Bipole III Transmission Project

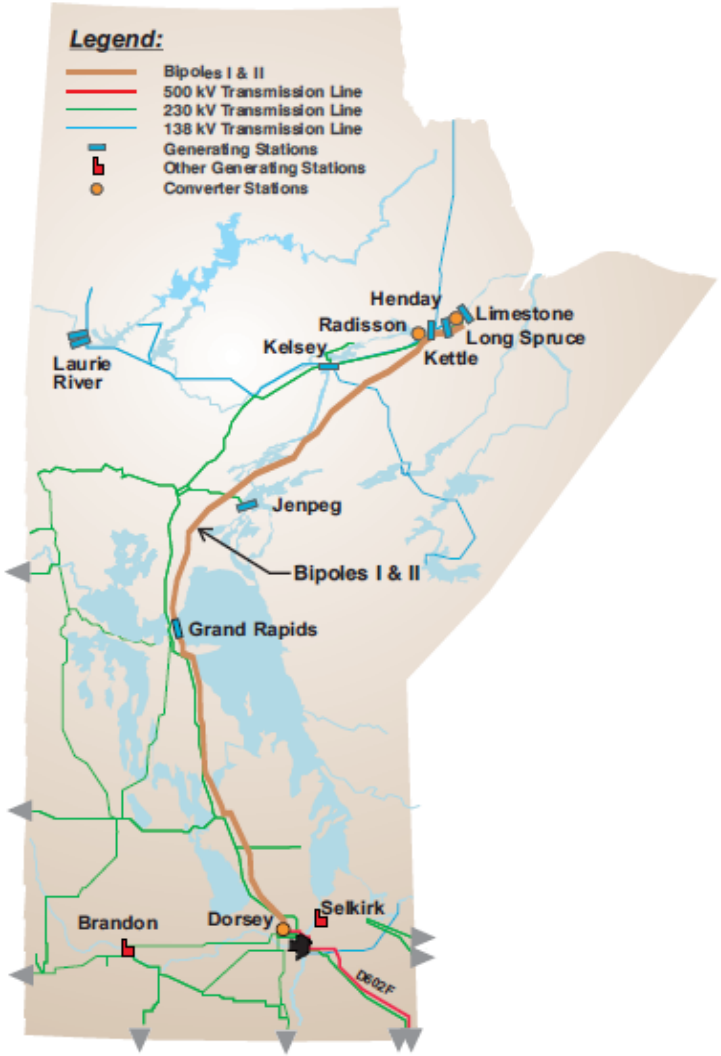
Clean Environment Commission
Public Hearings
Fall 2012
Reliability
Ed Tymofichuk

Manitoba Hydro

Overview

- History of Bipole I and II
- Critical Infrastructure
- Vulnerabilities and Exposure
- Near Misses/Other Events in Manitoba
- Neighbouring Provinces
- Consequences
- Present Need

