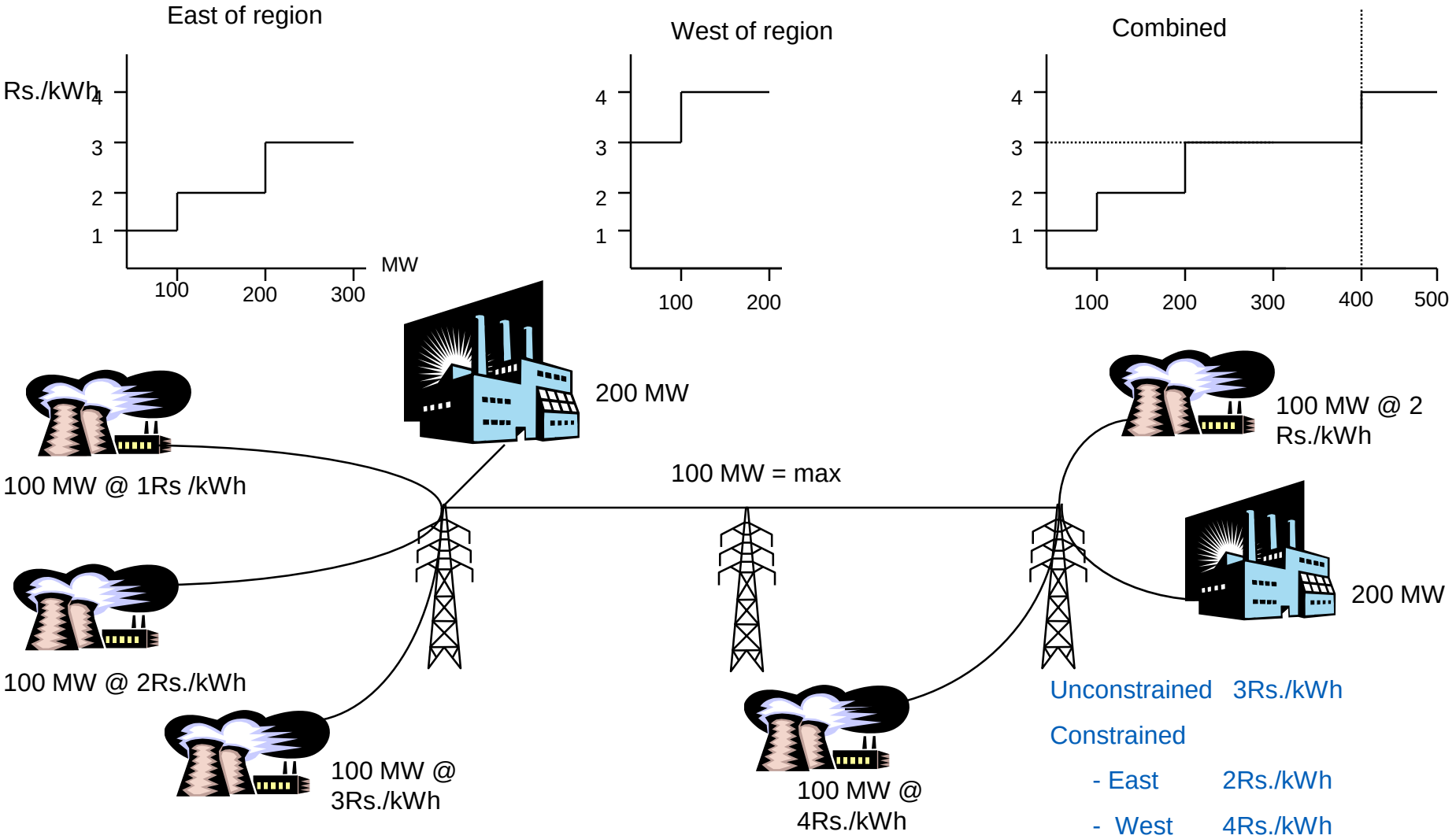
- Cost based approaches
  - Postage stamp
  - Contract path method
  - Mega-watt mile method
  - Zonal pricing
- Market value based approaches
  - Zonal pricing
  - Nodal pricing

