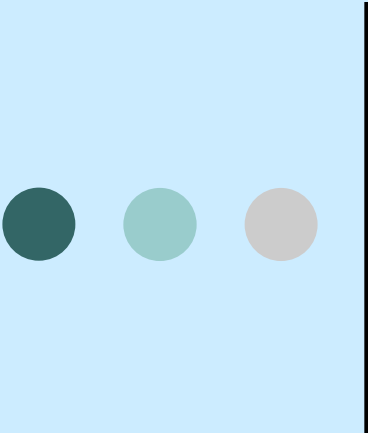




Manitoba Hydro's Export Markets

A. David Cormie P. Eng.
Division Manager Power Sales and Operations
Manitoba Hydro
May 2010



Topics

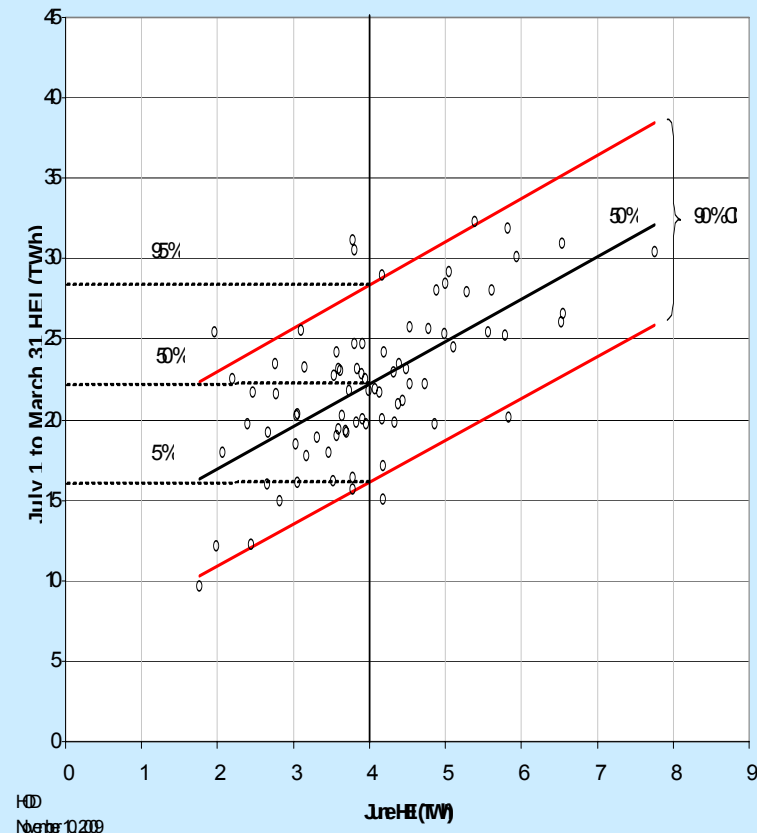
- What is Surplus
- Export Background
- The Border and Loop Flows
- Curtailment Rights, Events and Priority
- Markets
- Merchant Transactions
- Prices, Pricing and Price Example and Volumes Relationships
- Transmission, Transfer Capability, TX Rights
- Manitoba Hydro's Future in the Market



Planning in Uncertainty

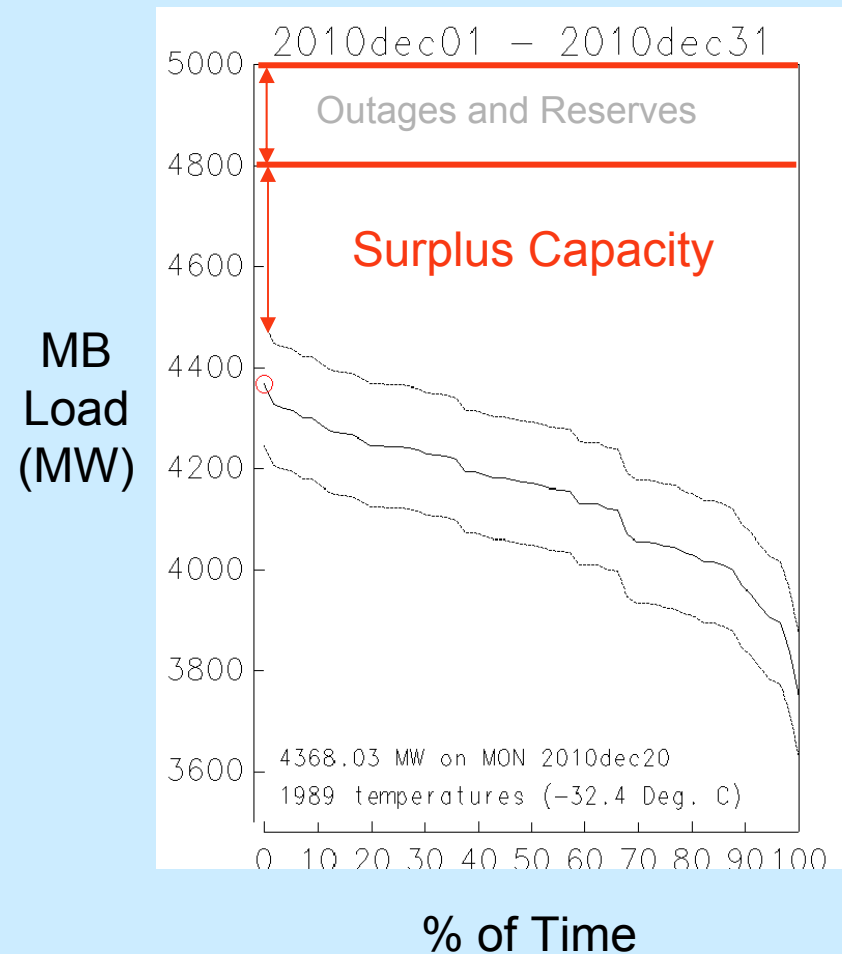
- Accurate long term forecasts are not available
- History is only an indicator
 - Statistics help
- Reliability of Supply
 - Societal costs of power shortages are enormous
 - MH does not rely on its predictive ability
 - Decisions made on the worst case
 - 95%-99% CI
 - Export curtailment rights
- Economics
 - Decisions made on expected outcome
- 3 ● Understand the risks

Water Supply



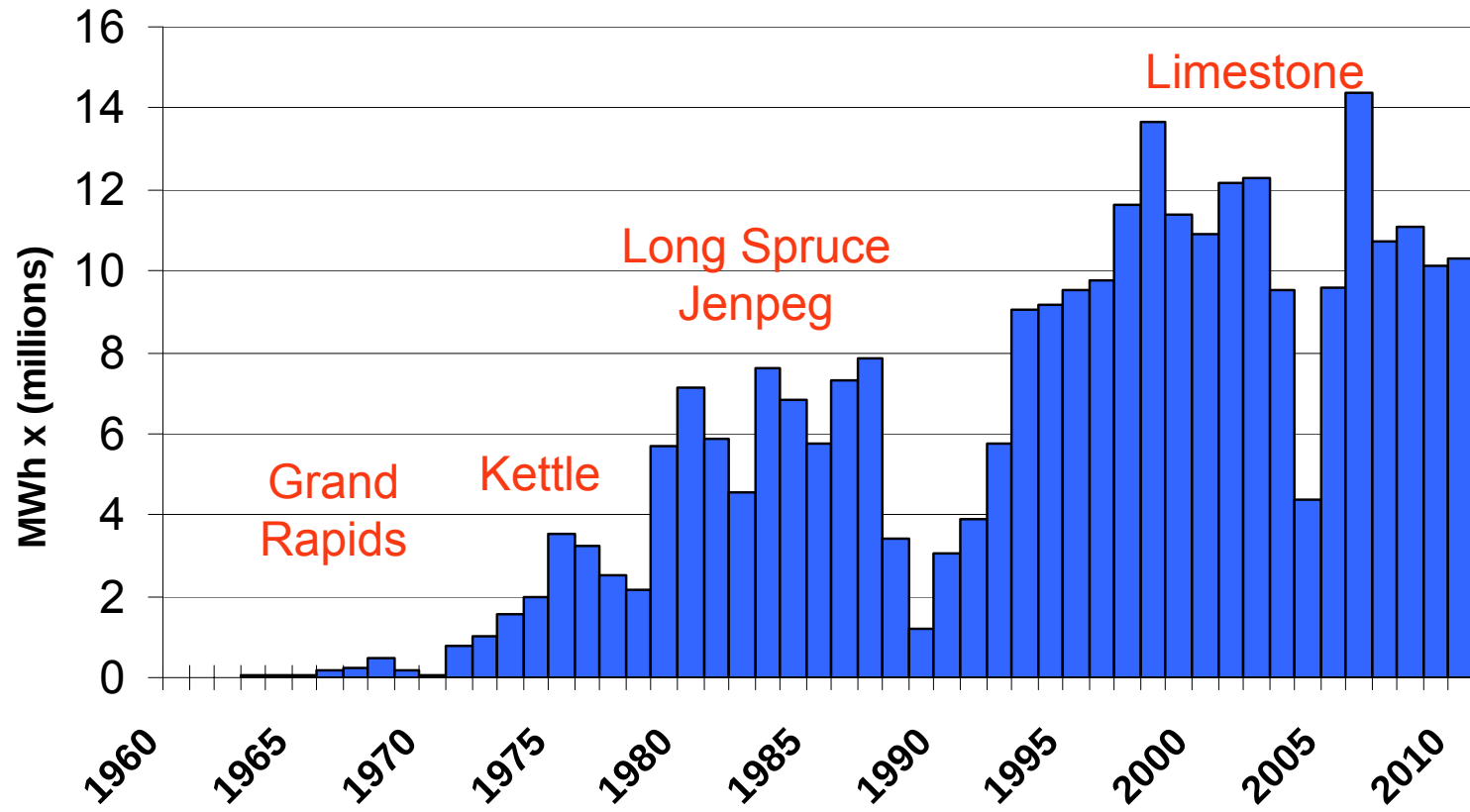
What is Available to Export?

- Surpluses not needed by Manitobans
 - Firm load
 - Energy
 - Capacity
 - Reserves
- All transactions asset backed

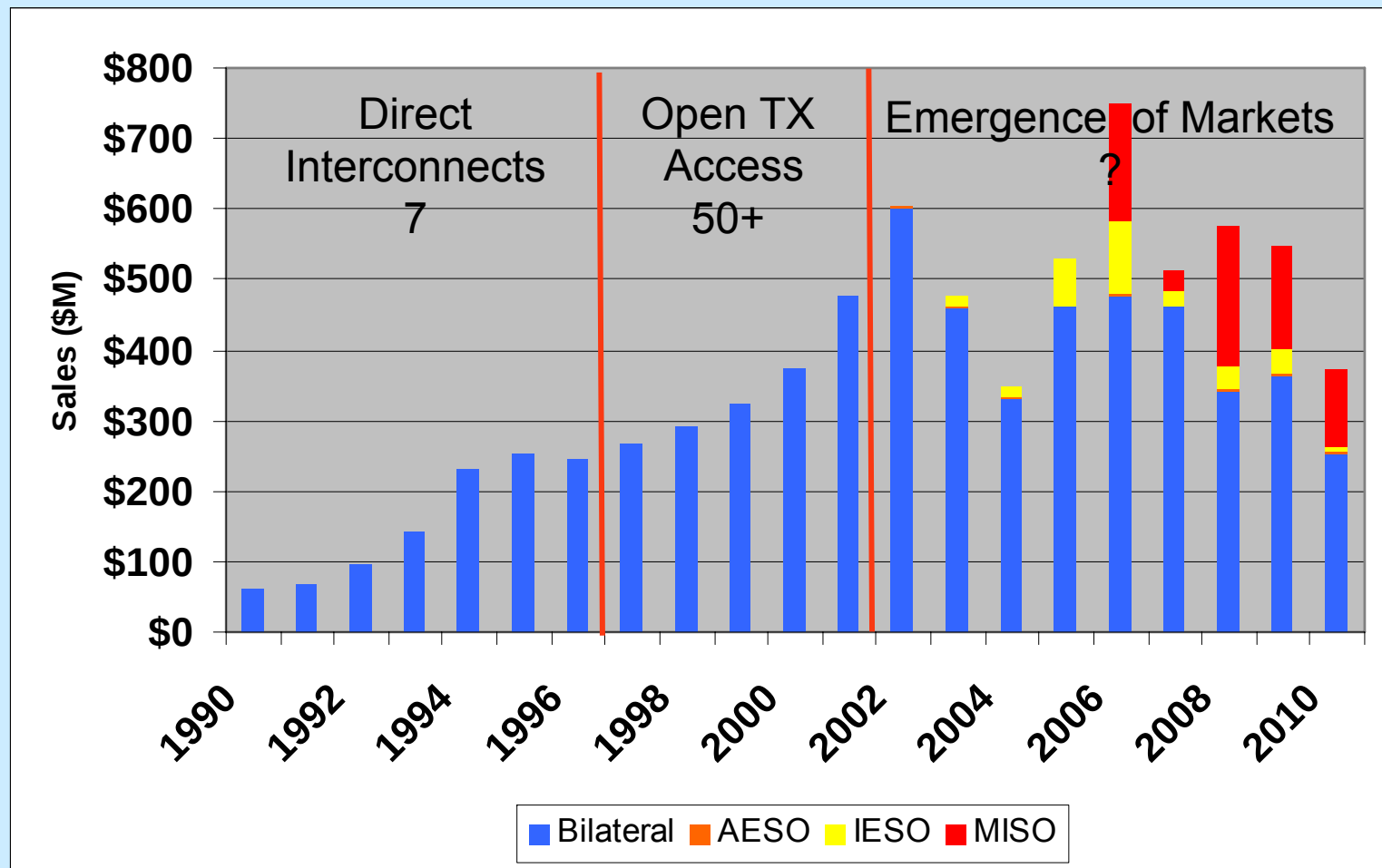


50 Years of Exports

Sales = \$8.5 billion



Changing Nature of Export Market





Export Customers - 2009/10

(millions)

○ Customer A	\$164	40%
○ MISO	\$102	25%
○ IESO	\$ 49	12%
○ Customer B	\$ 23	6%
○ Customer C	\$ 18	4%
○ Customer D	\$ 15	4%
○ Customer E	\$ 8	2%
○ Customer F	\$ 6	1%
○ Others	\$ 17	4%

Markets = 40% But Who?



