



# Transmission Studies & PowerWorld Software

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# Agenda

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- ✓ Introduction.
- ✓ Types of transmission studies.
- ✓ Main characteristics.
- ✓ Challenges.
- ✓ Looking forward.
- ✓ Closing remarks.



# Introduction

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- ✓ Paliza Consulting was founded in 2002 with a focus on the emerging LMP/FTR markets in the Midwest ISO region.
- ✓ Transmission customers needed support with their current operations under existing market structures.
- ✓ Paliza Consulting expanded its services to provide operational analysis & transmission studies under current RTO/TP tariffs.



# Introduction

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- ✓ Paliza Consulting customers are located in MISO, MAPP, SPP and Entergy regions.
- ✓ Paliza Consulting has been a customer of Power World software since early 2003 and a user of the following capabilities:
  - ✓ Power flow program.
  - ✓ ATC program.
  - ✓ TDF calculations.
  - ✓ One-line diagrams.



# Transmission Study Types

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- ✓ Power flow based techniques
  - ✓ Can the existing transmission system enable desired delivery from source to sink according to relevant OATT?
  - ✓ If the existing system can not support desired transaction, what are the transmission limits preventing the delivery and how do we fix it?
- ✓ LMP based techniques
  - ✓ Evaluation of transmission congestion



# Power Flow Based Studies

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1. Interconnection studies.
2. System impact studies.
3. Facility studies.
4. Deliverability analysis.
5. ATC studies.
6. Redispatch studies.



# LMP Based Studies

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- ✓ Would there be congestion costs associated with desired deliveries?
- ✓ What are the mechanisms to hedge/mitigate these costs?
  - ✓ FTRs.
  - ✓ Scheduling in the day-ahead market.
  - ✓ Transmission upgrades.



# Main Characteristics

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- ✓ Large size networks (40,000+ buses)
  - ✓ Data management
  - ✓ Model Updates
  - ✓ Long list of contingencies & monitored equipment
- ✓ Transmission Provider (TP) methodology
  - ✓ ATC calculation
  - ✓ Worst case scenarios
  - ✓ Specific rules (counterflow) & TDF cutoffs



# Main Characteristics

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- ✓ Models & Data availability
  - ✓ TP transmission models
  - ✓ OASIS transmission reservations
  - ✓ Transmission service queue
- ✓ System knowledge
  - ✓ Detect invalid limits
  - ✓ Application of operating guides
- ✓ System dynamics
  - ✓ Short-term studies (less than a year)
  - ✓ Long-term studies (beyond a year)



# Challenges

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- ✓ Data compatibility with PSS/E & MUST
  - ✓ Capability to read PTI data
    - ✓ IDEV
    - ✓ Subsystem File
    - ✓ Contingency File....
  - ✓ Model compatibility
    - ✓ Three winding transformers
    - ✓ Treatment of very small impedance branches
    - ✓ Voltage control.....



# Challenges

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- ✓ Benchmarking results with PTI programs
  - ✓ Results are close but sometimes base case flows are different.
  - ✓ Major differences have been detected for contingency cases which do not converge.
  - ✓ TDFs are very close as long as right subsystem is used.



# Challenges

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- ✓ Program flexibility
  - ✓ Minimize work around.
  - ✓ Gain efficiency.
- ✓ Aid in comparing results
  - ✓ To detect incremental violations.
  - ✓ Violations above a TDF cut-off.
- ✓ Graphical presentation of results
  - ✓ One-line diagrams.
  - ✓ Bubble diagrams.
  - ✓ Flowgate representation.



# Role of Flowgates

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- ✓ The role of flowgates in the EI operation:
  - ✓ Maintain reliability (NERC TLR).
  - ✓ Compute and post ATC (less than a year).
  - ✓ Sell transmission service (less than a year).
  - ✓ Inter-regional coordination (PJM/MISO/SPP/MAPP).
- ✓ Accordingly, proper modeling of FGs and being able to efficiently process FG data in PW program is important.



# Looking Forward

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- ✓ LMP markets are here and expanding!
  - ✓ LMP congestion studies.
  - ✓ FTR studies.
  - ✓ Market power studies.
- ✓ Basic elements for studies.
  - ✓ LMP simulations.
  - ✓ FTR simultaneous feasibility test.
- ✓ System reliability is king!!
  - ✓ Transmission will play a key role.
  - ✓ Transmission planning & upgrades.



# Closing Remarks

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- ✓ Interesting & challenging times in the transmission business.
- ✓ Need robust, reliable, full-featured & inexpensive tools.
- ✓ Overall, we are pleased with Power World software performance.
  - ✓ Great customer service.
- ✓ Would like to see Power World team developing applications for LMP/FTR markets.



# Q & A

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