Pricing under Postage Stamp : Example

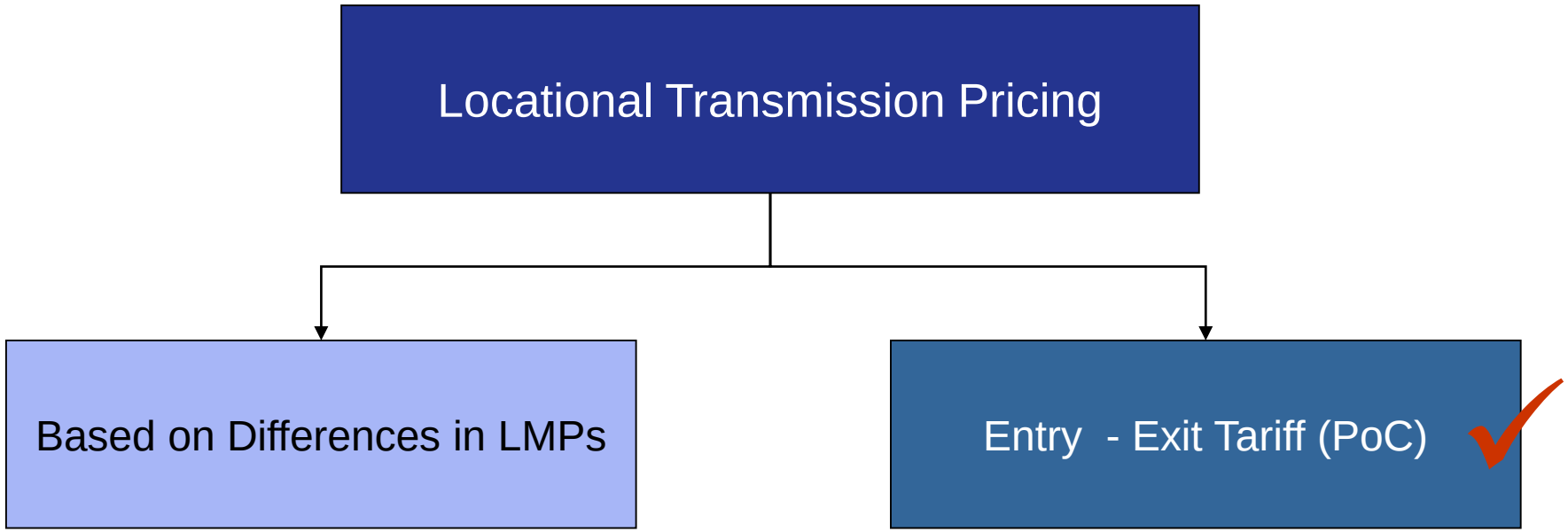


- Cost of delivery
  - Cost at Generator Terminals – 600 ps/kwh
  - Transmission costs to load centre – 110 ps/kwh
  - Cost of losses – 58 ps/kwh
  - Final costs – 768 ps/kwh
- Much of the cost levels are genuine. However,
  - If new line costs are loaded on to first user(s), then the cost of delivery can be prohibitive
  - There could be a tendency of over-estimation of losses
- **Hence the need to ensure a *fairer* allocation**

Nodal pricing : Example



Point of Connection (PoC) extends the principle of LMP to a meshed network



PoC uses cost and congestion based pricing for transmission in deeply meshed electricity markets

Progression in International Transmission Pricing Practices

- ✓ Most countries (particularly smaller ones) started with following a postage stamp approach (as shown in the adjacent table)
- ✓ Wherever the distances are large, trend was towards zonal/nodal pricing
- ✓ Cross-border transaction pricing was not well developed
  - US: Pancaked rates between ISOs
  - Nordpool: Point to point rates for all transactions within pool area
  - Germany: Matrix based transmission charges (akin to zonal)
  - Europe: With and without method of load flows

	Tariff design	Loss compensation	Time differentiation
Austria	Posatge stamp	Posatge stamp	No
Belgium	Posatge stamp	Posatge stamp	No
Denmark (East)	Posatge stamp	Posatge stamp	Yes
Denmark (West)	Posatge stamp	Posatge stamp	Yes
England & Wales	Zonal	Zonal	Yes
Finland	Posatge stamp	Posatge stamp	Yes
France	Posatge stamp	Posatge stamp	Yes
Germany	Posatge stamp	Posatge stamp	No
Ireland	Nodal	Nodal incremental	Yes
Italy	Posatge stamp	Zonal	Yes
Netherlands	Posatge stamp	Posatge stamp	Minimal
Norway	Nodal	Nodal	Yes
Portugal	Posatge stamp	Posatge stamp	Yes
Spain	Posatge stamp	Posatge stamp	Yes
Sweden	Nodal	Nodal	Yes