MH Export Functions

- 1998 Functional Separation
- Transmission System Operations Division
 - Reliability - “Keep the lights on”
 - Operate MH transmission system
 - Dispatch MH generation fleet
 - Provide wholesale non-discriminatory transmission service
- Power Sales and Operations Division
 - MH merchant function
 - Maximize the value of MH surplus assets in the export markets



National Energy Board

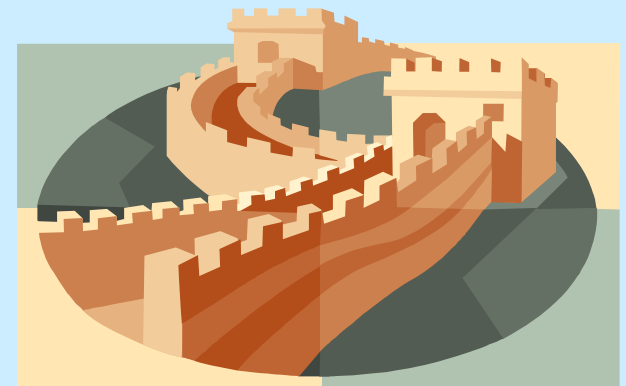
- Regulates MH's export activities to US
- All US exports are licensed
 - General export permits
 - Firm and non-firm
 - Duration less than 5 years
 - Specific sale permits
 - Transmission line licences
- MH reports monthly
 - Energy physically delivered
 - Does not include the portion of sales served from the market
 - Revenues





The Borders

- Title transfers at the border
 - Canada - US
 - Sale of electricity in Canada
 - Not subject to US/state tax law
 - Not subject to US jurisdiction
 - MH does not have Market Based Rate Authority
 - Can't sell at market based rates in US
 - Ontario
 - Saskatchewan
- Meters are deemed to be at the border
 - Compensated

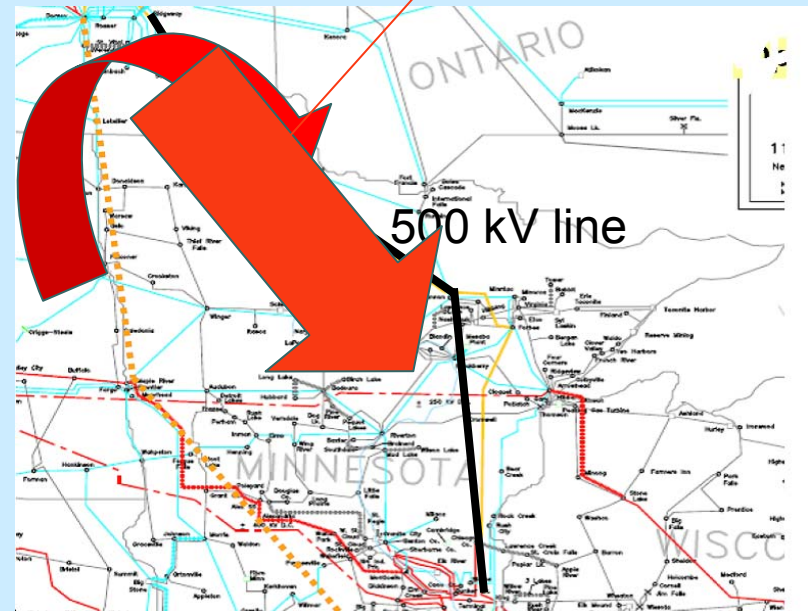




Electricity Flows

- Physical flows
 - MH is electrically connected to the entire Eastern Interconnection
 - Electricity flows over a transmission network
 - It follows path of least resistance
 - Vary second by second
 - MH responsible to control flows in/out MB
 - Metered
 - Includes inadvertent loop flows
- Scheduled flows
 - Includes exports and imports on interface
 - Not just MH transactions
 - Vary hourly
 - Assumed to follow contract path
 - NERC tagged for reliability
 - Cut when necessary by NERC priority
- Financial transactions
 - No effect on power flows

MH-US Interface
MHEX_S
Net flow on
1 x 500 kV
3 x 230 kV





MH Curtailment Rights

- All export sales include the right to physically curtail delivery in order to give Manitoba firm load priority
- Defined in contract
- Corollary: Dependable sale contracts improve the reliability of supply
 - Generation reserved for export sale is ultimately available to serve MB
 - TX lines built for export provide import capability
 - Import lines help in emergencies



Curtailment Events

- Generation

- Forced outages
- Scheduled outages
- Derates
- Loss of HVDC capacity
- Unavailability of purchased power
- Events of Force Majeure

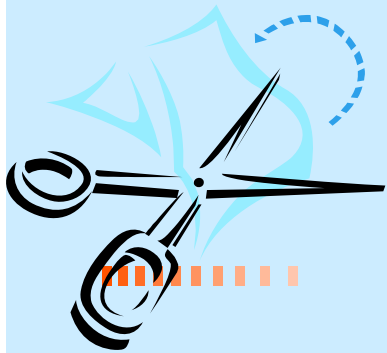
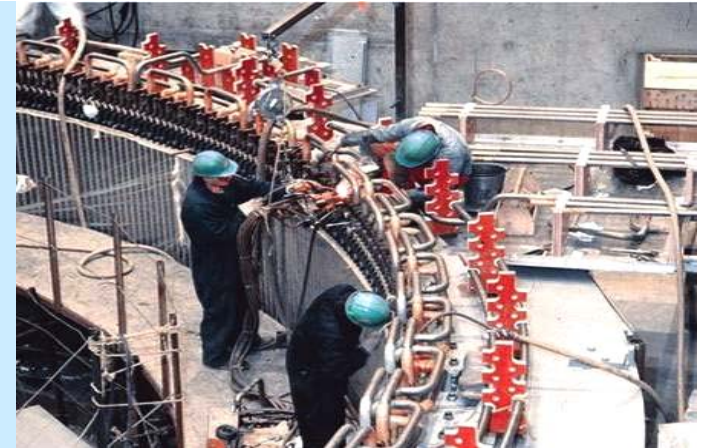
- Transmission

- Loss of Transmission Service





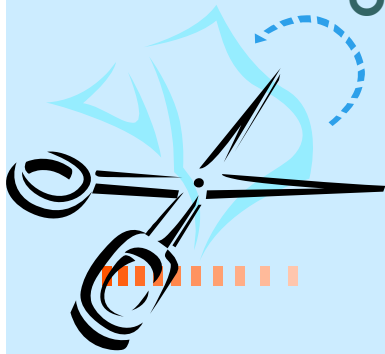
Generation Curtailment Priority



4. MH's firm load
 3. Energy sales backed by planning capacity
 2. Firm energy sales
 1. Other energy sales
- On a prorata basis within a priority group
 - Vintage contracts may vary



Transmission Curtailment Priority



- NERC transmission service priority
 - Firm 7
 - Non firm
 - 6 – network
 - 5 – monthly
 - 4 – weekly
 - 3 – daily
 - 2 – hourly
 - 1 – secondary
- On a prorata basis within a priority group
- Vintage contracts may vary



Generation Curtailments

- MH can only curtail to the extent necessary to serve higher priority sale
- Economics is **not** a reason for curtailment
 - Would destroy the value of fixed price contract
- MH may choose to continue to serve
 - Economics
 - Sale = \$60/MWh Replacement Cost = \$45/MWh
 - Reputation

● ● ● | Curtailment LD Risk

- Liquidated Damages
 - Cost of replacement power
 - Seller pays LD to buyer
- Generation curtailments
 - MH Dependable sales do not include LD provisions
 - Market Sales include LD
 - Most sales are Day Ahead
 - DA trades above Real Time on average
- Transmission curtailments
 - LD risk depends on market rules





System Sales

- Sales from MH resources
 - Asset backed
- Surplus to the needs of Manitobans
- Expectation of net benefit
- Dependable sales
 - Strategic
 - Long term
 - From dependable energy and accredited capacity resources
 - Fixed or market priced
- Opportunity sales
 - All other (long term, term, firm, non-firm, merchant, ancillary services, environmental attributes, etc.)



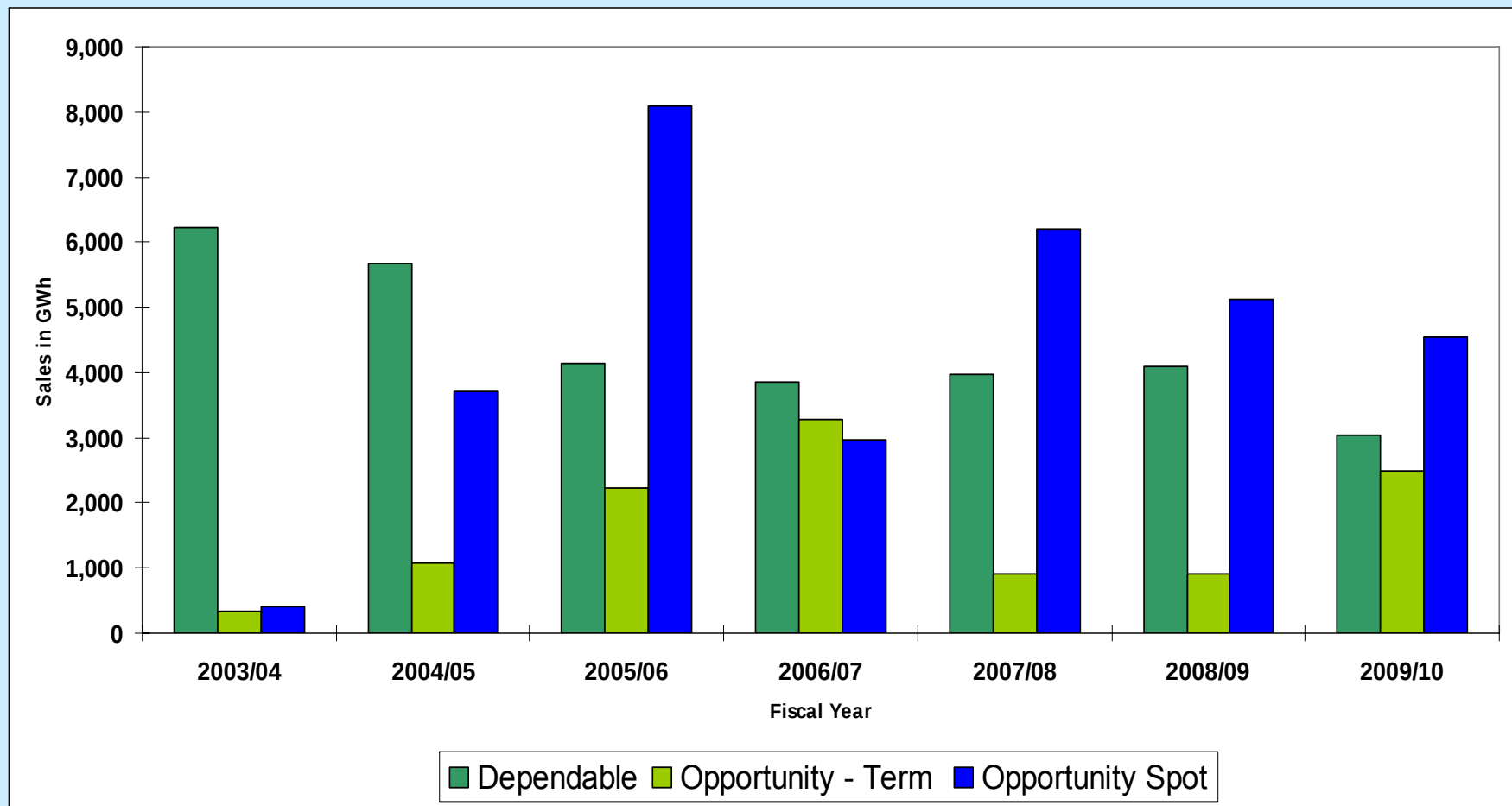
Exports

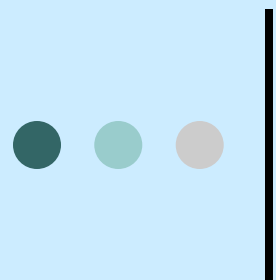
Dependable, Term and Spot

44%

16%

44%





2009/10 Sales

	<u>Millions</u>	<u>GWh</u>
○ Dependable	\$186 (46%)	3,263
○ Merchant	\$ 26 (6%)	775
○ Opportunity		
● Bilateral		
● Term	\$ 59 (15%)	2,594
● Day Ahead	\$ 0.5 (0%)	25
● Real Time	\$ 0.5 (0%)	10
● Market	\$130 (32%)	4,969
○ Total	\$402	11,636

Electricity Markets

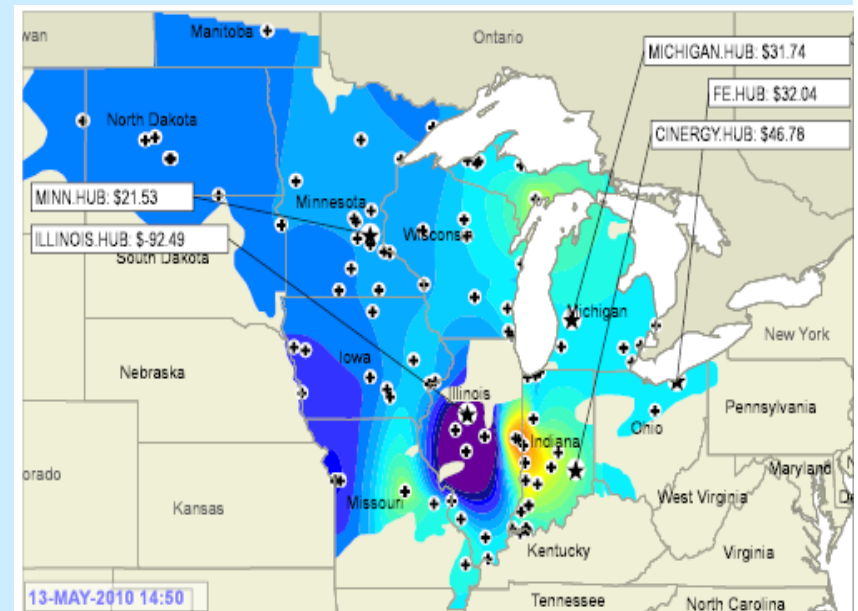
- Centrally dispatched electricity markets
 - many generators in competition
- MH generation and load are outside the markets
- MH is a market participant



