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The India Electricity Simulation Tool (IES)

Presentation at IIT-K for Officers of Electricity Regulatory
Commissions (ERCs)

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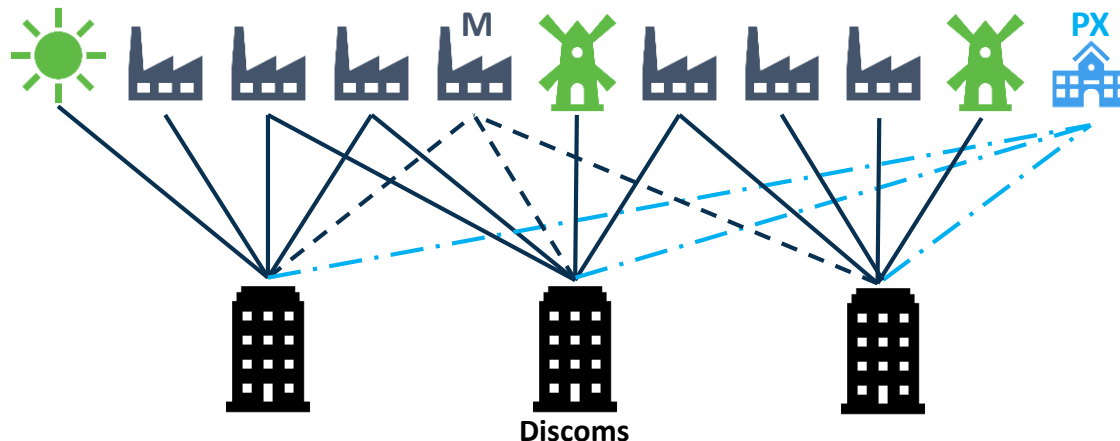
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Wholesale Electricity Markets?

- Where electricity is bought and sold, primarily by distribution and generation companies for delivering it to end consumers.
- How is India's wholesale electricity market structured?
 - Decentralized, bilateral scheduling model
 - Long-term PPAs which are physical contracts.
 - A few market based products available in the PXs.



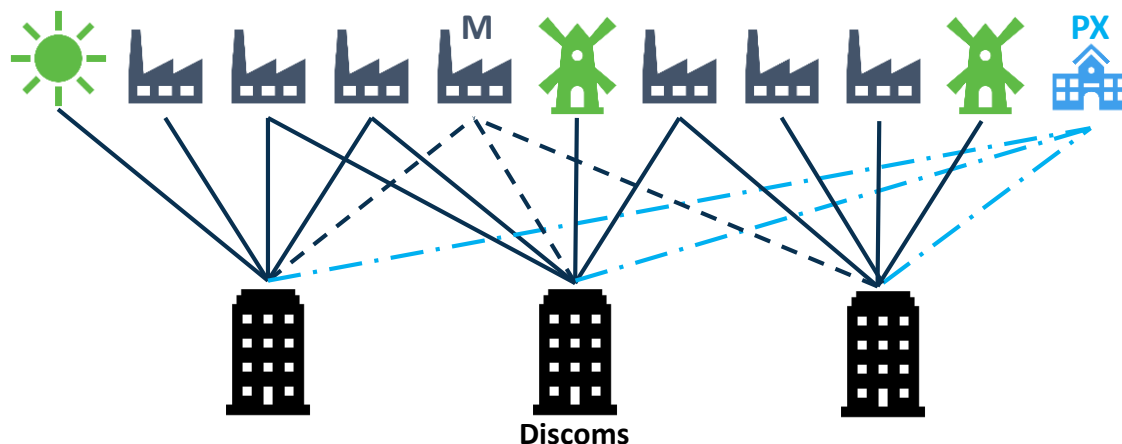
Wholesale Electricity Markets?