Source: EU benchmarking studies, 2005

- ✓ Over time transmission pricing has evolved in most jurisdictions. These days “pure” postage stamp or any other method rarely exists
- ✓ Hybrid methods are being adopted because it is becoming increasing important to differentiate between “Economy” and “Reliability” assets

Closing thoughts

1	**Market reforms are a continuous process that responds to emerging needs (e.g. renewables) and learnings of implementation of prior phases. It is not a single magic bullet**
2	**Certain enablers are essential irrespective of market forms (e.g. forecasting, capacity adequacy statements, planning)**
3	**Market reforms can cause significant acceleration in policy implementation (e.g. CfD for offshore wind, nuclear or even storage hydro)**
4	**Transmission access and pricing is a key enabler of markets**
5	**Retail competition is essential to deliver real value of market reforms and requires structural intervention to be successful**
6	**Capacity building (technological and human) across the chain is a non-negotiable if value is to be derived from market reforms and sophisticated pricing approaches**

Thank You

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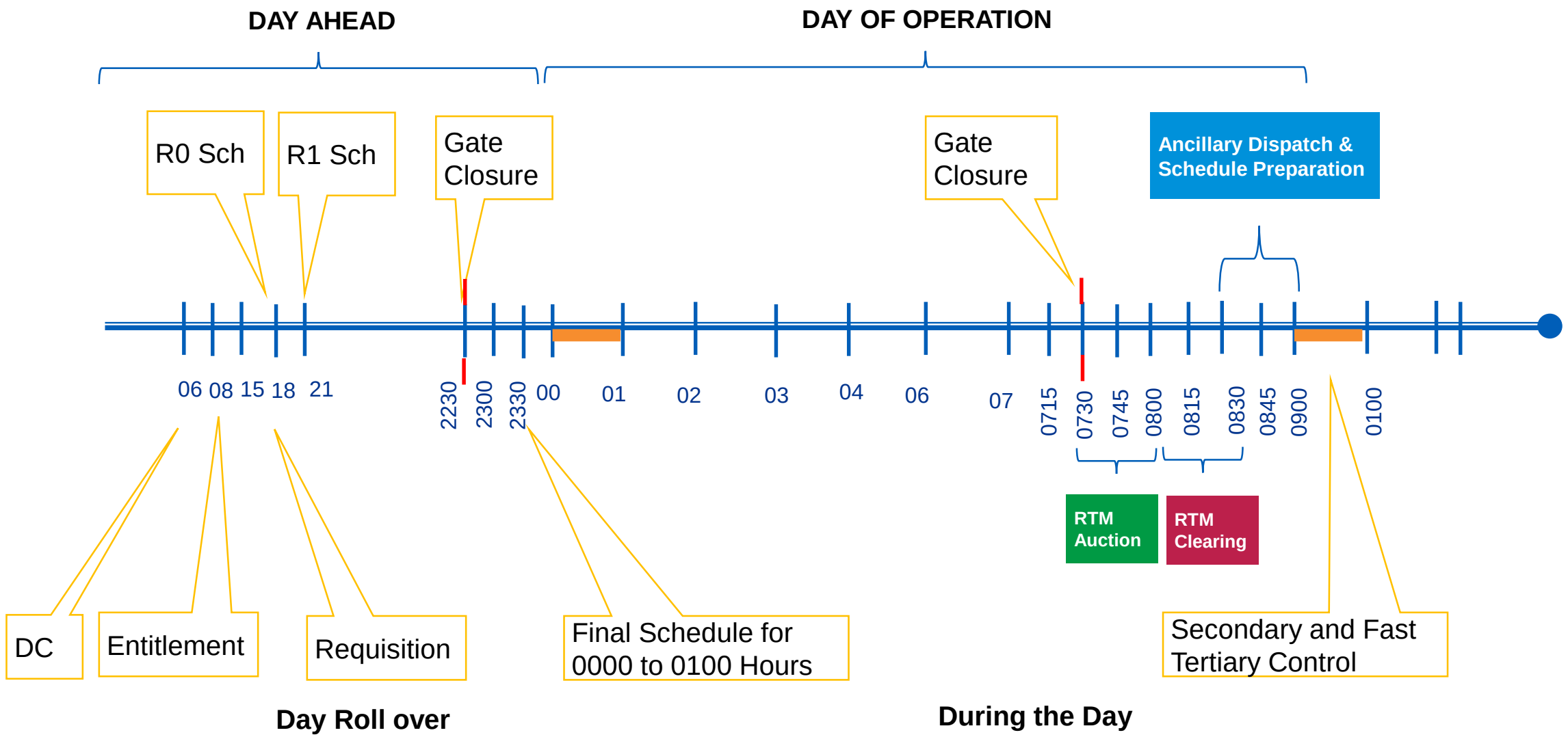
Schematic of Real Time Market