MISO

Mid-West Independent System Operator

- 159,000 MW generation
- Locational Marginal Price LMP
 - 2072 pricing nodes
- Day Ahead Financial Market
 - Energy and Ancillary Services
 - MH can set price
 - Hourly pricing
 - Hedging products
 - Clears and Settles DA
- Real Time Physical Market
 - 5 min pricing...paid hourly
 - MH is price taker on energy
 - Deviation from DA subject to penalties
- MH offer in up to 1950 MW





IESO

Ontario Independent Electricity System Operator

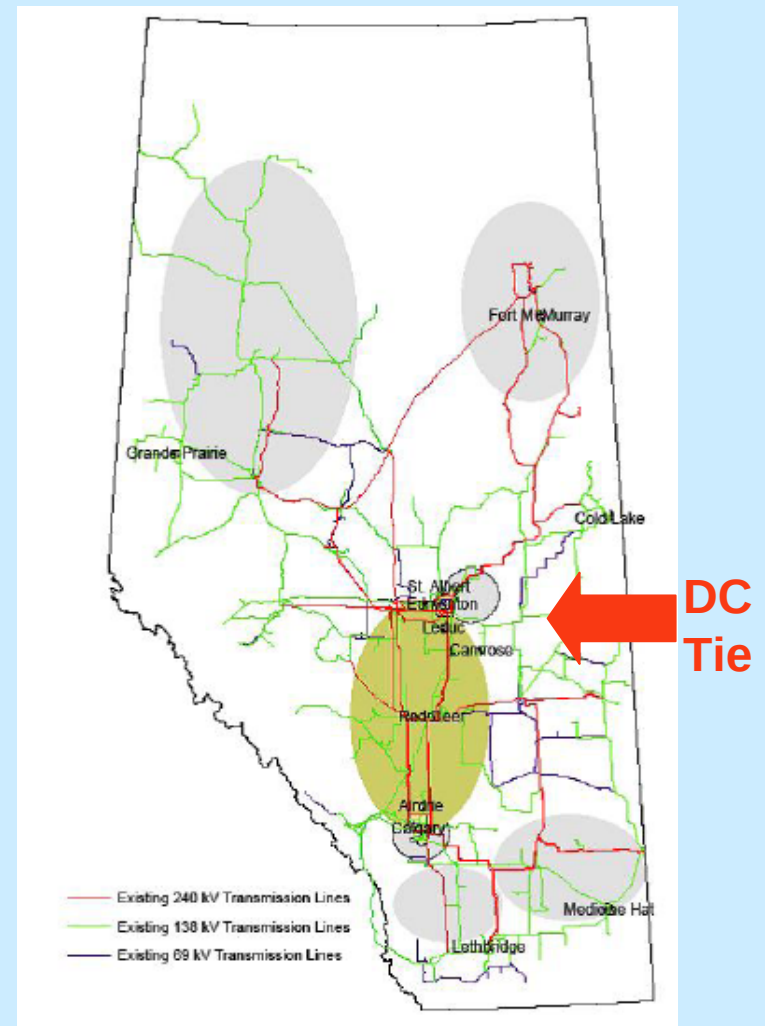
- 38,000 MW
 - 20 power producers
- Real Time Market
 - MH can set price
 - 5 min pricing...paid hourly
 - Hedging products
- CMSC Payments
 - Congestion managed at the border first
 - IESO pays make whole payments
 - \$20 million in 2009/10
- MH can offer in 263 MW



AESO

Alberta Electricity System Operator

- 11,000 MW
- Real Time Market
 - 5 minute pricing
...paid hourly
 - MH is price taker
- Transmission into Alberta from Saskatchewan is limited to 150 MW
- Transmission across Saskatchewan is limited





Sales/Purchase Types

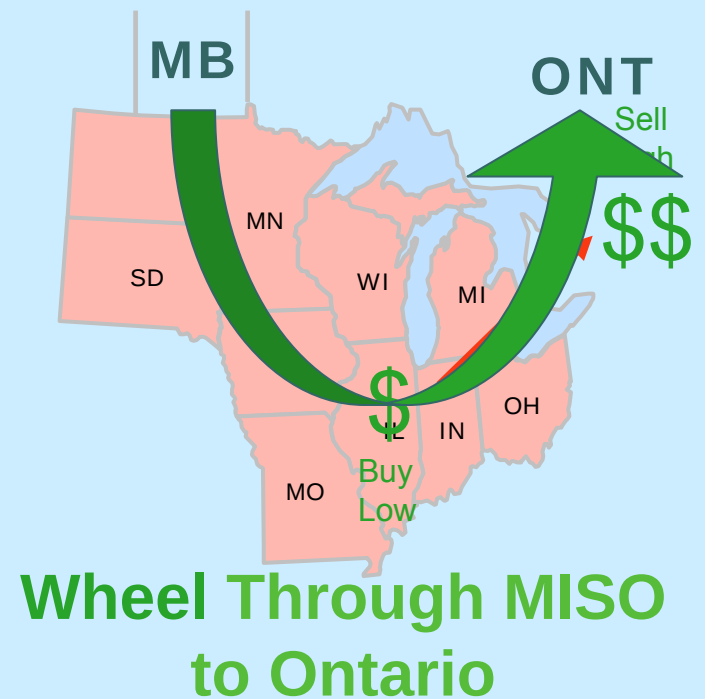
- Dependable
 - Physical
 - Financial
- Opportunity
 - System
 - Bilateral or Term
 - Physical
 - Financial
 - Market
 - Day Ahead
 - Real Time
 - Merchant



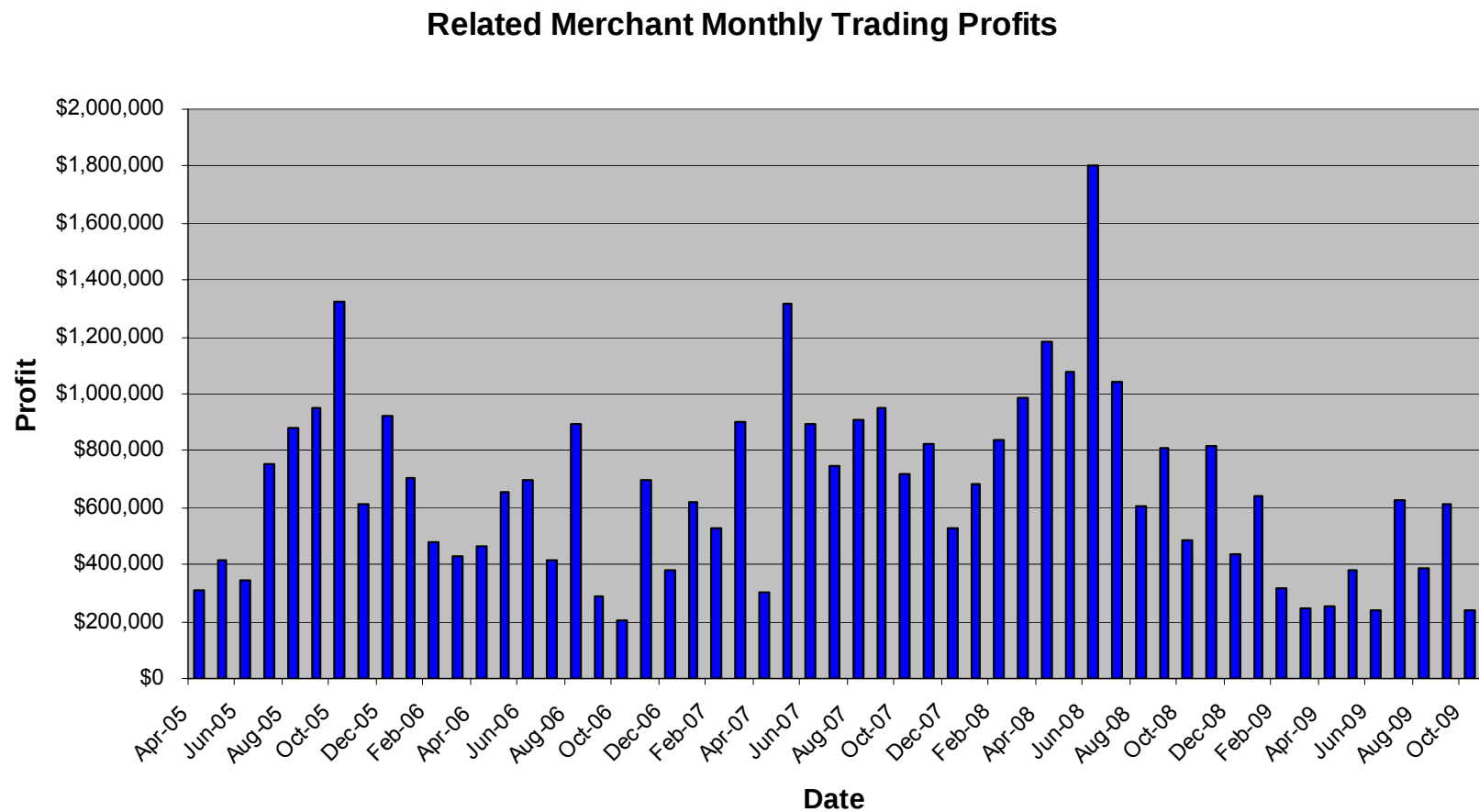


Merchant Transactions

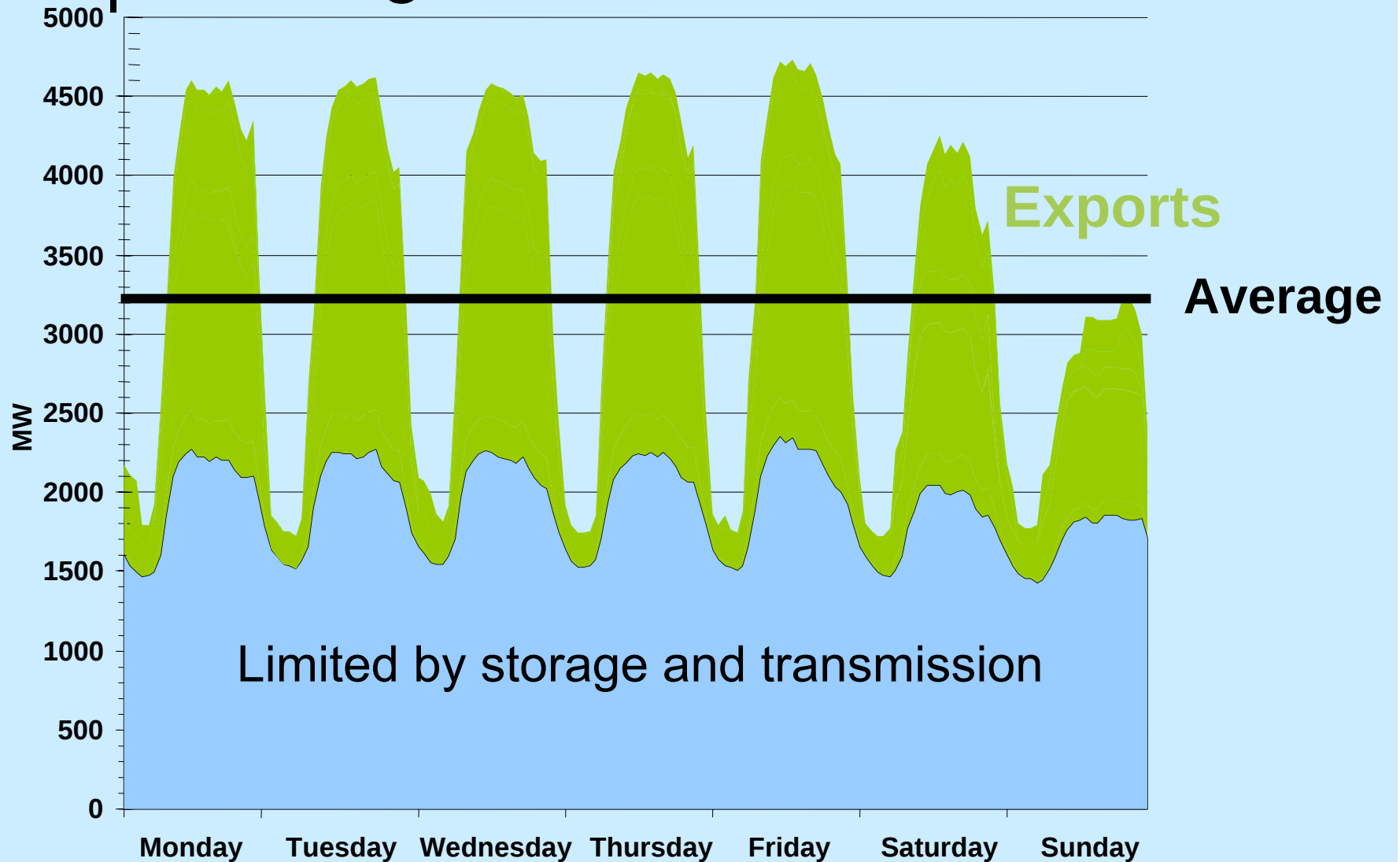
- Arbitrage
 - Off system
 - Buy for immediate resale
 - In markets where MH already has a presence
 - Profits (>2005)
 - Revenues \$44.4 million
 - Expenses \$32.4 million
- Non-Arbitrage
 - Not permitted
 - Speculative