Bipole I and II - History

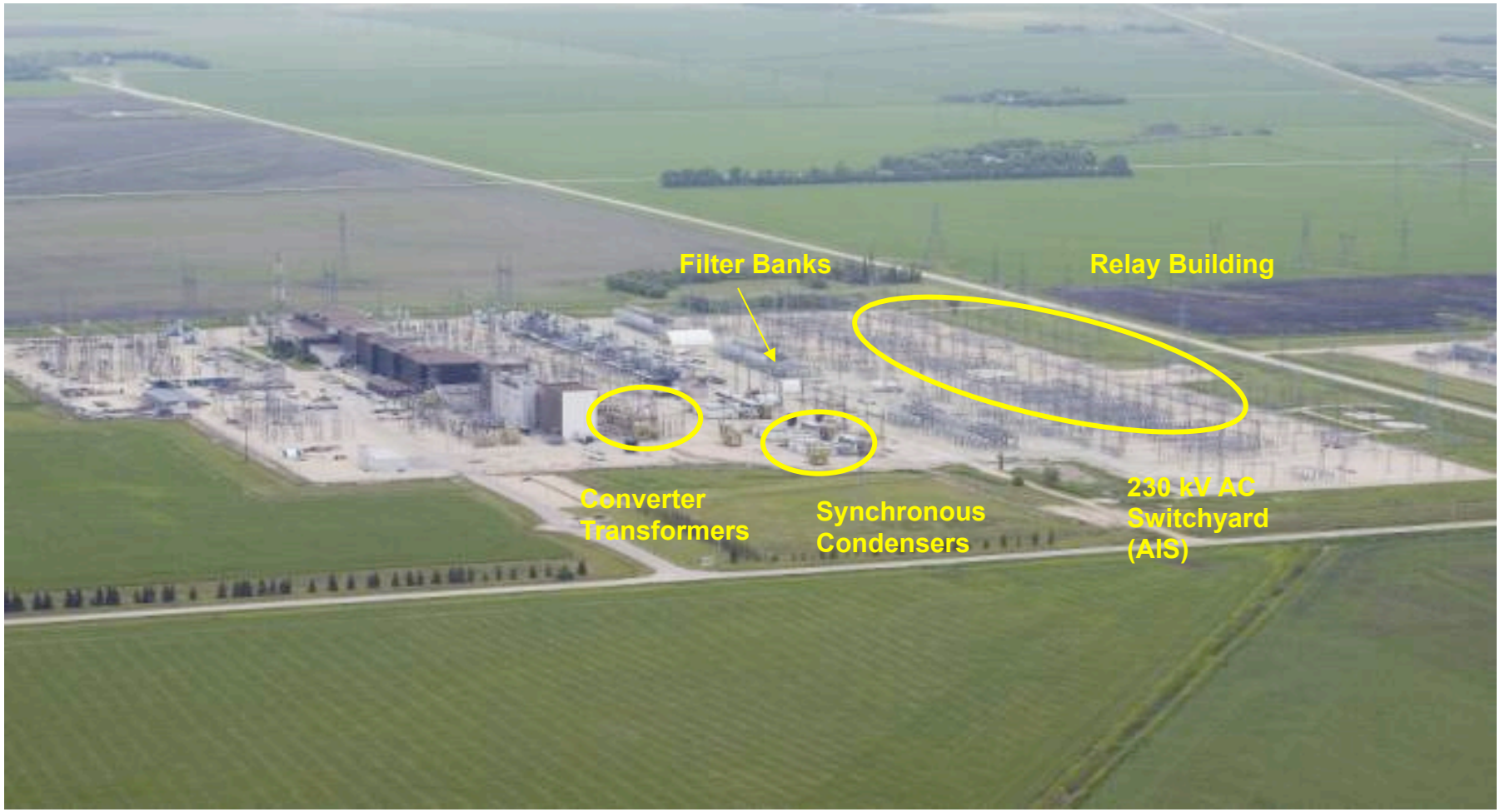


Bipole I and II - History

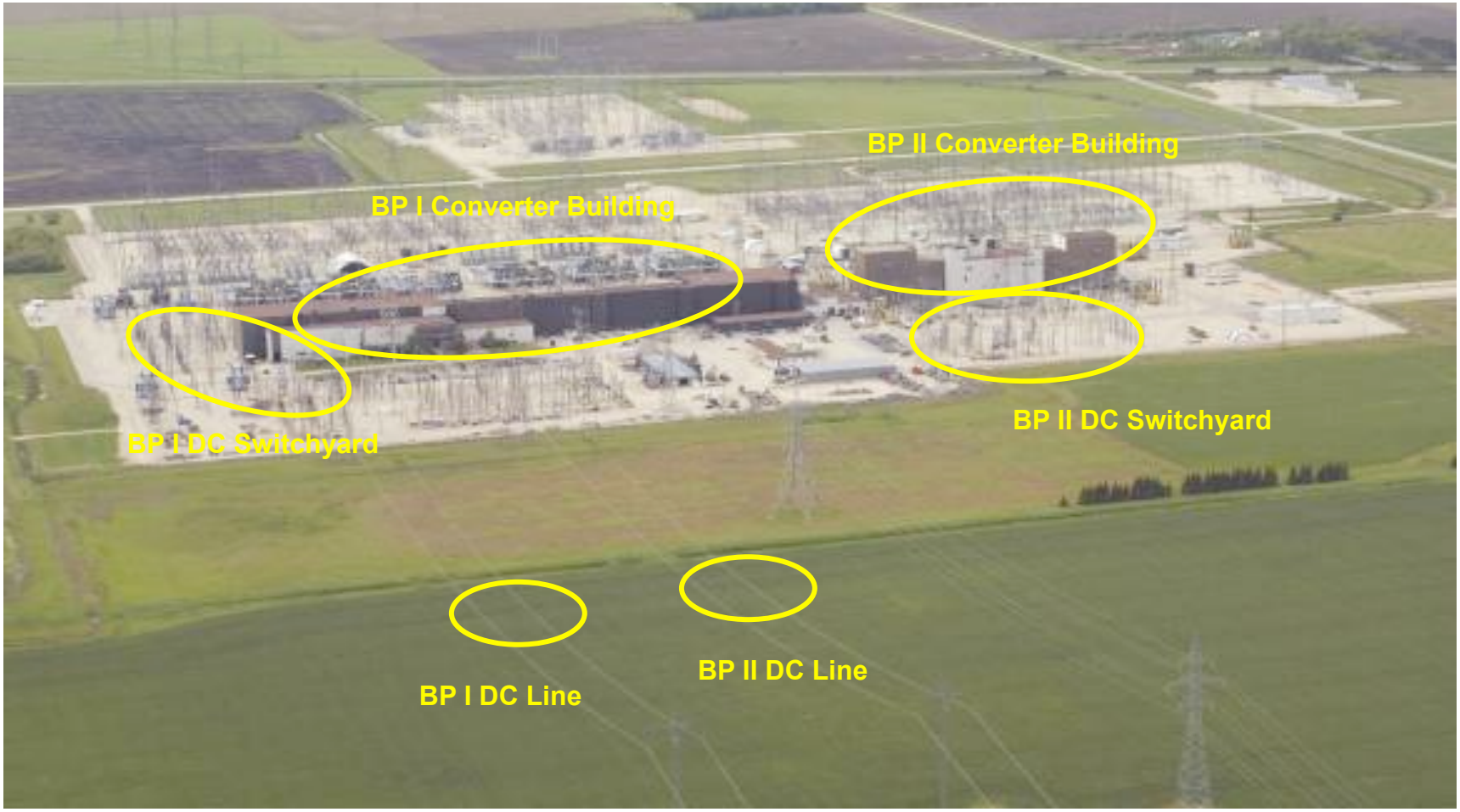
- In late 1960s and early 1970s load growth was forecast in the order of 7% annually, hence …
- More new northern generation would require a third Bipole, and therefore an
- Economic decision to build Bipole I and II lines on same corridor anticipating a third Bipole shortly thereafter
- Bipole I and II converter stations were developed in economic stages from early 1970s to mid 1980s matching needs of load growth
- This Nelson River HVDC scheme put Manitoba Hydro on the world leader map

Dorsey

BPI/BPII Dorsey Converter Station AC Equipment



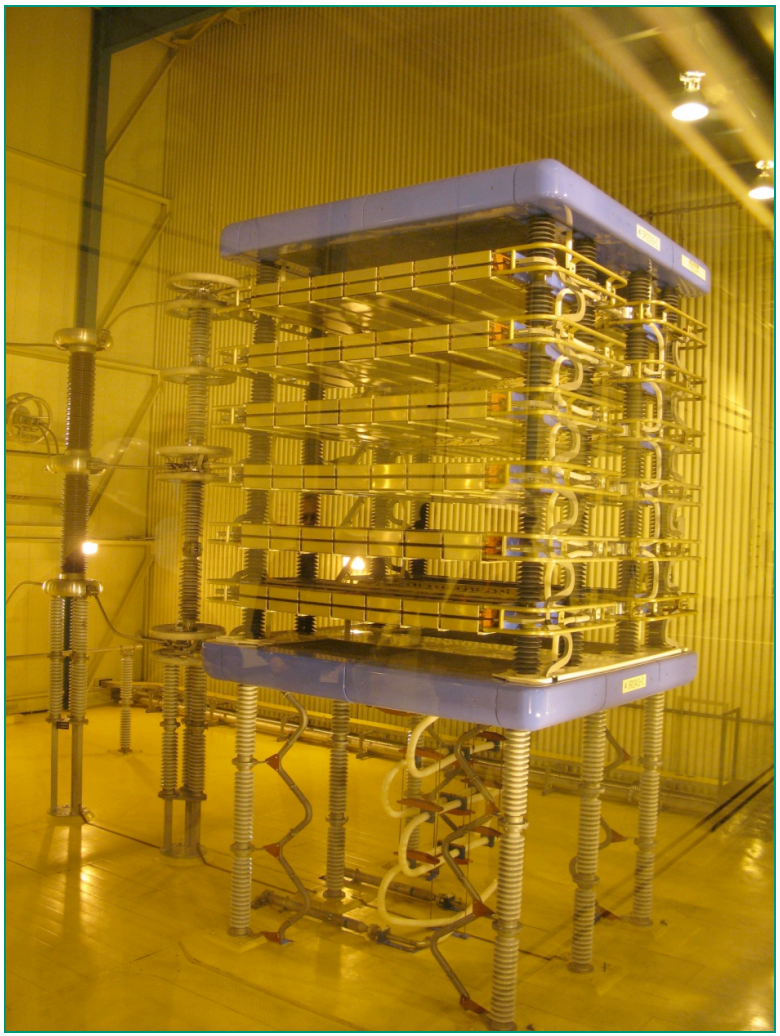
BPI/BPII Dorsey Converter Station DC Equipment