Suite of Modeling tools

1. Power Portfolio Optimisation

- Modelling tools for utilities to address issues from long-term Perspective Planning to Core Day-Ahead and Intra-Day Operations. Involves demand & price forecasting at 15—minute intervals

2. CAPLAN – Generation Expansion Model

- Mixed Integer Linear Programming (MILP) model used for projecting **short-run and long-run marginal prices, power plant dispatch, electricity deficits, generation capacity planning, fuel consumption, transmission congestion, emissions etc.**

3. UCM – Unit Commitment Model (SCUC/SCED)

- Mixed Integer Programming (MIP) model used to
  - Model daily scheduling of generators/contracts by DISCOMs
  - Study **impacts of intermittent & variable generation.**
  - **Agricultural Scheduling**

4. EDM – Electricity Demand Forecasting

- Bottoms up model based on econometric techniques used for projecting **consumer category wise electricity demand**.

5. CGE – Computable General Equilibrium

- Macro Economic Modelling for studying the impacts of Free Trade Agreements, impact of alternative tax regimes, other key macroeconomic / sectoral initiatives by Governments

6. Benchmarking

- Advanced benchmarking methodologies to evaluate and compare the efficiencies of decision making units based on the inputs and outputs associated with them in a multi-criteria decision making setup

Models can be used as stand-alone, or in an integrated manner

Backed by comprehensive database representing the Power Market

Ideal framework for integrated analysis of the Power Markets – generation, transmission, distribution, renewables and fuels

Alternative 1: Contract path based pricing

- **Introduces the concept of distance in cost based pricing**
- **Producer and consumer agree on a fictitious transmission path**
    - Once the transmission path is established the costs of that transmission path is allocated to the users of that path in proportion of their usage
    - Overall usage of contract path by all users must be known in advance to establish the contract path charges
- **Compared to postage stamp method the contract path takes distance into account**
- **Suffers from residual deficiencies**
    - Does not consider direction of flow and hence does not send appropriate price signal
    - Transaction costs may vary significantly resulting in inefficient pricing and usage

Aternative 2: Mega-watt mile method

The physical distance from injection to transaction point is considered in conjunction with the MW flow involved

$$R_t = TC * PX_t / \Sigma_i PX_i \quad \text{with,}$$

$$PX_t = DT*PM, \text{ where}$$

PX_t = MW-mile value

DT = Aerial distance

PM = Magnitude of flow

TC = Total transmission charges

While a significant improvement over earlier methods, it still does not consider actual network conditions

Variations of MW-mile method using power flows for cost allocation are sometimes used to send right price signals

Alternative 3: Long Run Marginal Cost

- **Transmission costs should be allocated to those agents that “stress” the network and therefore lead to its expansion**
- Advantages
  - closest to the “ideal” tariff
  - provides economic signals for sitting
  - easy to understand by regulators (economic justification)
  - considers clearly the difference between increasing or decreasing the use of the lines
- Disadvantages
  - relies on forecasted future planned expansions
  - strong variation from one year to the other
  - has “negative” charges (payment to generators or loads) which may be high

Alternative 4: Extent of Use

- **Transmission costs are allocated to those agents which use the resource, similar to the “tolls” applied to a transportation system**
- Advantages
  - easy to understand
  - perceived to be “fair” by agents
  - more stable signals
  - there are no “negative” charges
- Disadvantages
  - weaker economic justification
  - cost recovery could be inadequate. May need backstopping through recovery guarantees or complements

Alternative 5: Zonal pricing

- **In zonal pricing the electricity transmission network is sub-divided into congestion zones**
  - Works well when few serious and systemic constraints exist (i.e., when a few zones can be defined and they are stable)
- **The price of transmission services between networks is related to the cost differences between the zones. Alternative basis include,**
  - **Network costs and incremental losses** for transmitting the energy between the zones (cost plus approach)
  - **Differences in marginal costs of generation** between the zones (generally reflected through differences in spot prices of electricity in the zones)

Definition of Reserves