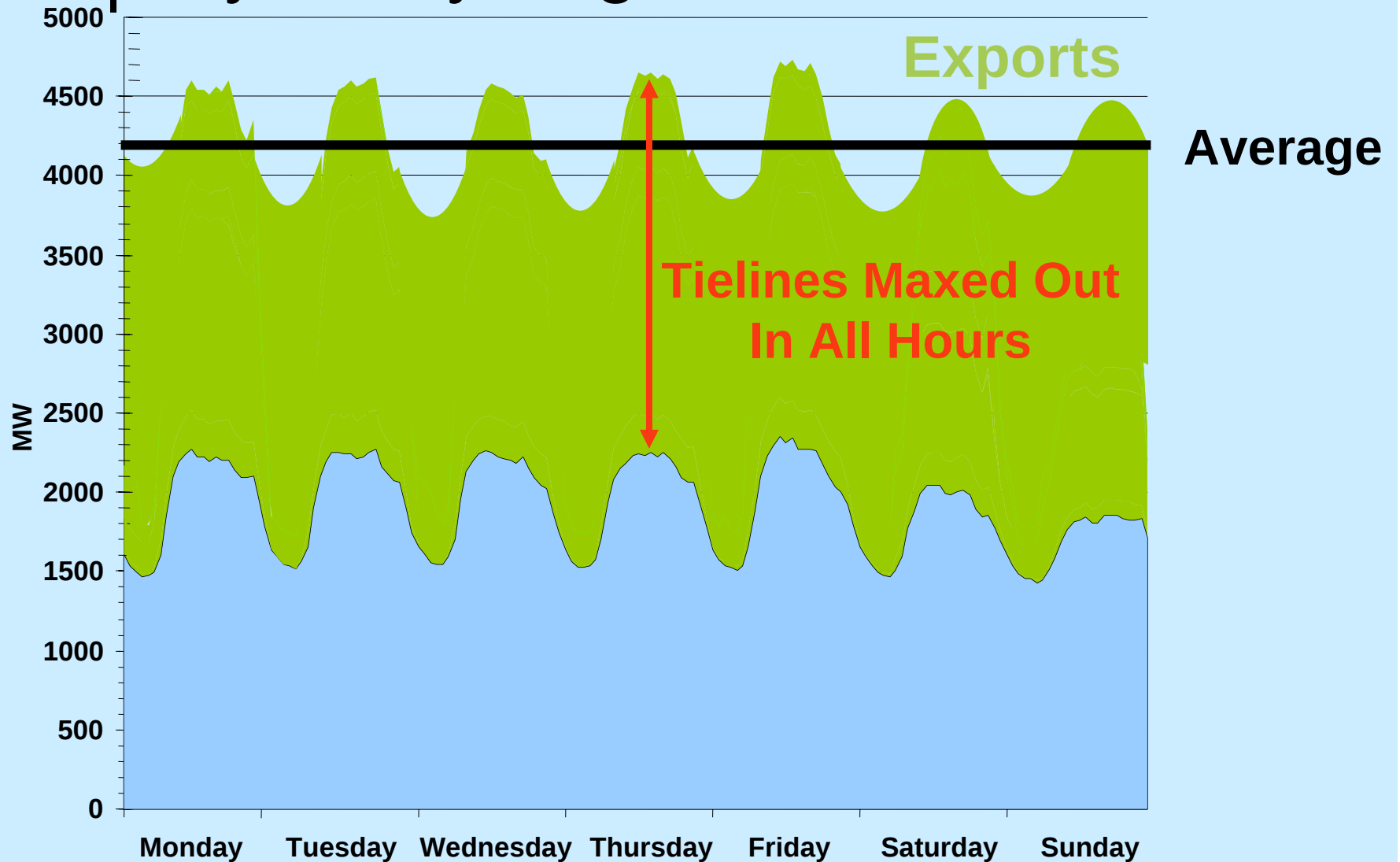
Merchant Transactions Since April 1, 2005



Hydro Can Concentrate Generation into Highest Value Hours

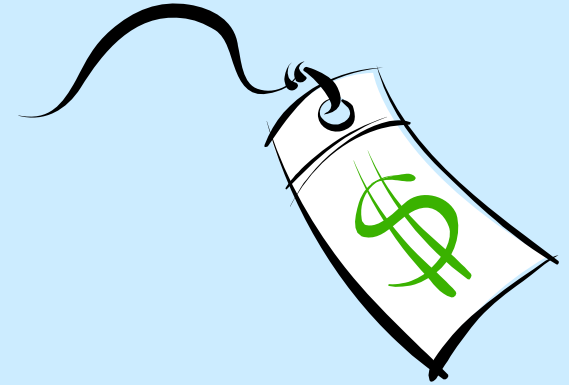


Under High Flows Hydro Cycling Is Limited





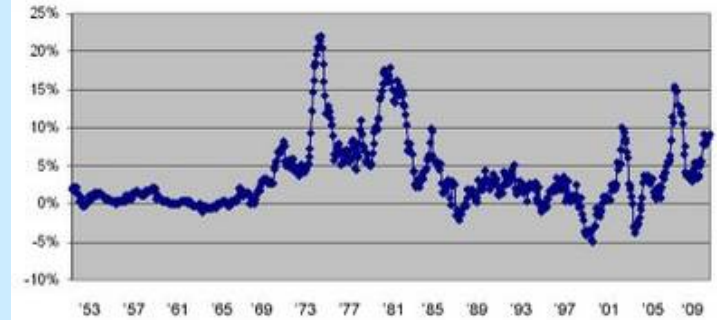
Pricing



- Fixed
 - Long term contracts are indexed to inflation
- Market
 - Day Ahead and Real Time
- Market Traded Term Products
 - 5 x 16
 - 7 x 8
 - Wrap
 - Traded at electricity hubs
 - Minn Hub, Cinergy
 - Liquid

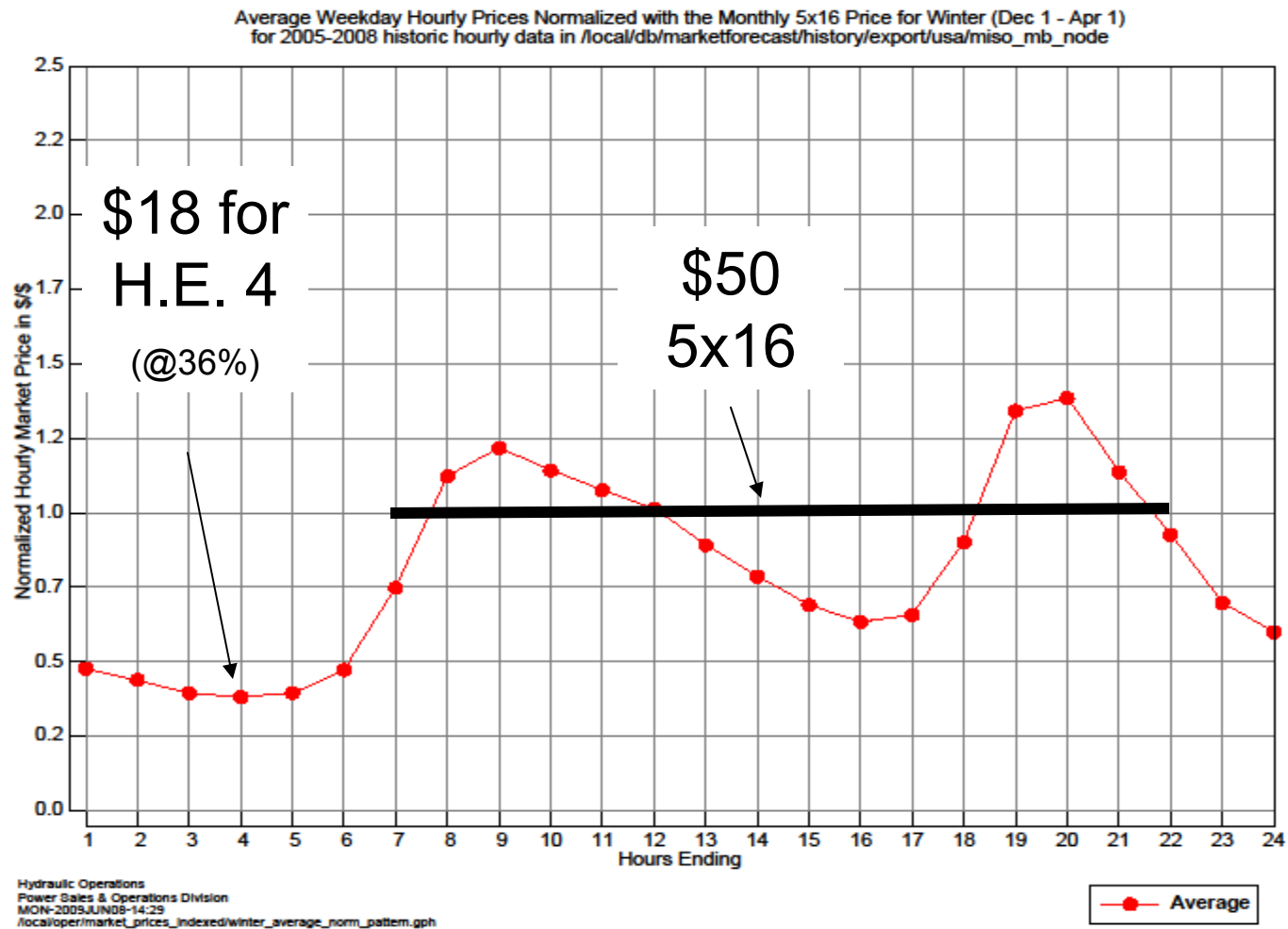


Prices

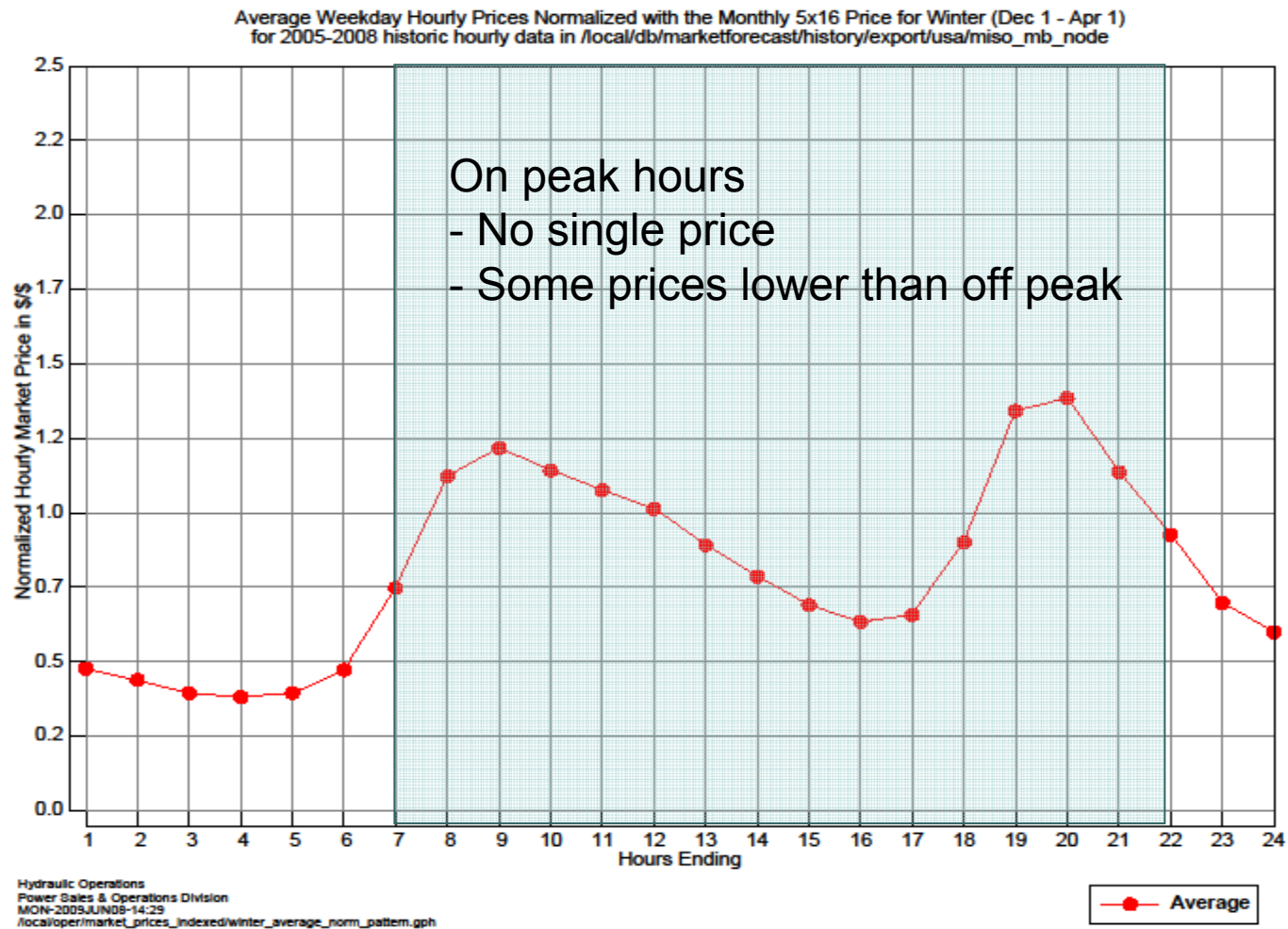


- Locational Marginal Prices reflect the marginal cost of supplying the next MW of load
 - 5 minute prices are aggregated into an hourly price
- Hourly prices follow load pattern
 - Low loads = low prices
 - Low cost generation is run first
 - High loads = high prices
 - High cost generation is run last
- On Peak / Off Peak
 - Averaging periods
 - MH average prices aren't necessarily average market prices
 - Volume weighted