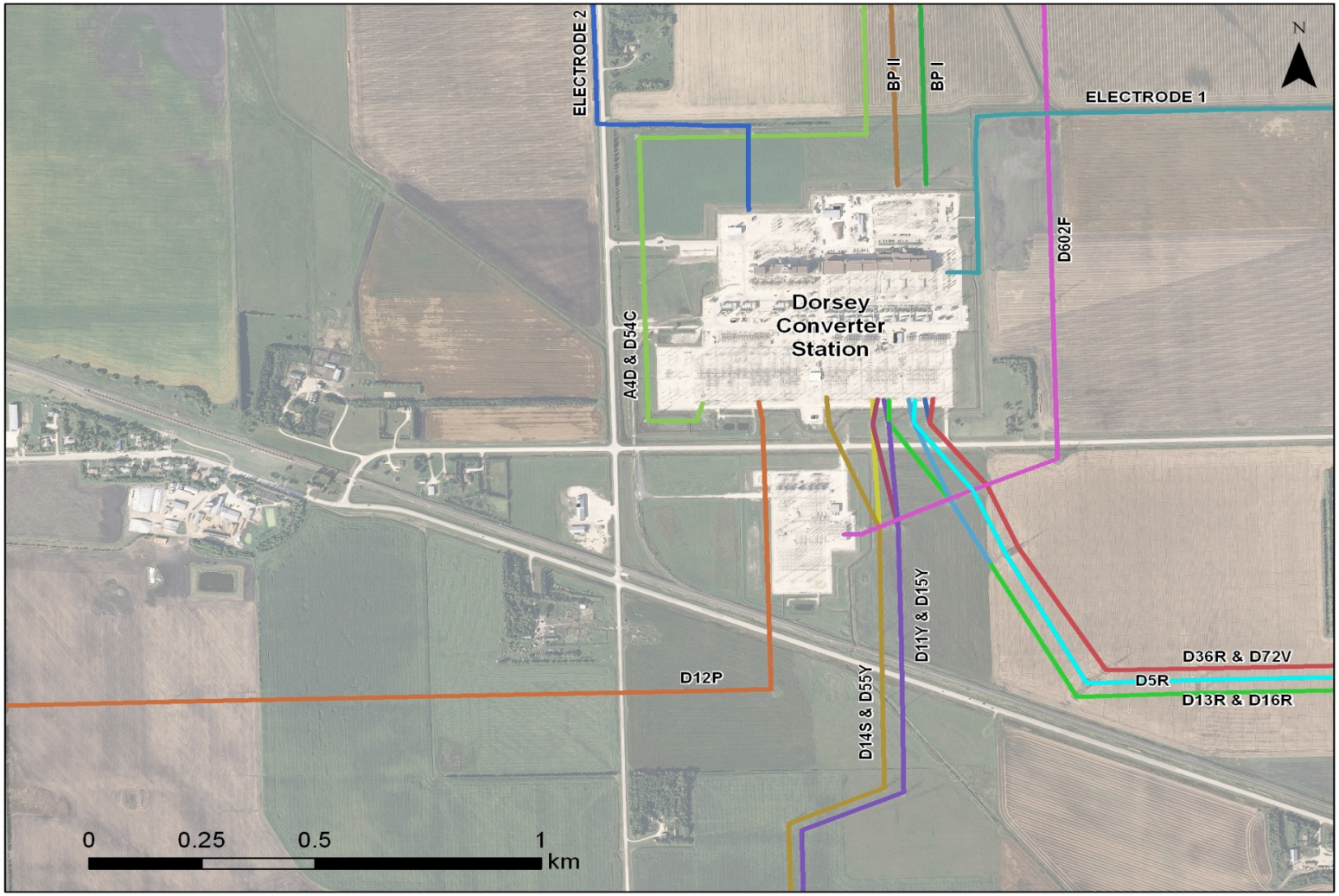
Dorsey

Dorsey

Dorsey 500kV Valve Group



Dorsey


ELECTRODE 2
BP II
BP I
ELECTRODE 1
N
D602F
Dorsey
Converter
Station
A4D & D54C
D11Y & D15Y
D36R & D72V
D5R
D13R & D16R
D12P
D14S & D55Y
0
0.25
0.5
1
km

Critical Infrastructure

- A term used by governments to describe assets that are essential for the functioning of a society and economy
- Canadian government has 10 sectors
- U.S. government has 18 sectors
- EU has an Operator Security Plan identifying important assets, risk analysis of major threat scenarios, vulnerabilities of assets, and counter-measures

Canadian Critical Infrastructure Sectors

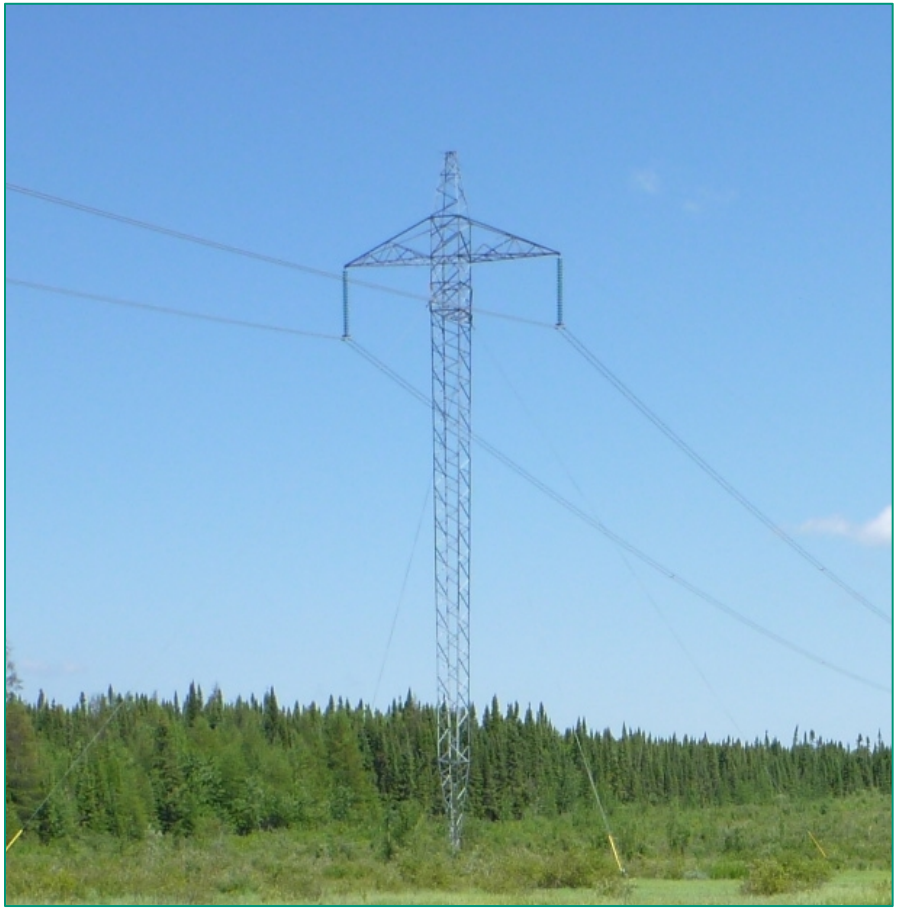
- Energy and Utilities (Includes electricity)
- Finance
- Food
- Transportation
- Government
- Information and Communication technology
- Health
- Water
- Safety
- Manufacturing

