Energy Storage Prospects of an Independent System Operator

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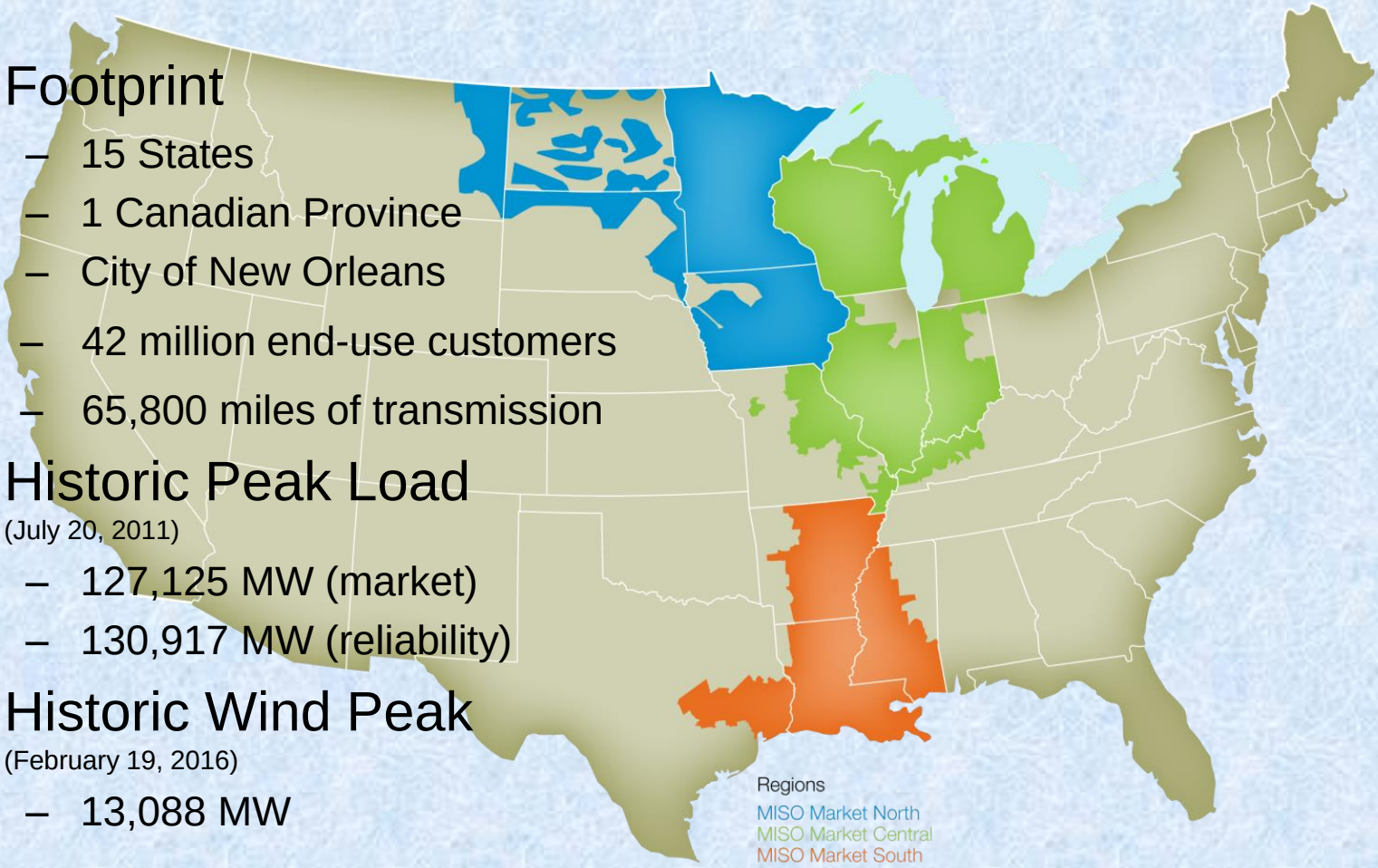
MISO Introduction

MISO is part of North American ISO/RTOs

Scope of Operations

- Footprint
  - 15 States
  - 1 Canadian Province
  - City of New Orleans
  - 42 million end-use customers
  - 65,800 miles of transmission
- Historic Peak Load
  (July 20, 2011)
  - 127,125 MW (market)
  - 130,917 MW (reliability)
- Historic Wind Peak
  (February 19, 2016)
  - 13,088 MW



Market Opportunities

Why is Energy Storage a “Hot Topic”?

- Federal Energy Regulatory Commission (FERC) Notice of Proposed Rulemaking (NOPR) on Energy Storage Resources
- Storage can be combined with renewables
- State storage mandates
- Industry events
- Economics- Battery prices are dropping
- Enabling markets such as electric vehicles
- Commercial & Industrial scale “behind the meter” motivations to reduce peak demand charge

Energy Storage Opportunities for Finnish Companies in Minnesota/MISO

- Partnership with Minnesota utilities is key
- These are the areas where Finnish expertise can help:
  - Continued Renewable Integration - Wind, solar (both utility scale and customer sited)
  - Continued demand response and energy efficiency
  - Distributed Generation/Distributed Energy Resources
  - Microgrids
  - Electric Vehicles
  - Peer to Peer exchanges
  - Blockchain technology

Why does Minnesota make sense?

Economic	• MN is one of the most economically forward states in US
Social	• Good mix of diverse cultures with typical rural versus urban divide
Legal	• Framework in place, trust in organizations like Public Utilities Commission, Department of Commerce well placed
Environmental	• MN utilities exceeding Renewable Portfolio Standards targets, talk about 50% renewables by 2030, utility of the future like discussions, recently recognized in the top 5 states in US for grid modernization activities
Technological	• Electrically advancements include High Voltage Direct Current (HVDC) transmission, energy storage, water chiller,
Political	• Stable atmosphere

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