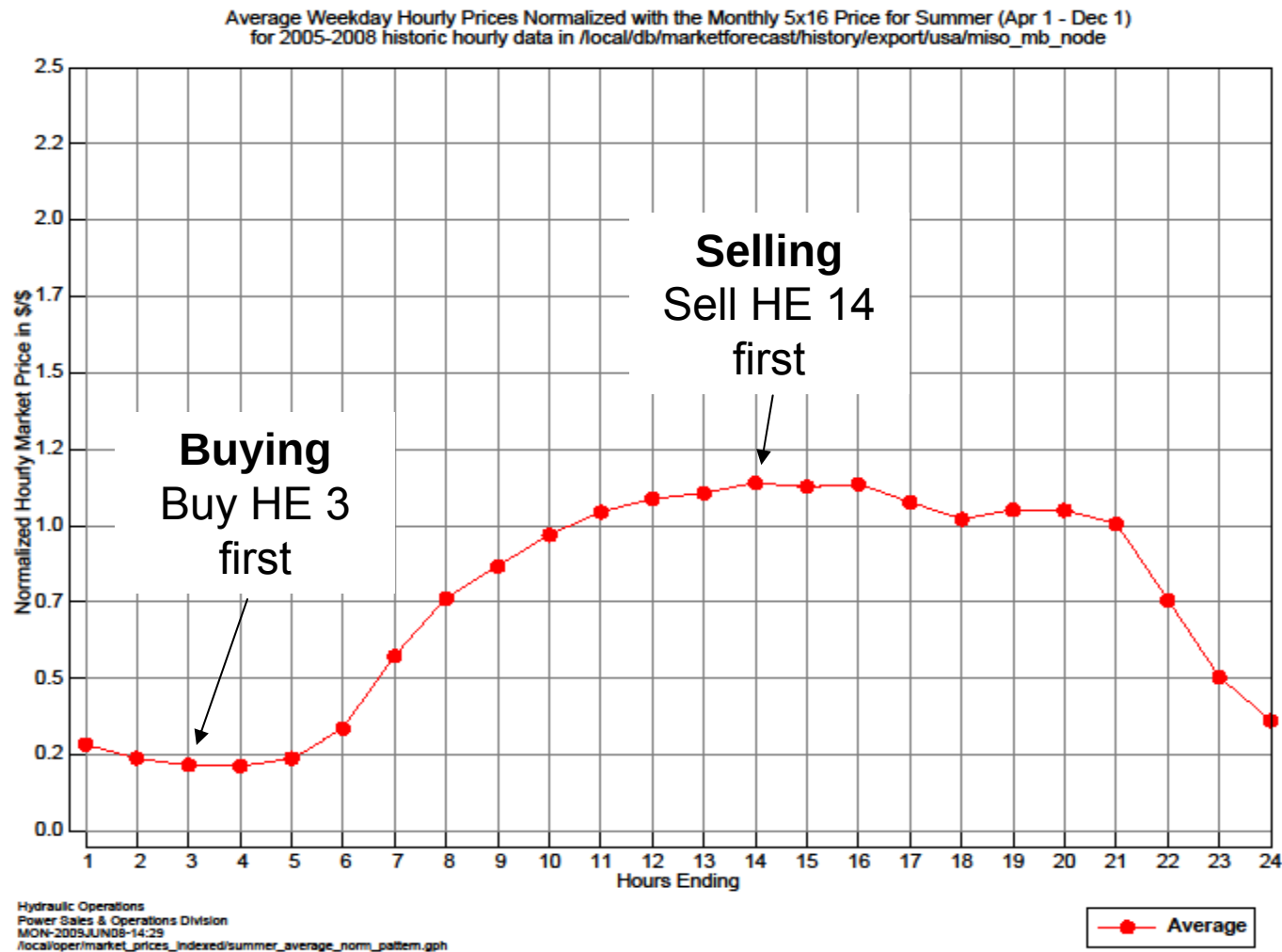
Normalized MISO Market Prices Monday – Friday Winter



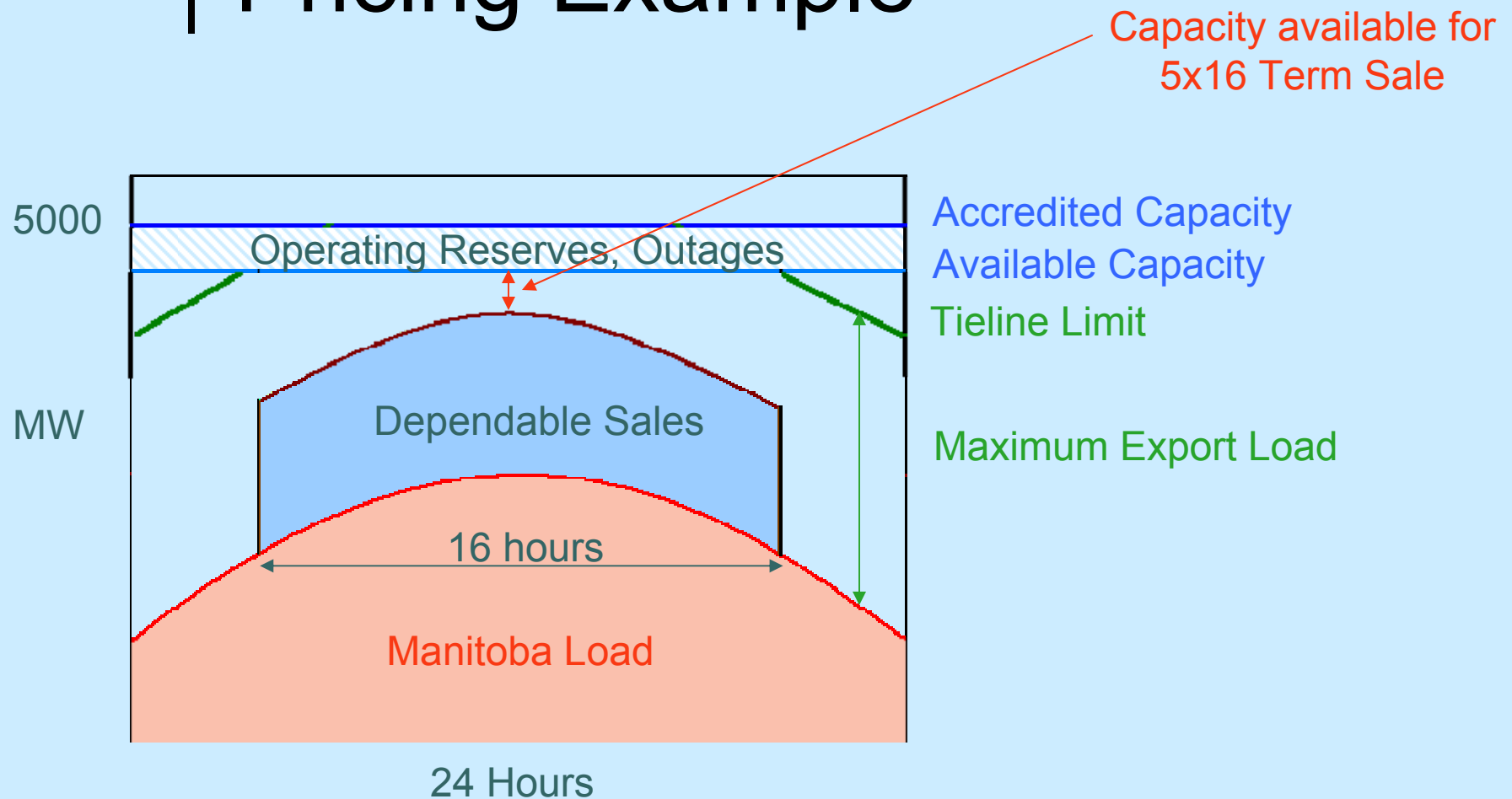
Normalized MISO Market Prices Monday – Friday Winter



Normalized MISO Market Prices Monday – Friday Summer

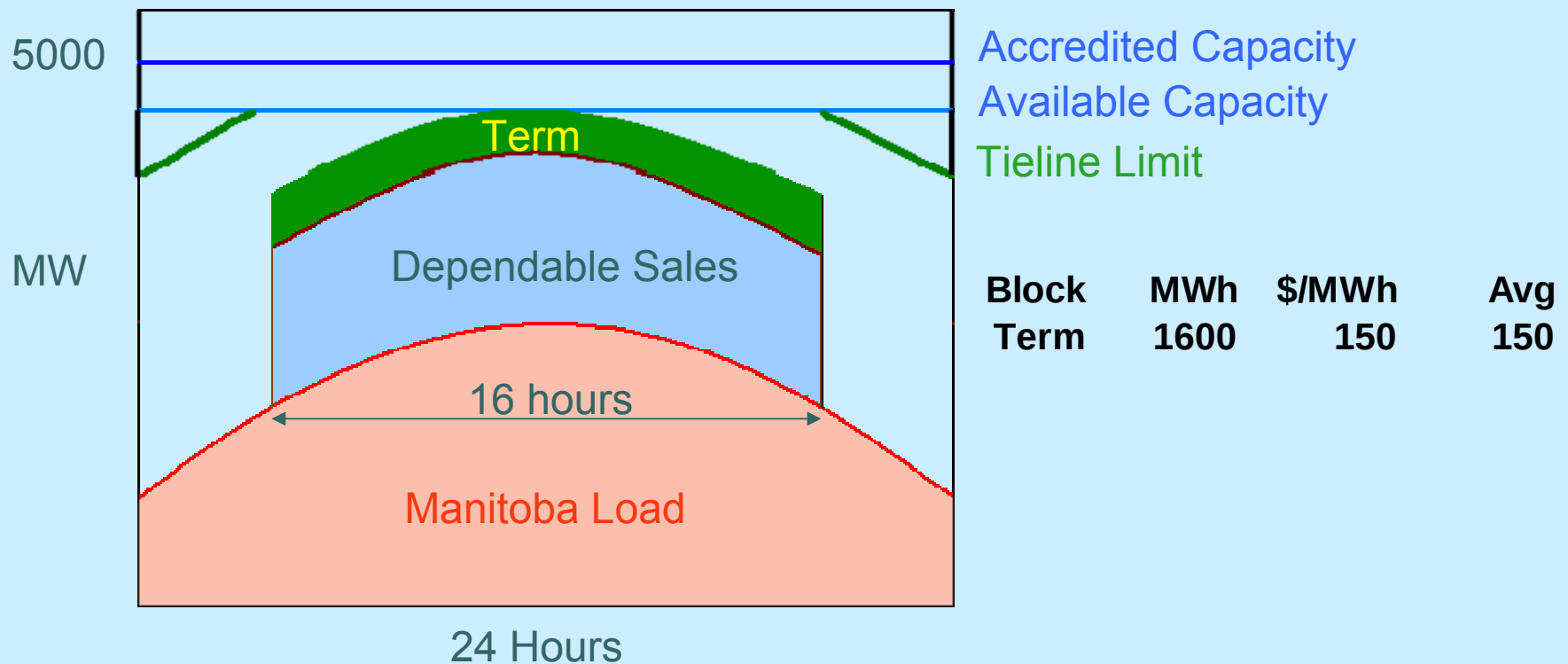


Opportunity Sales Pricing Example

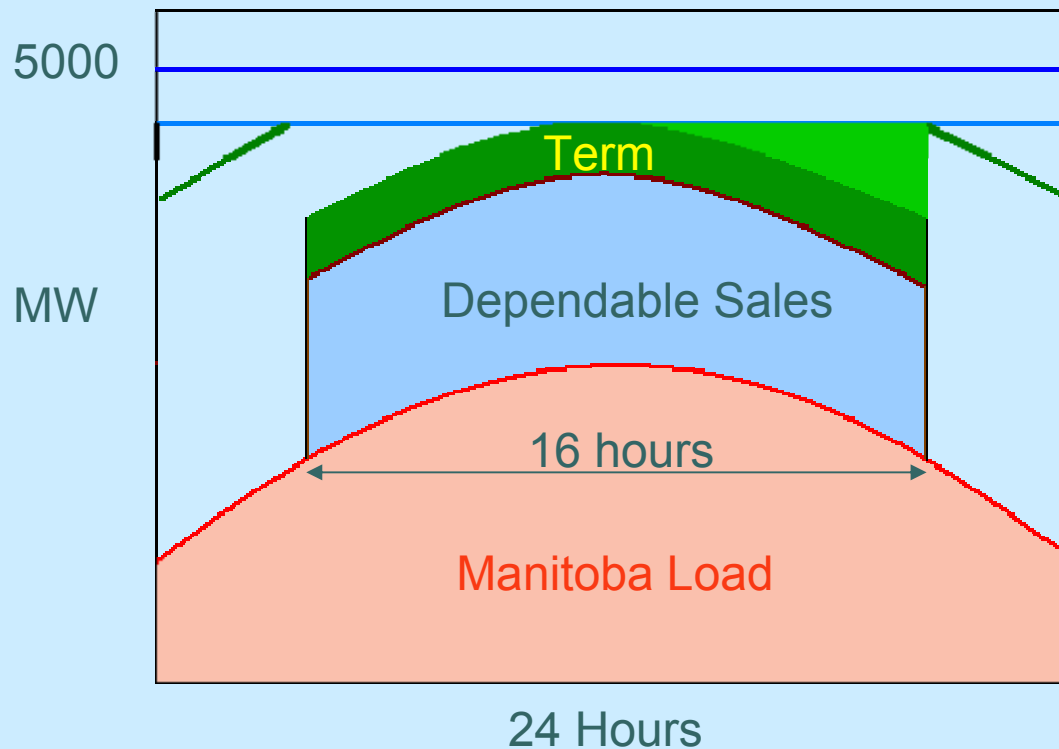


Add 100 MW Bilateral Term Sale

1600 MWh @ \$150/MWh



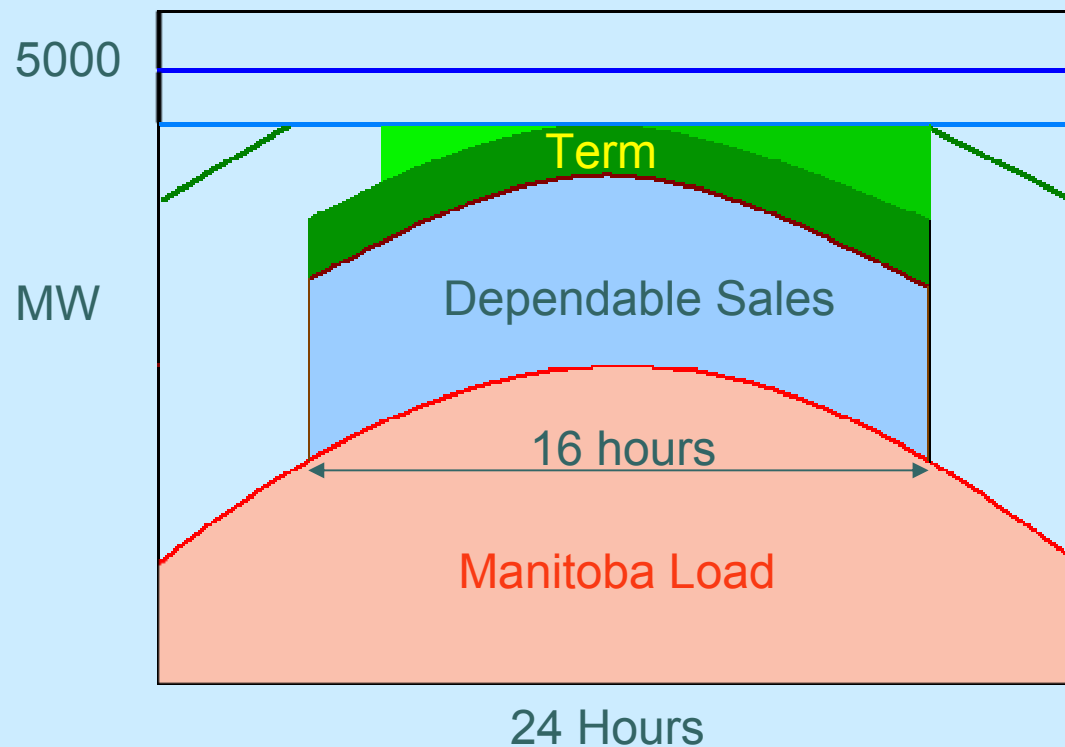
Next Add 600 MWh On Peak Day Ahead Sales @ \$105/MWh