The Most Critical

- The Electrical Infrastructure is deemed to be the most critical in that it ….
- Enables and supports all other critical infrastructures
- Failure of Electrical infrastructure diminishes the other infrastructure sectors that depend on electricity, and so….
- Society and economies suffer

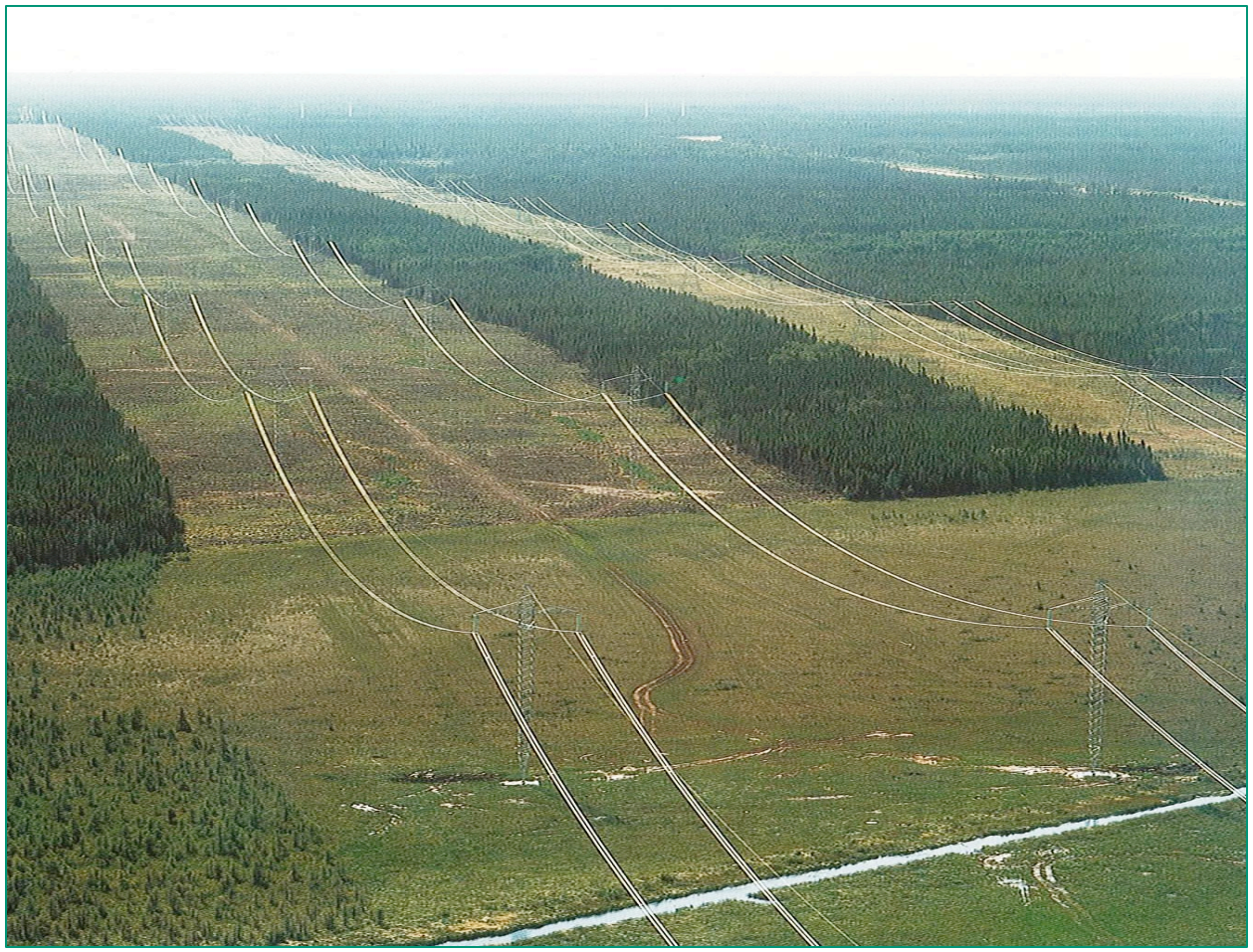
DC Transmission- South

DC Transmission Lines – Northern Manitoba



Guyed towers in non-agricultural areas for BP3

DC Lines - Northern Manitoba



- 2 – HVdc lines
- 2 – 230kv lines in northern Manitoba

DC Lines – Northern Manitoba

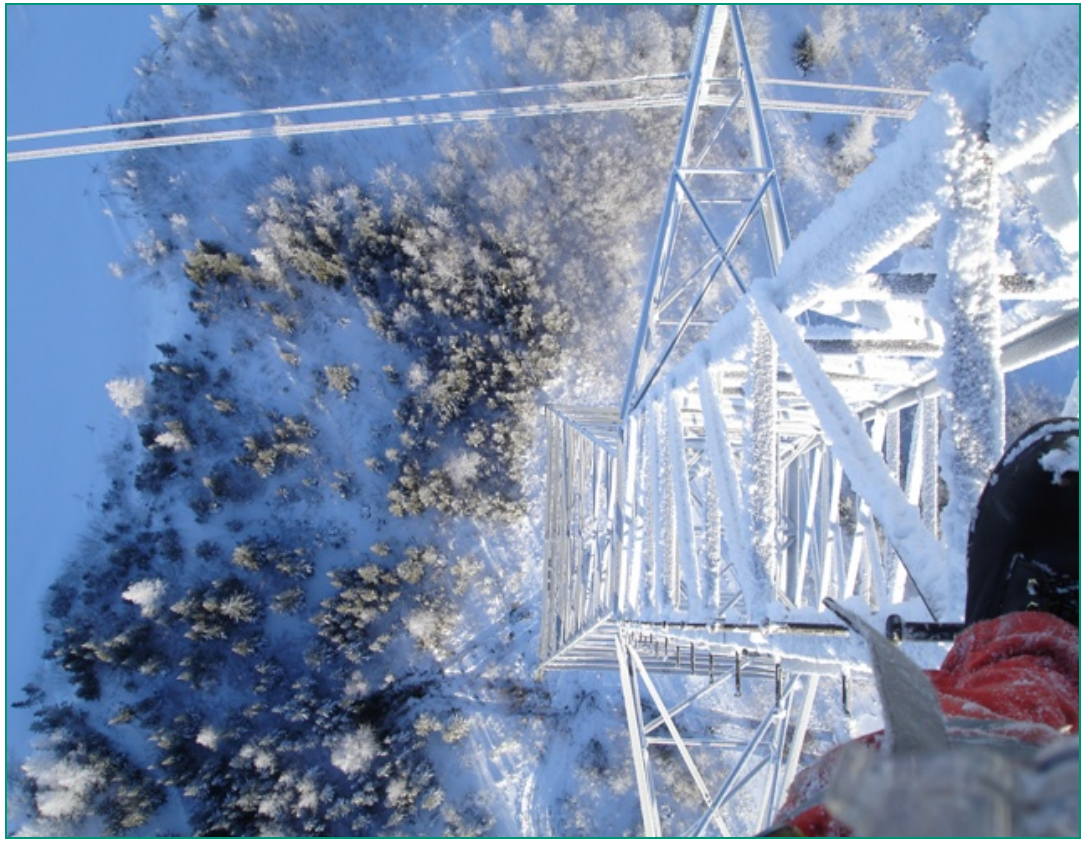
Difficult terrain and access

DC Lines – Southern Manitoba

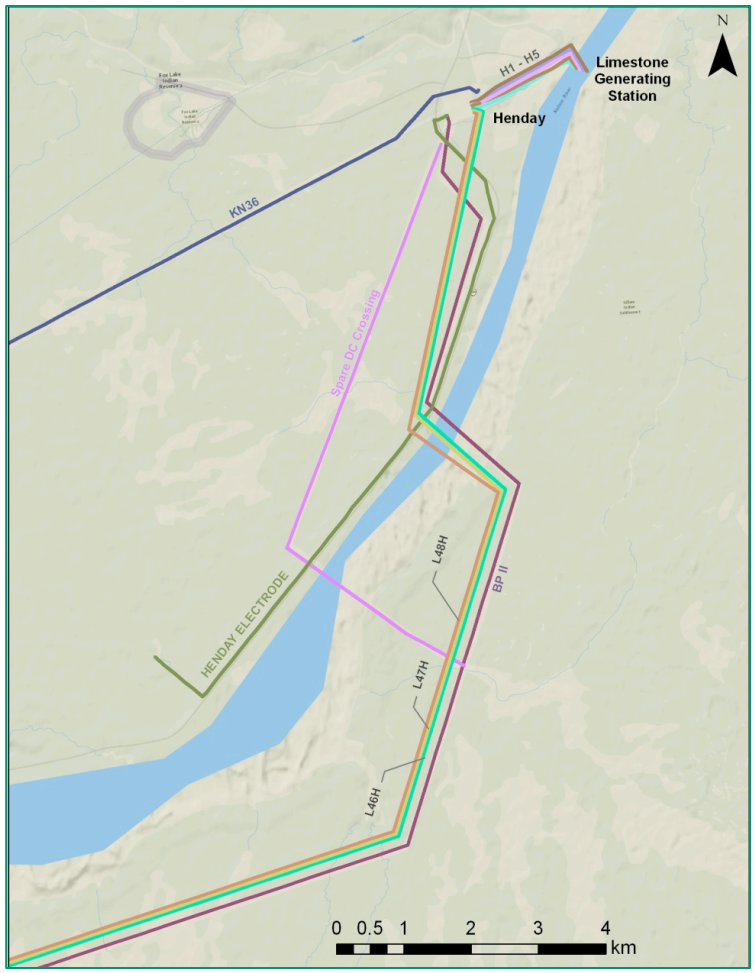
- No guyed towers for Bipole III
- Self supporting towers only
- Preserves arable land for agriculture use