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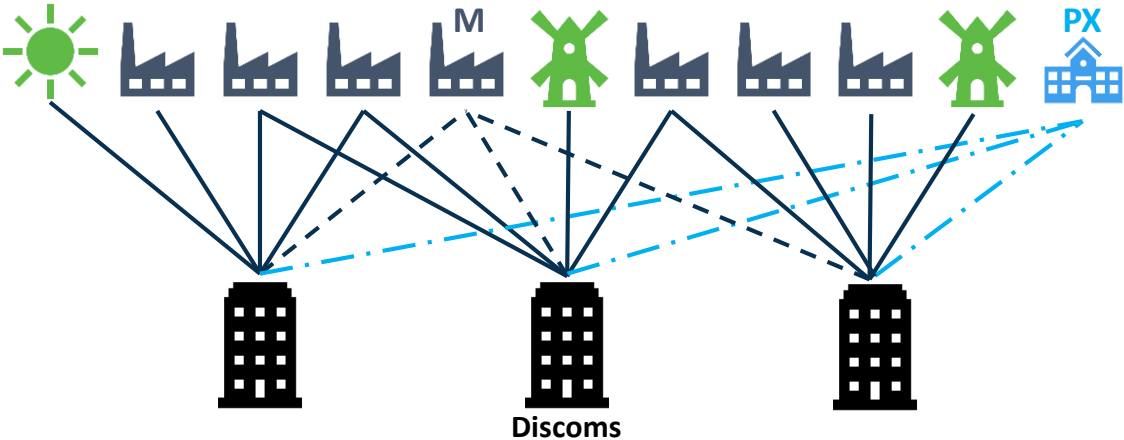
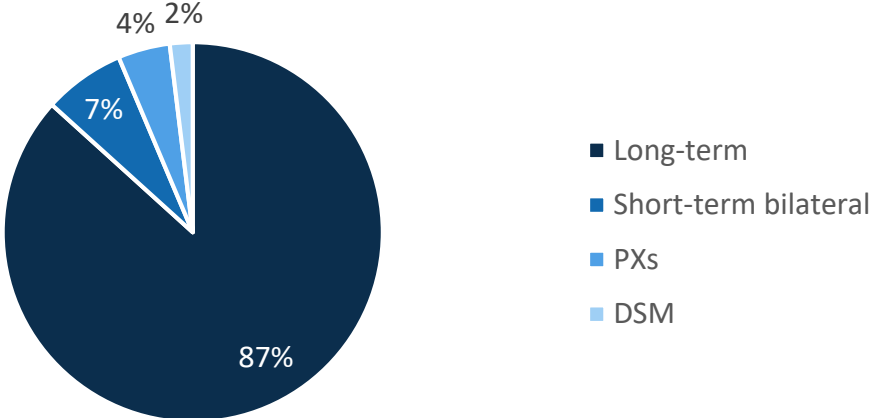
India's current wholesale electricity market structure

- Decentralized, bilateral scheduling model
- Long-term PPAs which are physical contracts.
- A few market-based products available in the PXs.



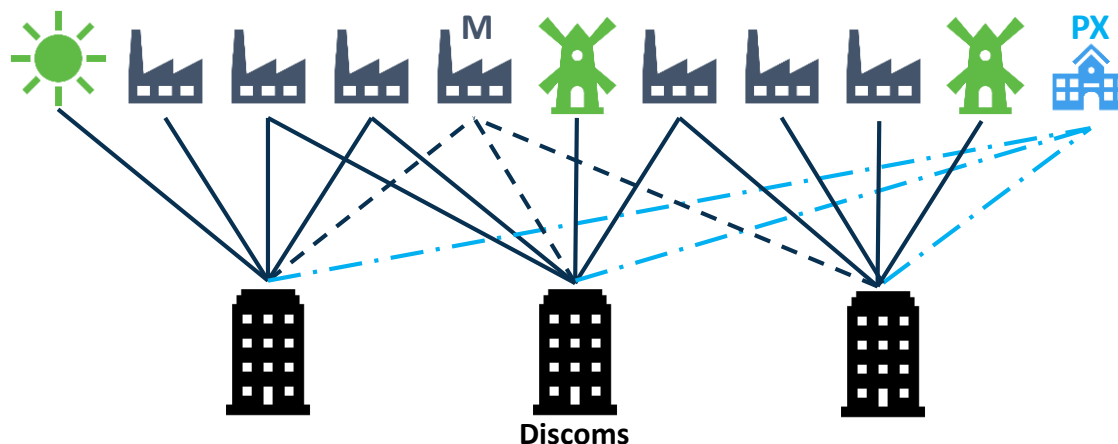
What is happening today?

Type of transactions



Challenges with Current Structure

- Lack of imbalance management in real-time
- Small balancing areas incompatible with increasing variable RE
- Sub-optimal use of generation resources due to scheduling in individual silos
- Cost of generation in any given time-block is undiscovered i.e. system marginal cost



What is CERC Proposing?

- Centralized platform for scheduling and dispatch of resources in day-ahead and real-time.
- Market based bidding mechanism to ensure the cheapest resources are being utilized.
- PPAs are proposed to be made into financial contracts or hedges against market prices.
- Co-optimization of ancillary services with day-ahead and real-time market.