Accredited Capacity
Available Capacity
Tieline Limit

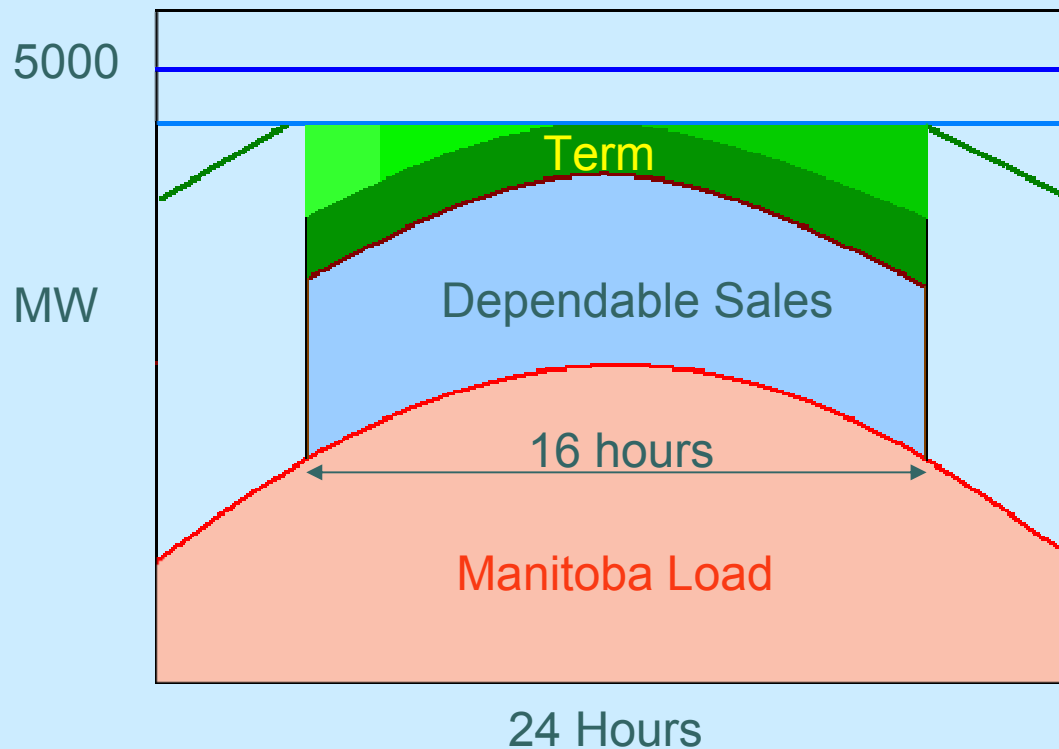
Block	MWh	\$/MWh	Avg
Term	1600	150	150
1	600	105	138

Next Add 240 MWh On Peak Day Ahead Sales @ \$95/MWh



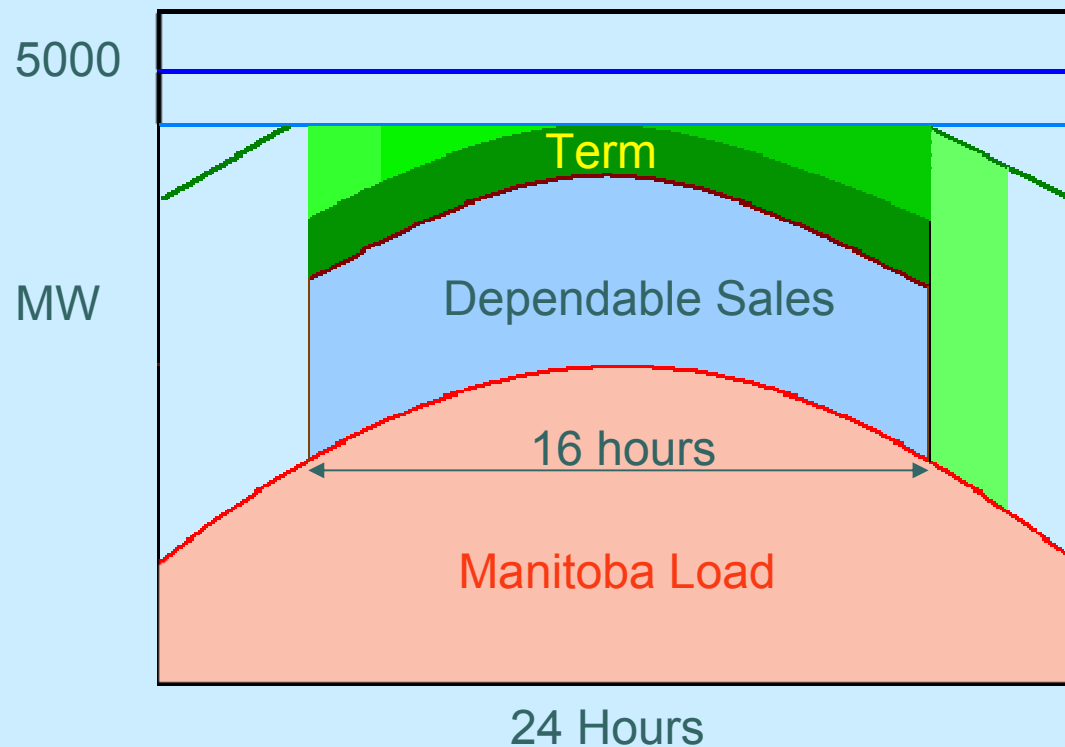
Block	MWh	\$/MWh	Avg
Term	1600	150	150
1	600	105	138
2	240	95	134

Next Add 230 MWh On Peak Day Ahead Sales @ \$55/MWh



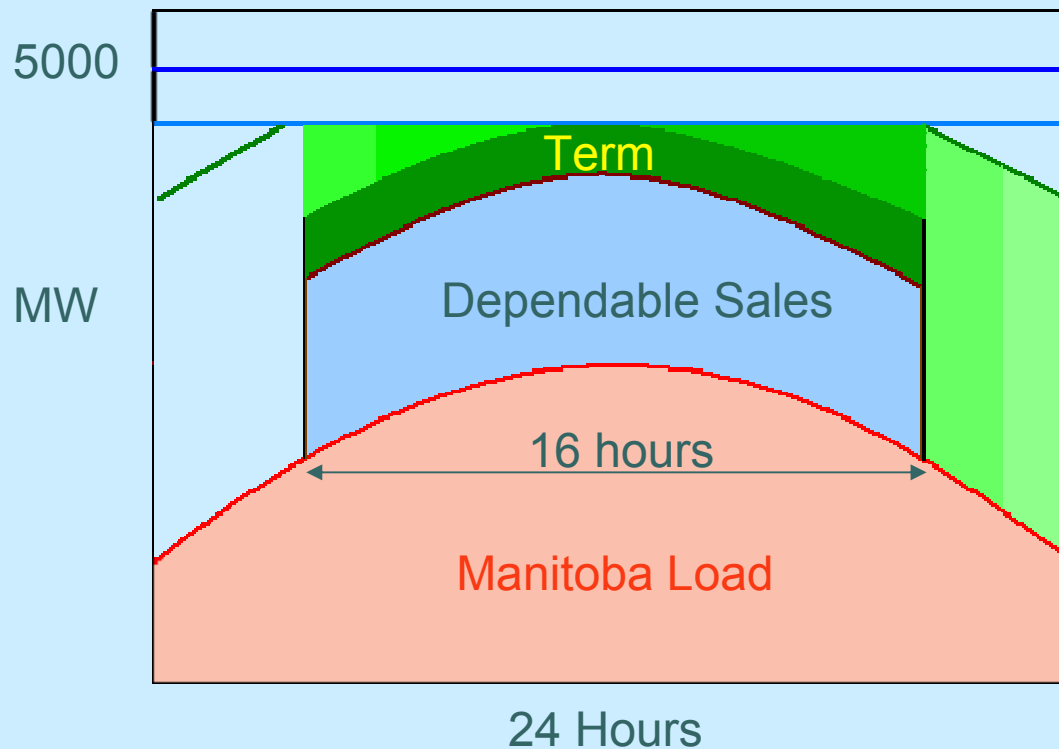
Block	MWh	\$/MWh	Avg
Term	1600	150	150
1	600	105	138
2	240	95	134
3	230	55	127

Next Add 1000 MWh Off Peak Day Ahead Sales @ \$50/MWh



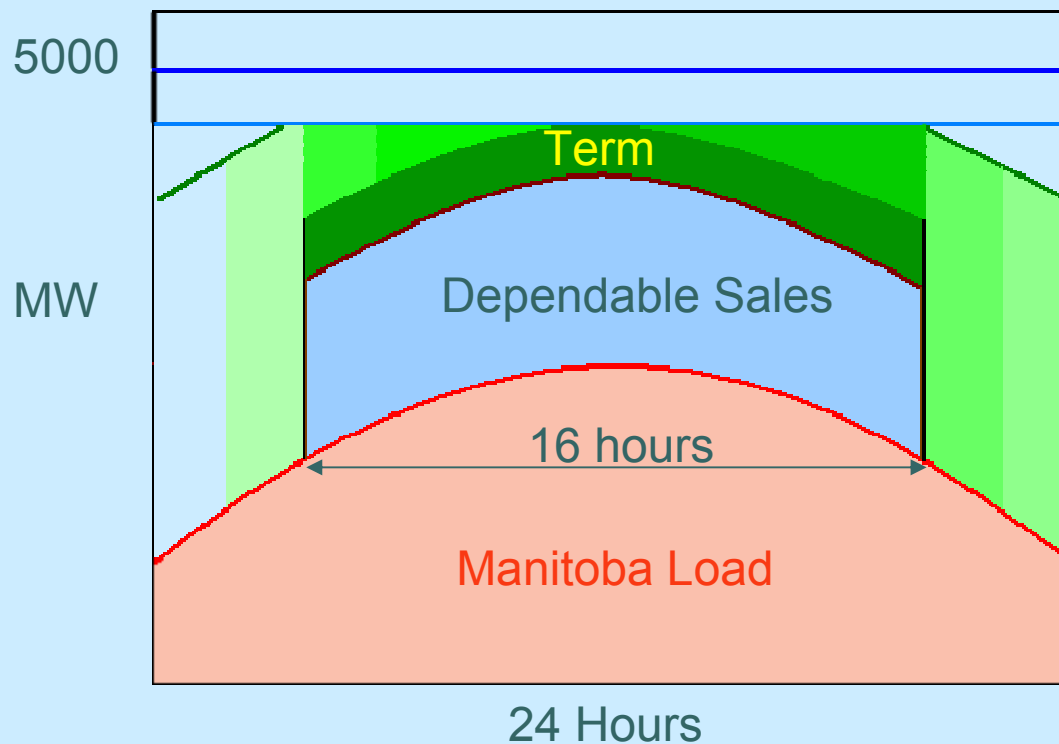
Block	MWh	\$/MWh	Avg
Term	1600	150	150
1	600	105	138
2	240	95	134
3	230	55	127
4	1000	50	106

Next Add 1000 MWh Off Peak Day Ahead Sales @ \$24/MWh



Block	MWh	\$/MWh	Avg
Term	1600	150	150
1	600	105	138
2	240	95	134
3	230	55	127
4	1000	50	106
5	1000	24	88

Next Add 1000 MWh Off Peak Day Ahead Sales @ \$19/MWh

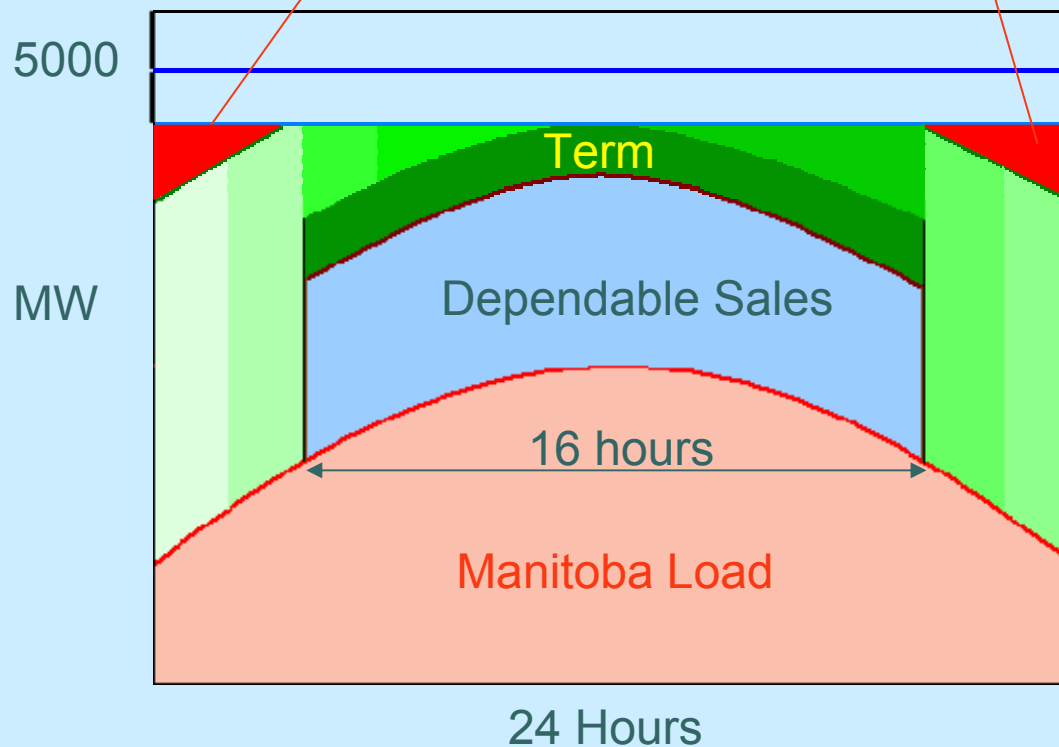


Accredited Capacity
Available Capacity
Tieline Limit

Block	MWh	\$/MWh	Avg
Term	1600	150	150
1	600	105	138
2	240	95	134
3	230	55	127
4	1000	50	106
5	1000	24	88
6	1000	19	76