BP II DC Line

Largest span crossing of Nelson River 288’ high, 4000’ span

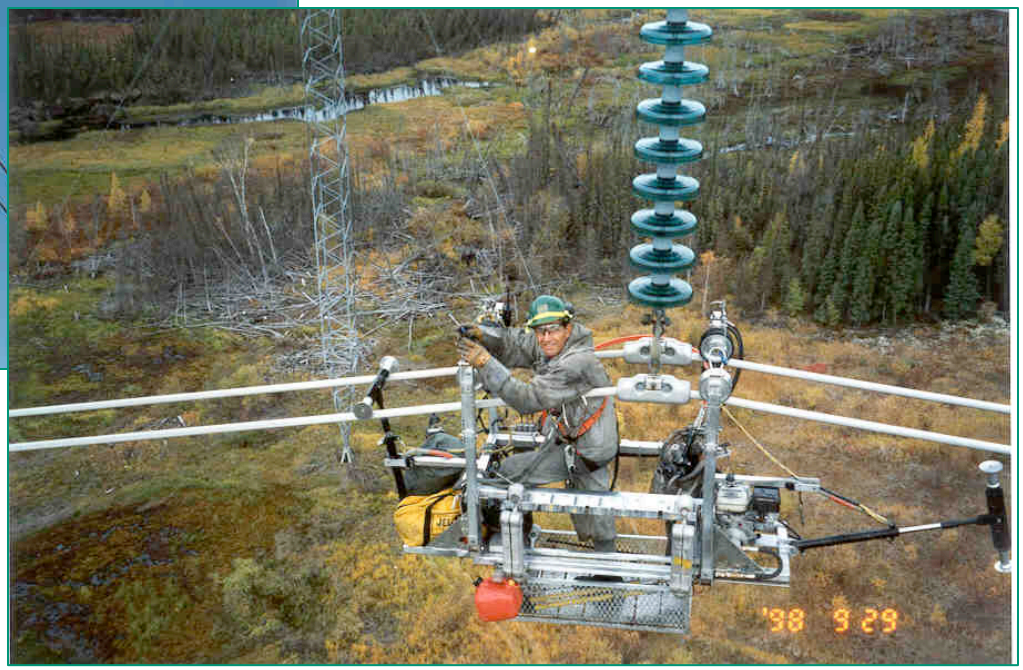


Nelson River BP2 Crossings near Henday



Emergency crossing protects bottling up Limestone power

DC Lines – HVDC Spacer - Damper Refurbishment



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Spacer Damper

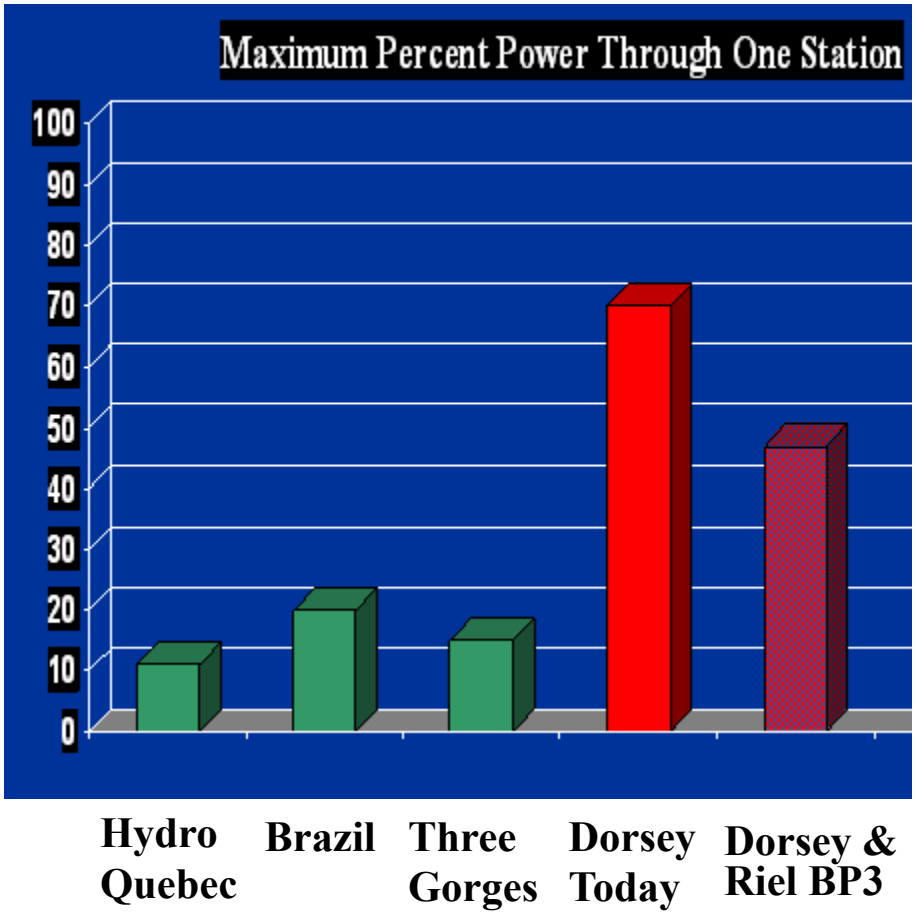
Vulnerabilities & Exposure of HVDC System

- Two Bipole lines 900kms long on same right-of-way
- Two lines and the southern Dorsey Station transmit 70% of northern hydro generation
- Dorsey has "most eggs in one basket"
- No utility in world transmits so much power through one critical facility

Vulnerabilities & Exposure of HVDC System

Statement of the Problem

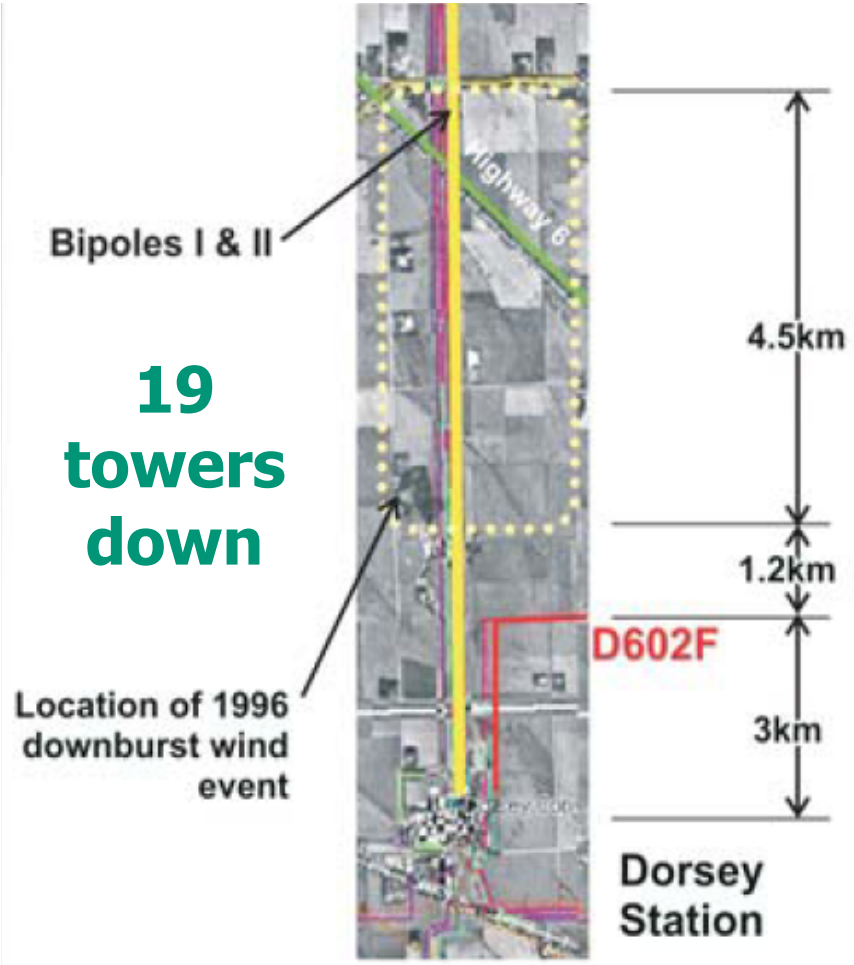