Check out CERC's proposals

➤ Day-Ahead Market

➤ Real-Time Market

- Explanatory Memorandum

➤ Ancillary Services Market

Have you ever wondered

how decentralized
bilateral wholesale
market decisions are
made?

what if there was a
centralized balancing
market?

how to operate
merchant vs contracted
plant?

what if there
were no legacy
contracts?

what if there is
market power
present?

how to make long-term
investments in
capacity?

India Electricity Simulation (IES)



Programmed by Bostian Consulting LLC

What is IES all about?

- Player-driven simulation
- Experiment with various market designs and structures
- Switch between the roles of Discoms and Gencos
- Go through multiple rounds of gameplay to assess various decision making behavior and its outcomes



Simulation Gameplay! (1/3)

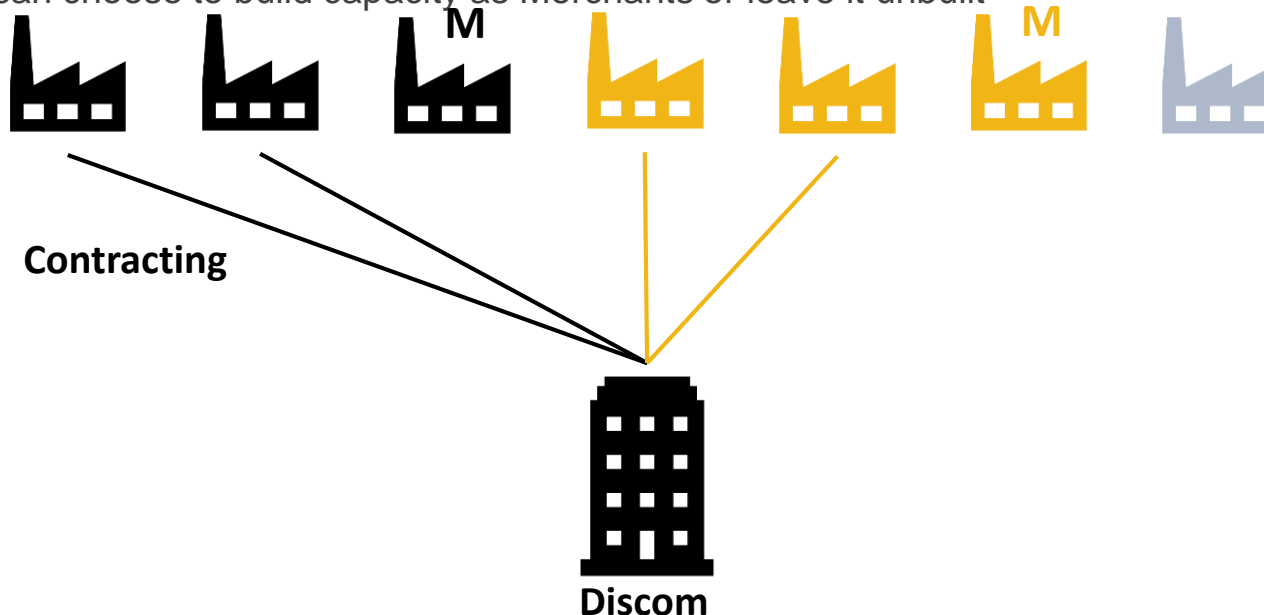
Things to know

- Distribution and Generation companies interact with each other under different *market designs, rules and time horizons*.
- Players
 - 3 Distribution Companies
 - 6 Generation Companies
 - 3 Automated Generation Companies*
- Three Stages
 - Long-Term – contracting and investment decisions
 - Day-Ahead – scheduling and procurement decisions
 - Real-Time – imbalance management

Simulation Gameplay! (2/3)