Lastly Add 1000 MWh Off Peak Day Ahead Sales @ \$18/MWh

Extra Energy Gets Spilled

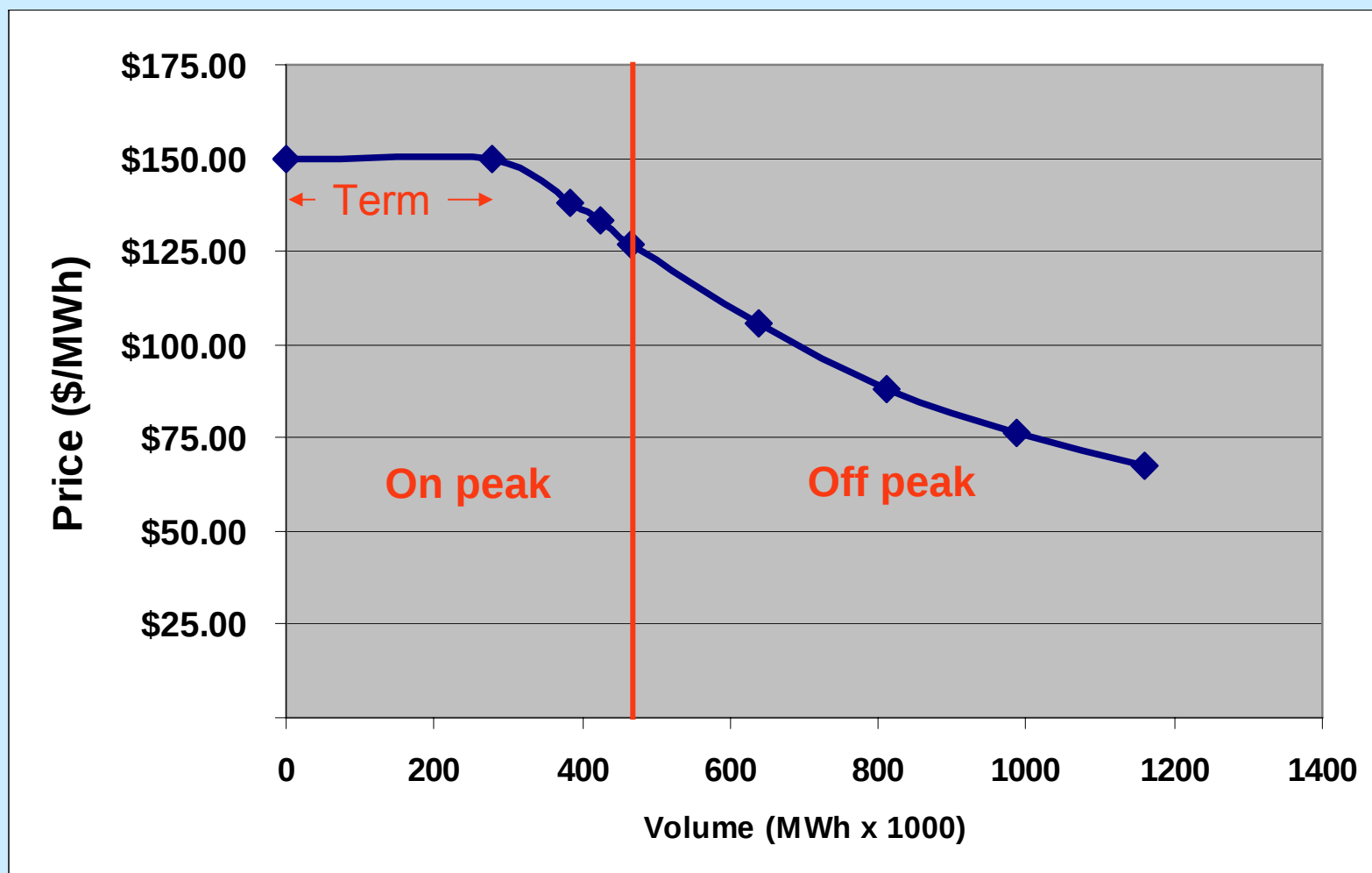


Accredited Capacity
Available Capacity
Tieline Limit

Block	MWh	\$/MWh	Avg
Term	1600	150	150
1	600	105	138
2	240	95	134
3	230	55	127
4	1000	50	106
5	1000	24	88
6	1000	19	76
7	1000	18	67

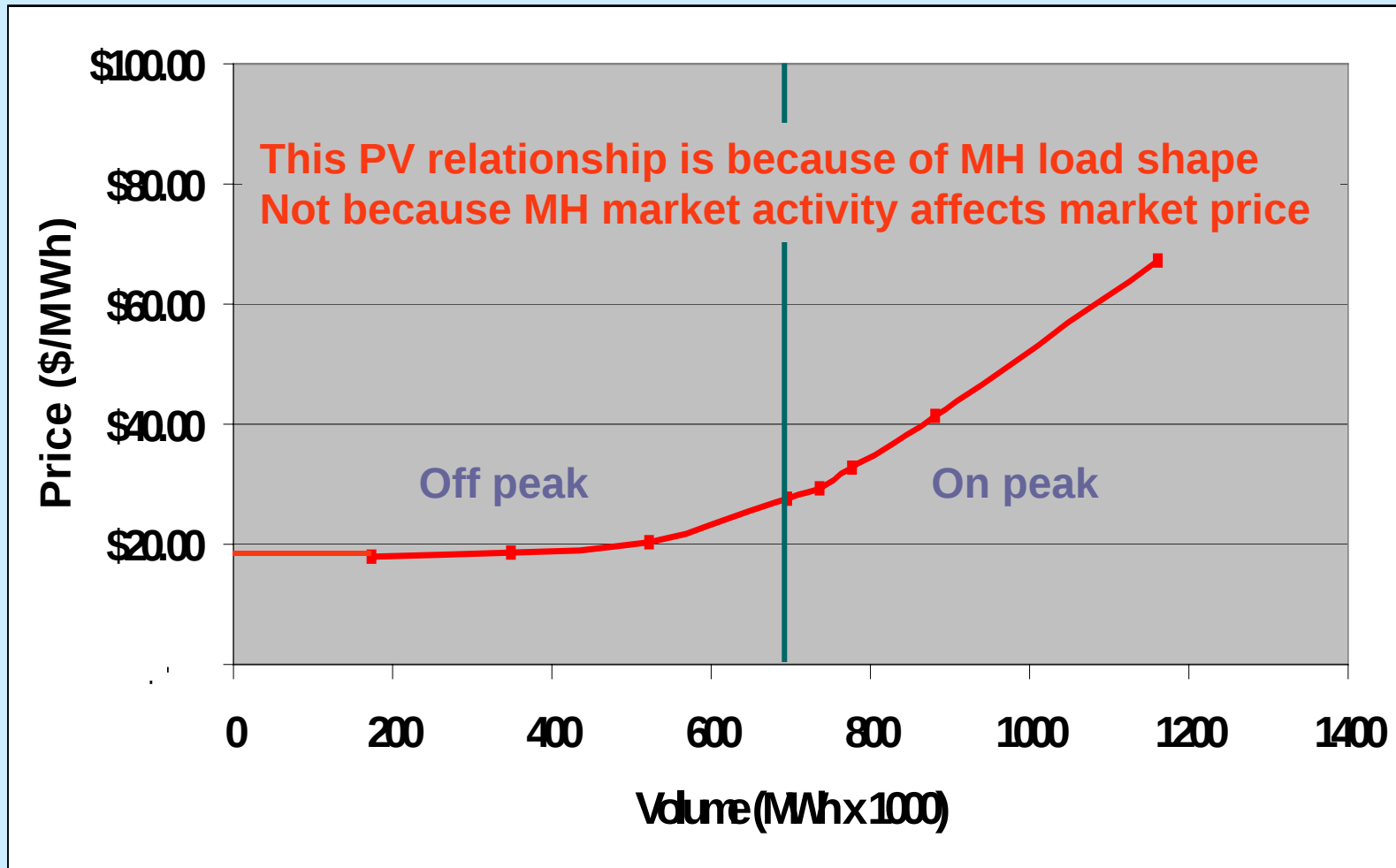
Illustrative MISO Selling Price-Volume Relationship

April - November



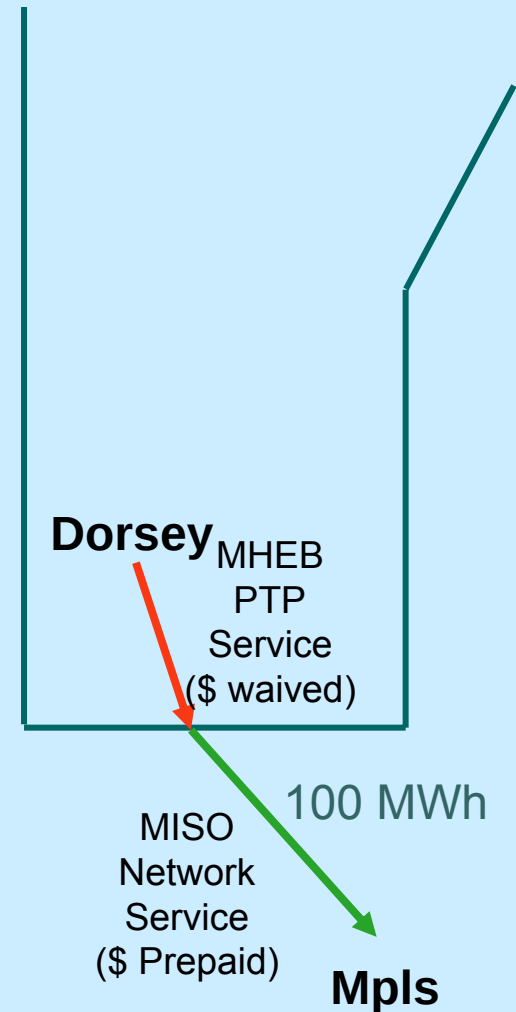
Illustrative MISO Buying Price-Volume Relationship

April - November



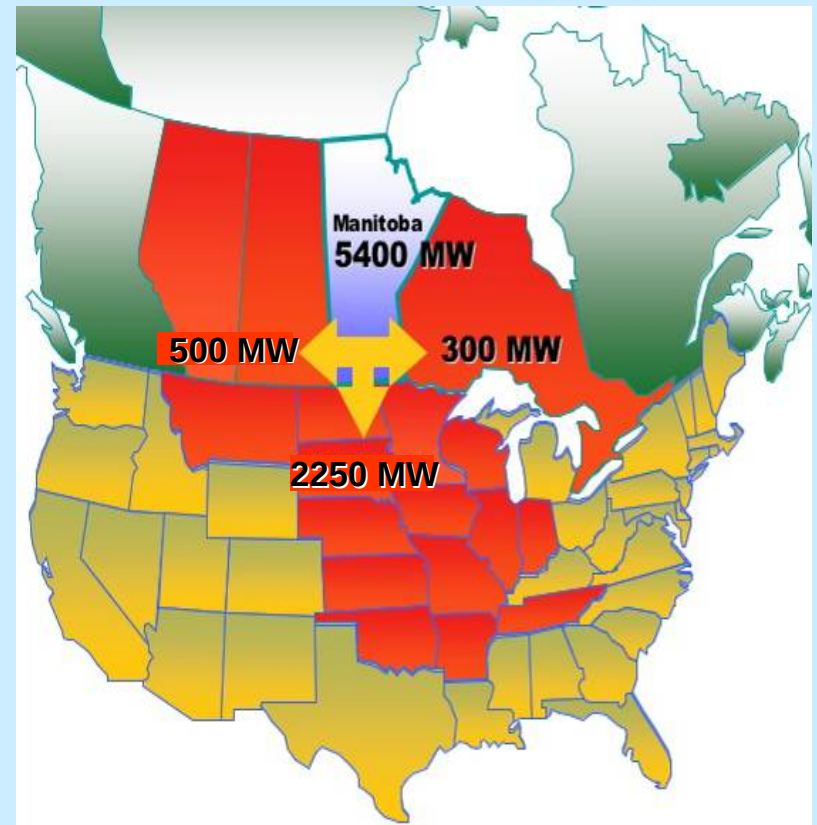
Transmission Service

- Each RTO has Transmission Tariff
 - Network Service
 - Serve network load
 - Point to Point Service
 - Merchant transactions (across SK)
- MH-MISO Coordination Agreement
 - Tariffs
 - MISO waives PTP when sinking in MB
 - MH waives PTP when sinking in MISO
 - Coordinated TX operations
 - Outage scheduling
 - Transfer limits



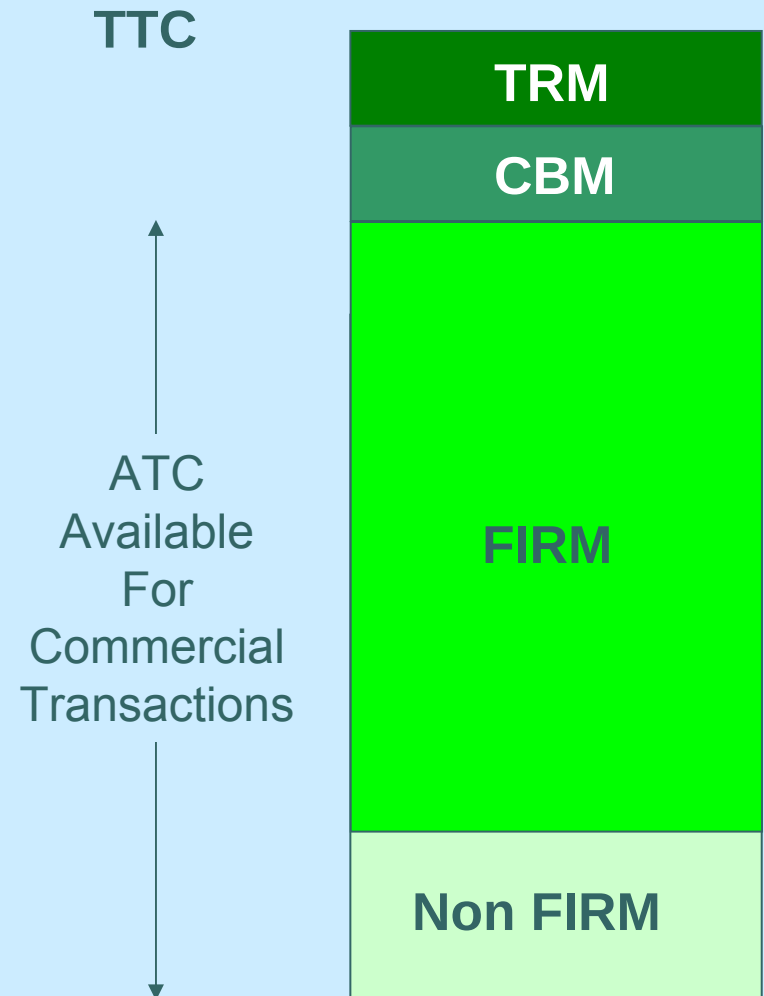
● ● ● | Total Transfer Capability

- Ratings
 - Export/Import
 - On Both Sides
 - May be different
 - Varies Seasonally
 - System Intact