- World comparison
- Manitoba Hydro has a serious load serving reliability problem as driven by vulnerabilities in the HVdc system.

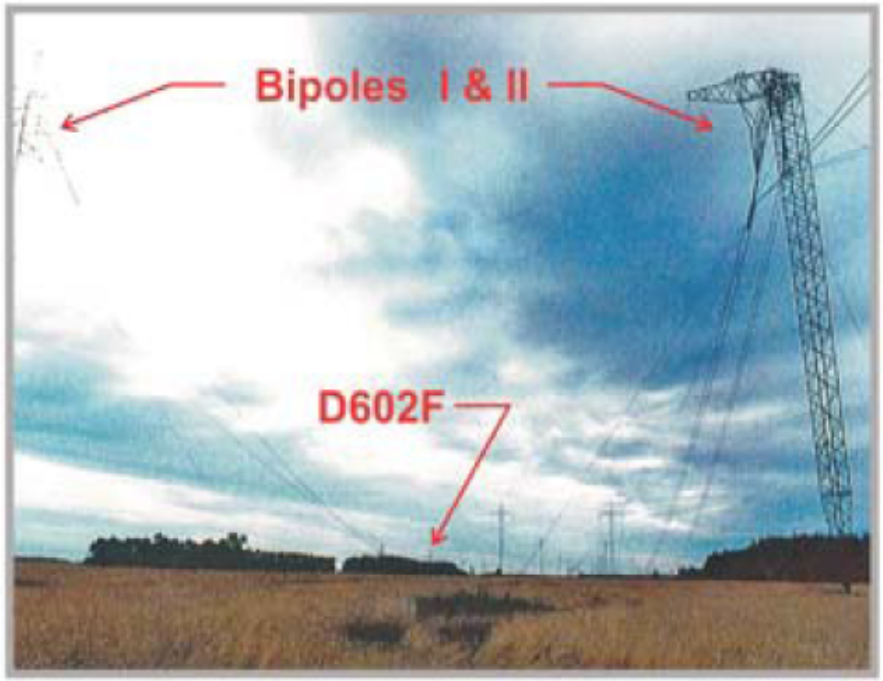


Near Misses & Other Events in Manitoba

- September 5, 1996 - Downburst 1.5 miles north of Dorsey
- July 17, 2006 Storms collide over Winnipeg
- June 2007 – Elie F5 Tornado
- August 9, 2007 – Storm Hits Dorsey Bipole 1
- May 2008 - Marchand Forest Fire – 500 kV AC line
- June 2008 – Buffalo Lake Forest Fire – DC lines
- January 2011 – Flood waters /Ice buildup on 117 km of DC row and structures in northern Manitoba – 50 towers and 400 guys encased in 3 feet of ice
- May 2012 – Forest Fires in SE Manitoba
- July 29, 2012 – 150 km/hr Plow Winds in St. Laurent and area