Long-Term Stage

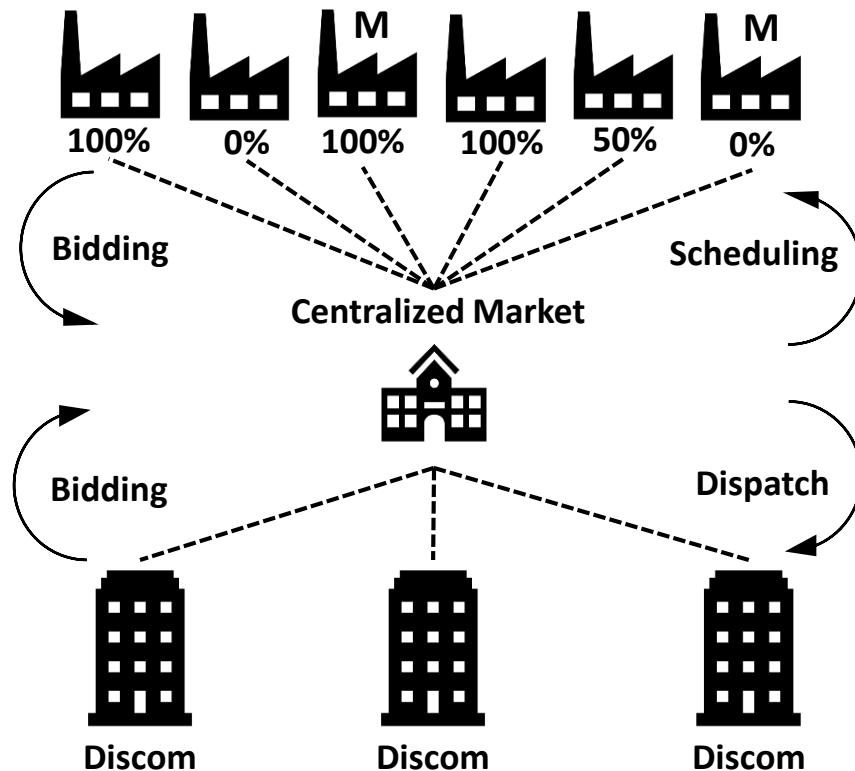
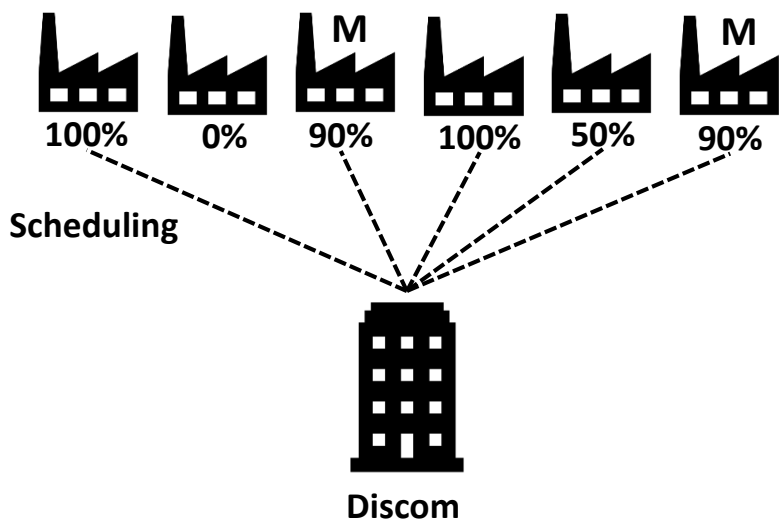
- ❖ Market Design – **Decentralized Bilateral Long-Term Procurement**
- Players start with some existing capacity.
- Gencos present long-term offers to each Discoms for new capacity
- Discoms can accept or reject offers
- Gencos can choose to build capacity as Merchants or leave it unbuilt



Simulation Gameplay! (3/3)

Day-Ahead Stage and Real-Time Stage

- Two Market Designs – Decentralized Bilateral Scheduling and Centralized Market-based Scheduling
- Deviation Settlement Mechanism



Simulation Features

Policy Scenarios and Market Designs

Scenario	Long-term stage	Day-ahead stage	Real-time stage
1	Bilateral	Bilateral	DSM
3	Bilateral + Initial Resale	Bilateral	DSM
	Note - Discoms have an additional opportunity to resell their legacy contracts to one another in the long-term stage.		
4	Bilateral	Bilateral + Centralized Auction	DSM
	Note - Most interactions occur bilaterally however Discoms are mandated to schedule at least 10% of their day-ahead forecast load from the centralized auction		
5	Bilateral	Centralized Auction	Centralized Auction
6	Bilateral	Bilateral	Centralized Auction

Simulation Features

Market Structures and Parameters

- Pair different scenarios with different market structures such as:
 - Less flexible capacity in the system
 - No legacy contracts
 - Level playing field
 - Market power in generation
- Modular simulations
 - Simulate specific stages in select scenarios as well
 - Faster gameplay and focus on specific topics



So lets get started!

Additional Resources

- Check out RAP's [Markets Learning Hub](#) for other resource material.

About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org



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