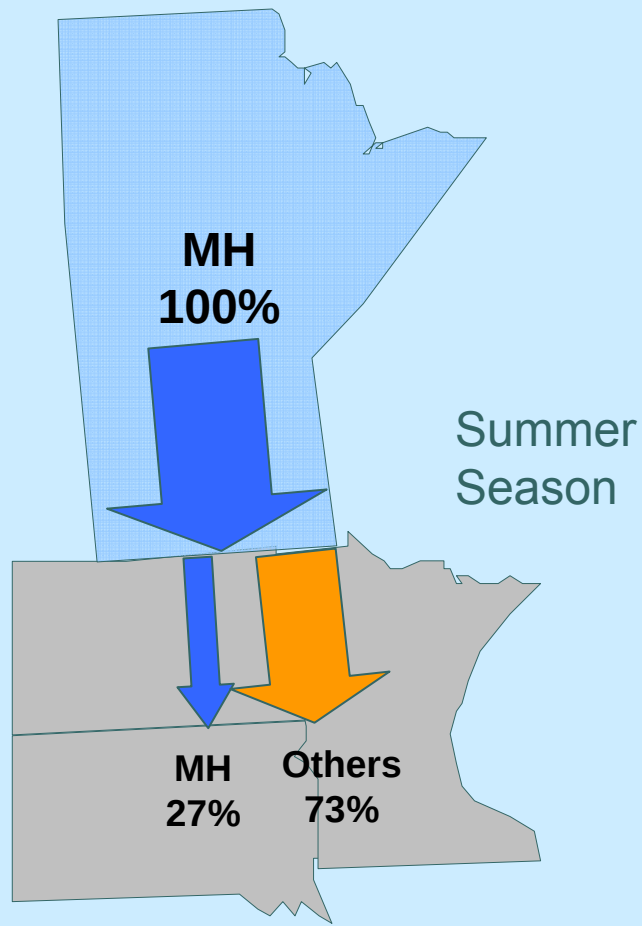
Transmission Physical

- Total Transfer Capability (TTC)
 - Maximum Rated Capacity
- TX Reliability Margins (TRM)
 - Set aside to manage unscheduled flows
- Capacity Benefit Margin (CBM)
 - Set aside to enable delivery of reserves
- Scheduling limits (ATC)
 - $ATC = TTC - TRM - CBM$
 - Firm (7)
 - If unused goes to non-firm
 - Like keys to the car
 - Non-firm (1-6)



Who Controls Transmission?

(Who owns the keys?)

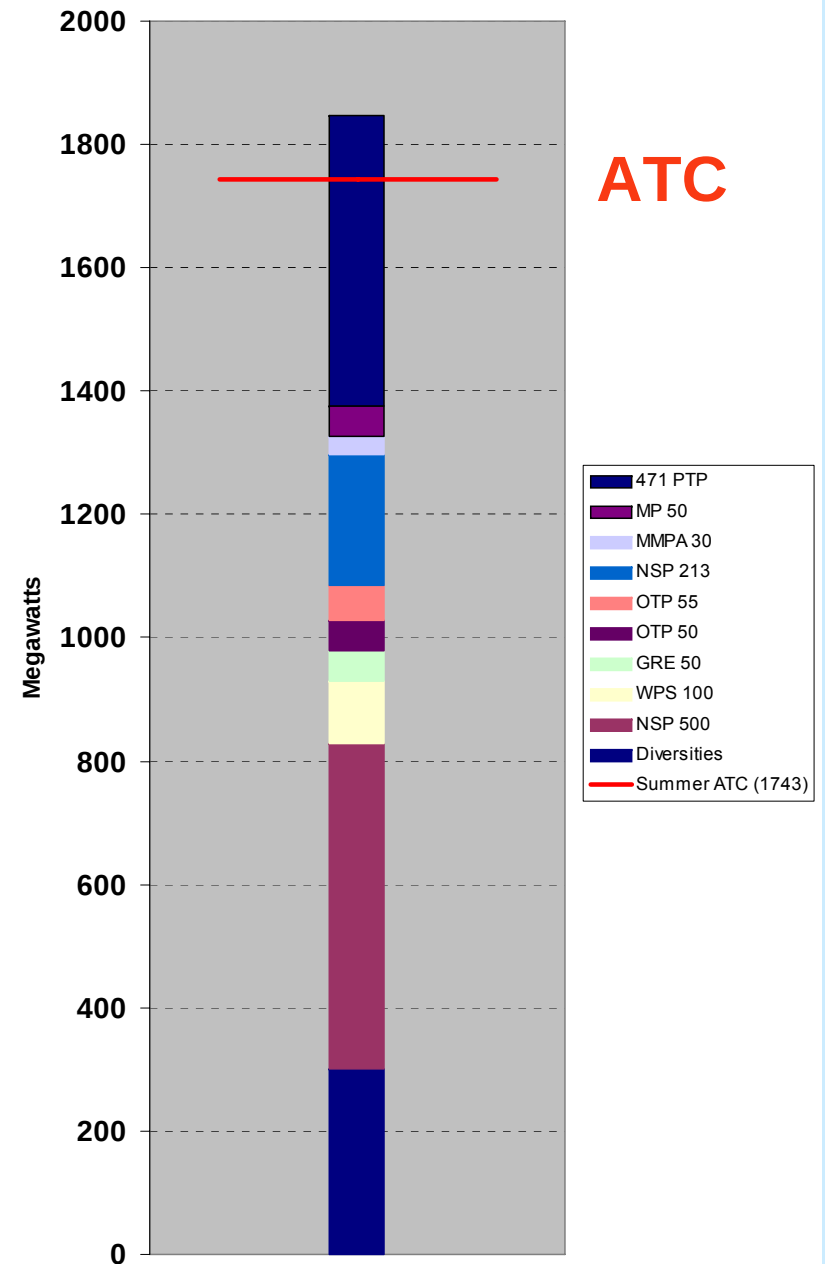


- In Manitoba
 - MH controls 100%
- No load at border
- In US
 - MH controls 27%
 - MH's customers control 73%

US Firm Transmission Reservations

- Holders
 - NSP
 - MH
 - GRE
 - WPS
 - OTP
 - MMPA
 - MP
- Roll Over Rights
- Right to Redirect

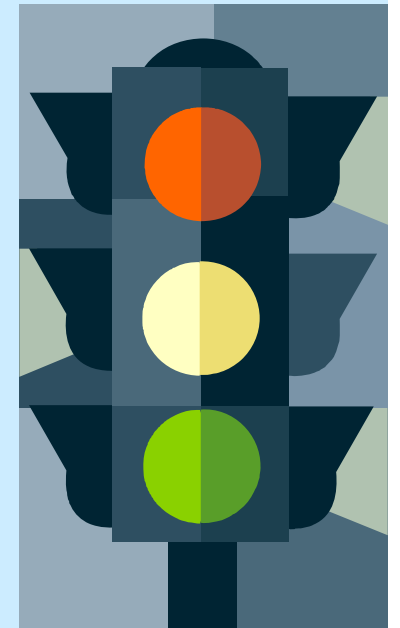
MHEX South Summer





Market Access is...

- Free trade (open borders)
 - No legal impediments
- Being physically connected
 - Having partners willing to invest in TX
 - Having a say in establishing the rules/limits
- Having the right to the transmission
 - Owning the keys
 - Coordinated TX Tariffs
- Non-discriminatory treatment
 - Market rules
 - Economic development policies





Manitoba Hydro is Small

- Relative to other utilities/suppliers
- By itself MH lacks significant influence
 - Outside of markets
 - Market rules are designed for those inside
 - Outside of Manitoba/Canada
 - Public policy is designed for local jurisdictions
- Strategic relationships are important
 - Government to government
 - Industry organizations
 - Customers

Manitoba Hydro is a Preferred Partner

- Highly respected and trusted
 - Shared values
- History of mutually beneficial relationships
- Sells products that provide value
 - Diversity
 - Storage
 - Flexible
 - Renewable





Transmission Is Key

- Manitoba is remote
 - Long transmission lines are required to reach large load centers
- Most of that transmission is outside of Manitoba
- New transmission is
 - Expensive and not built on spec
 - Unpopular
 - Very difficult to permit
- Transmission pays benefits in perpetuity



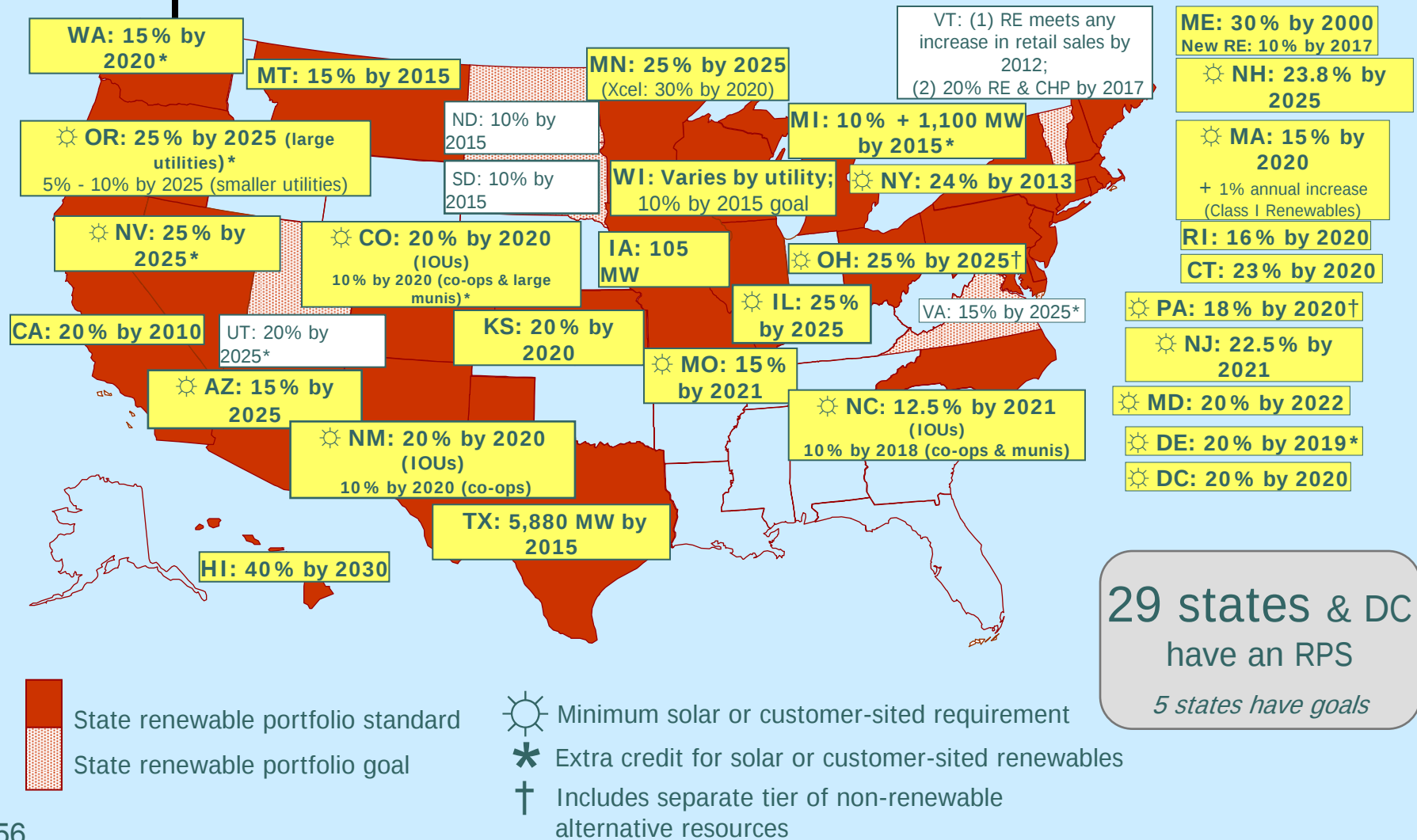
Wind is the Jet Stream on which new major transmission will be justified and built



- Renewable Portfolio Standards
 - 25 by 25 in MN
- Wind is seen as a major part of the solution in the US to climate change
 - 60,000 MW in the MISO transmission queue
 - Minnesota, Iowa, North Dakota
- In addition to being renewable hydro provides regional benefits
 - Manitoba Battery

Renewable Portfolio Standards

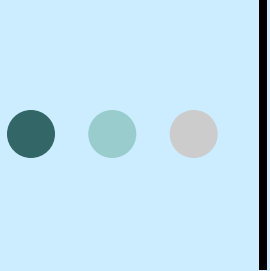
www.dsireusa.org / September 2009





U.S. Transmission Policy

- Who builds, owns, pays for it
 - Congress and the Federal Energy Regulatory Commission are struggling over cost allocation, siting and planning issues
 - Lack of clarity over the above issues makes connecting remote resources difficult
- Solutions will be developed soon
 - Will large hydro count?

A decorative graphic consisting of three colored circles (dark teal, light teal, and light brown) followed by a vertical line.

Manitoba Part of the Solution

- Opportunity for Manitoba to leverage its hydro advantage into a new 1100 MW MB-US interconnection
 - 750 MW of long term sales to MP and WPS
 - 1800 MW of new major hydro
- Secure access for MH surplus in perpetuity to a large valuable market
- US will meet its renewable goals with or without Manitoba Hydro
 - 80% reduction by 2050

● ● ● | The End

Thank
You !