September 1996 Downburst



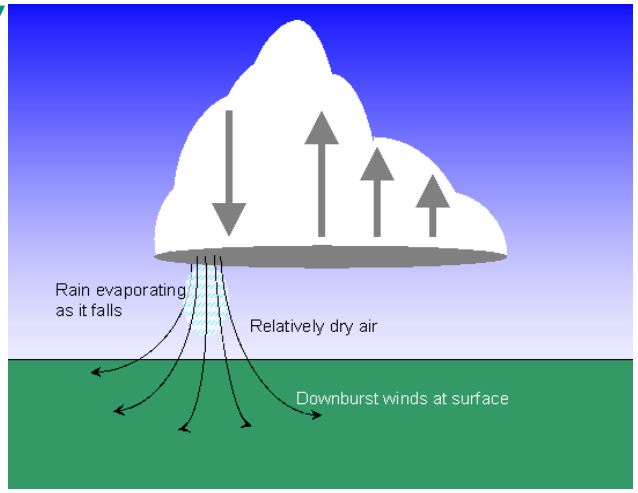


Sept. 5, 1996 Downburst Wind Event in which Bipoles I & II were lost

Electrode Line Damaged

September 1996 Downburst 1.5 miles north of Dorsey "5 times lucky"

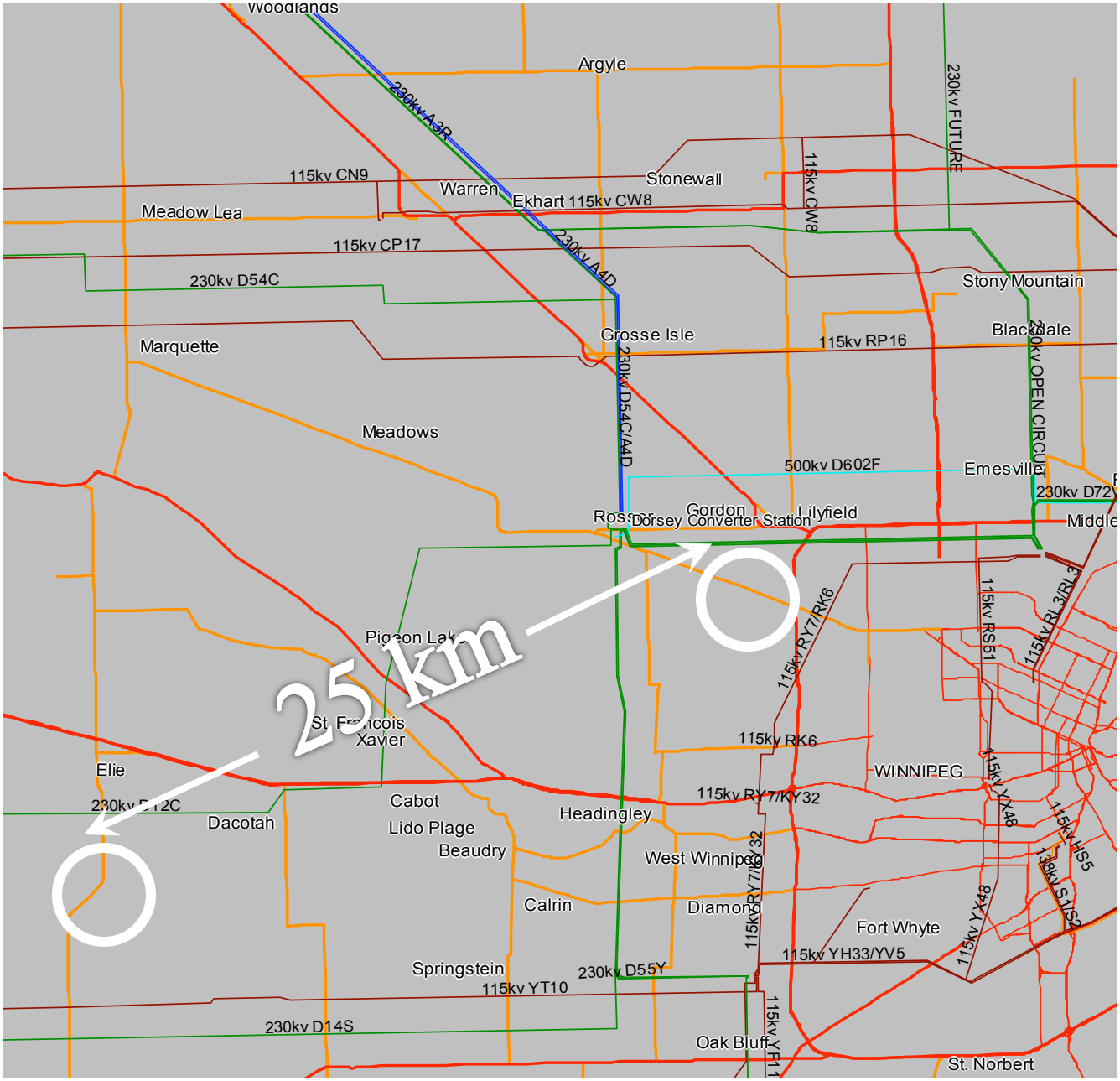
1. Barely missed Dorsey, 500kv station and 500kv line
2. Time of night; power flowed from U.S. instantaneously
3. Weather was perfect for next few days
4. Close to Hydro equipment storage
5. Access from PTH6 was excellent



