

# Network Pricing in the Low Carbon Power Markets

**R. Bhakar**

MNIT Jaipur India  
rbhakar.ee@mnit.ac.in

**N.P. Padhy**

IIT Roorkee, India  
nppfeeee@gmail.com

**F. Li**

Uni of Bath, UK  
f.li@bath.ac.uk

# Network Pricing

- Important aspect in restructured electricity market design
- Large fixed network cost
- Cost reflective pricing models: induce L&G towards optimal locations
- Growing complexity of networks, increasing number of transactions
- Development of fair pricing model is contentious

# Stages of Network Pricing

- Three stages
  - Network cost evaluation → Determination of costing methodology
  - Cost allocation
  - Revenue reconciliation

# Issues in Network Pricing

- Regulator's perspective
  - Economic network charges, high service quality, financial viability of network utilities, ability to invest in network operation and development
- Network owner's perspective
  - Long-term security of their investment
- Network user's perspective
  - Transparent & equitable use-of-system charges
  - Stability & predictability of prices
  - Firmness of access & rules for management of network constraints

# Characteristics of Distribution Networks

- Large number of nodes
- Correlated and uncorrelated set of data at different nodes
- Mesh and Radial Networks
- Possibility of network reconfiguration
- Metering at node-ends
- Aggregation of metered data is challenging
- Transfer of metered data

# Traditional Way Out ?

- Develop benchmarks for actual network
- Characterize distribution service areas/  
customers
- Reduce actual network to small representative  
network



**BENCHMARK NETWORKS**

# Challenges to Benchmark Network Development?

- Data aggregation to develop comprehensive network knowledge base
- Determination & modelling of disaggregation parameters
- Classification of actual feeders into coherent groups
- Construction of representative feeders for each group
- Actual network topology from network diagrams & files
- Evaluation of benchmark networks' compatibility with actual network

# Existing Data Usage from Distribution Systems

- Optimal Operation of Distribution Networks
- Load Profile
- Load Balancing
- Local Energy Balancing
- Distributed Generation Forecasting
- Network Reconfiguration
- Demand Side Responses
- Aggregation of Demand/ DSR
- Reliability Analysis: Utility and Regulatory Perspectives



# Changes in traditional network operation

- Distributed generation
- Distributed storage
- Smart distribution systems
- Fast network reconfiguration
- Time of Use / Real Time Prices
- Distributed LMP based energy pricing
- Smart DSM/DR mechanisms
- Local energy markets

# Data Sources in Distribution Systems

- Meter Data
- Network Data
- Substation Data
- Local Electricity Market
- Local Energy Storage Systems/ Electric Vehicles

# Data Analytic Challenges in Distribution Systems

- Real Time Meters almost non-existent
- Faulty Meter Data
- Three Phase Imbalance Systems
- Cost of installing Smart Meters/ Systems
- High cost-to-return ratio
- Data uncertainty

# Challenges for Network Pricing?

- Providing stable economic signals
- Providing fair economic signals

# Data Analytic based Network Pricing: Future?

- Innovative solutions required for low cost data generation
- Data aggregation methodologies
- Data analytics with domain understanding
- Revisiting distribution network aggregation/  
pricing framework / process

# Network Pricing in Data Driven Systems

- Understanding the impact of short term variations on long term pricing signals
- Balancing between short term and long term pricing signals

# Evolving Network Pricing Mechanisms

- In short term:
  - Customers would be more engaged with their supplier & consumption behavior
- In medium term:
  - Rapidly occurring changes in energy use
  - Extensive range of market options & devices that residential customers may employ to service their energy needs