July 2006 – Two Storms Collide

June 2007 – Elie F5 Tornado

1st recorded F5 Tornado in Manitoba



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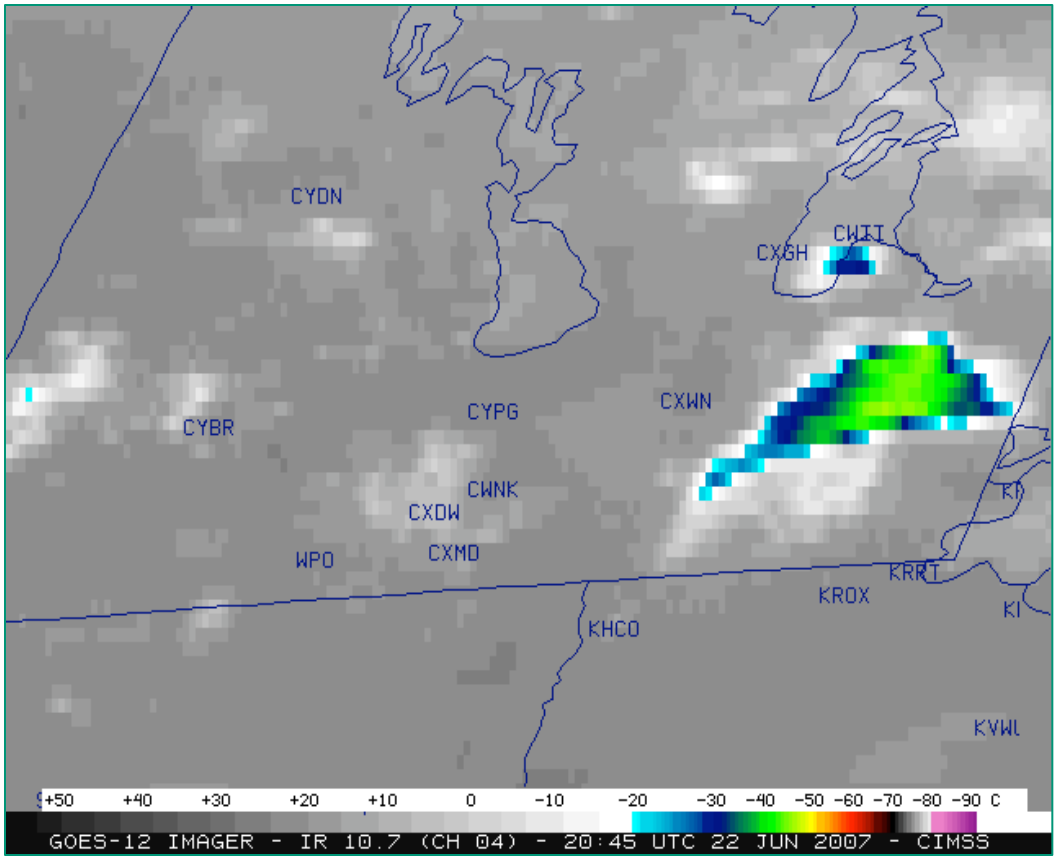
Clean Environment Commission – Fall 2012 – *Reliability*

June 2007 - Elie F5 Tornado

Elie F5 Tornado

Elie F5 Tornado



June 2007 – Elie Tornado

August 2007 – Storm Hits Dorsey Bipole I

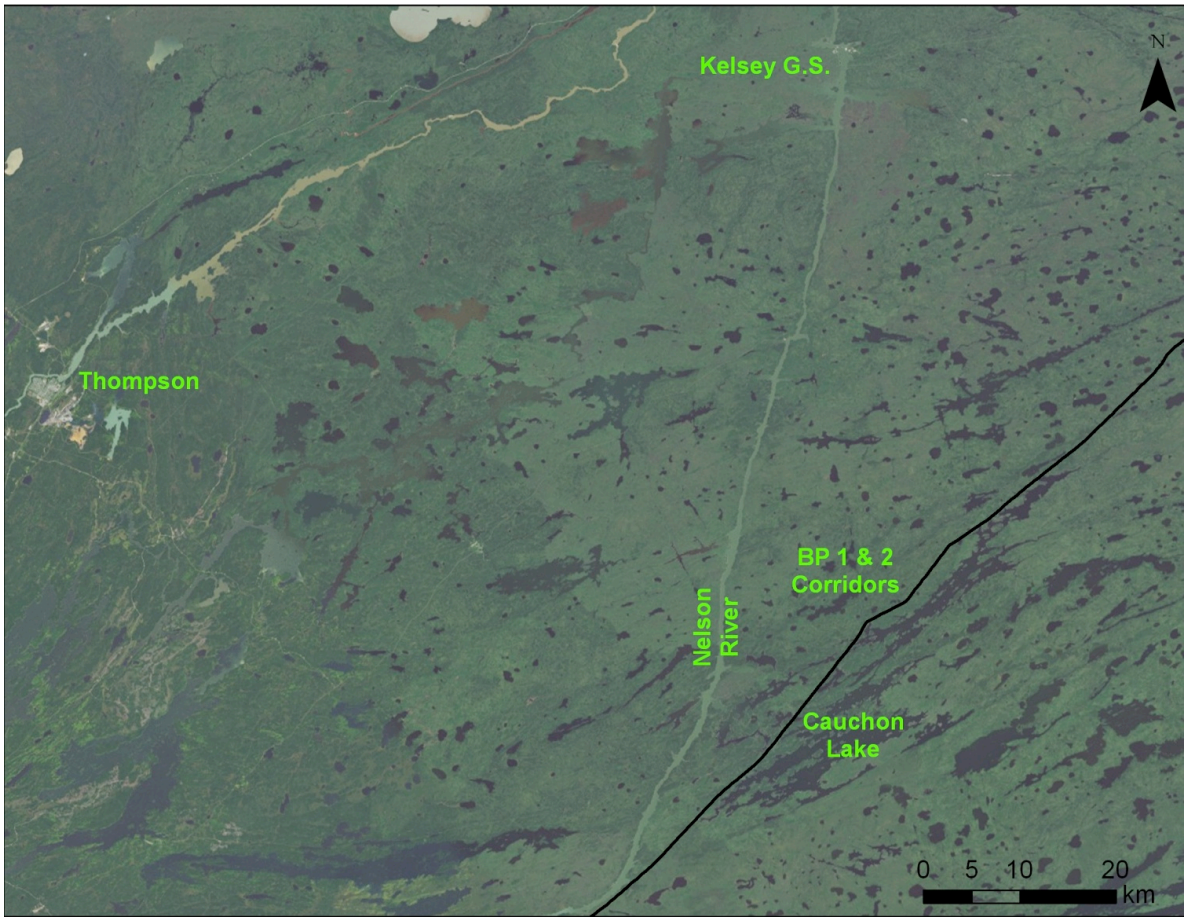
- Damaged equipment
- Lost 1348 MWs of power
- 7 valve groups tripped off
- 3 transmission lines tripped

August,2007 – Storm Hits Dorsey Bipole I

August, 2007 – Storm Hits Dorsey Bipole I

August, 2007 – Storm Hits Dorsey Bipole I

Cauchon Lake



- Very wet fall (2010)
- Excess water flows over Nelson River bank and inundates area
- Ice forms but water flows under ice
- Ice 3 feet thick
- Encases 50 towers and 400 guyed wires
- Damages towers and guyed wires
- Failure could have caused blackout

January 2011 – Flood in Northern Manitoba

Temporary device to hold tower on ice (left) and trained diver (right)

January 2011 - Flood in Northern Manitoba

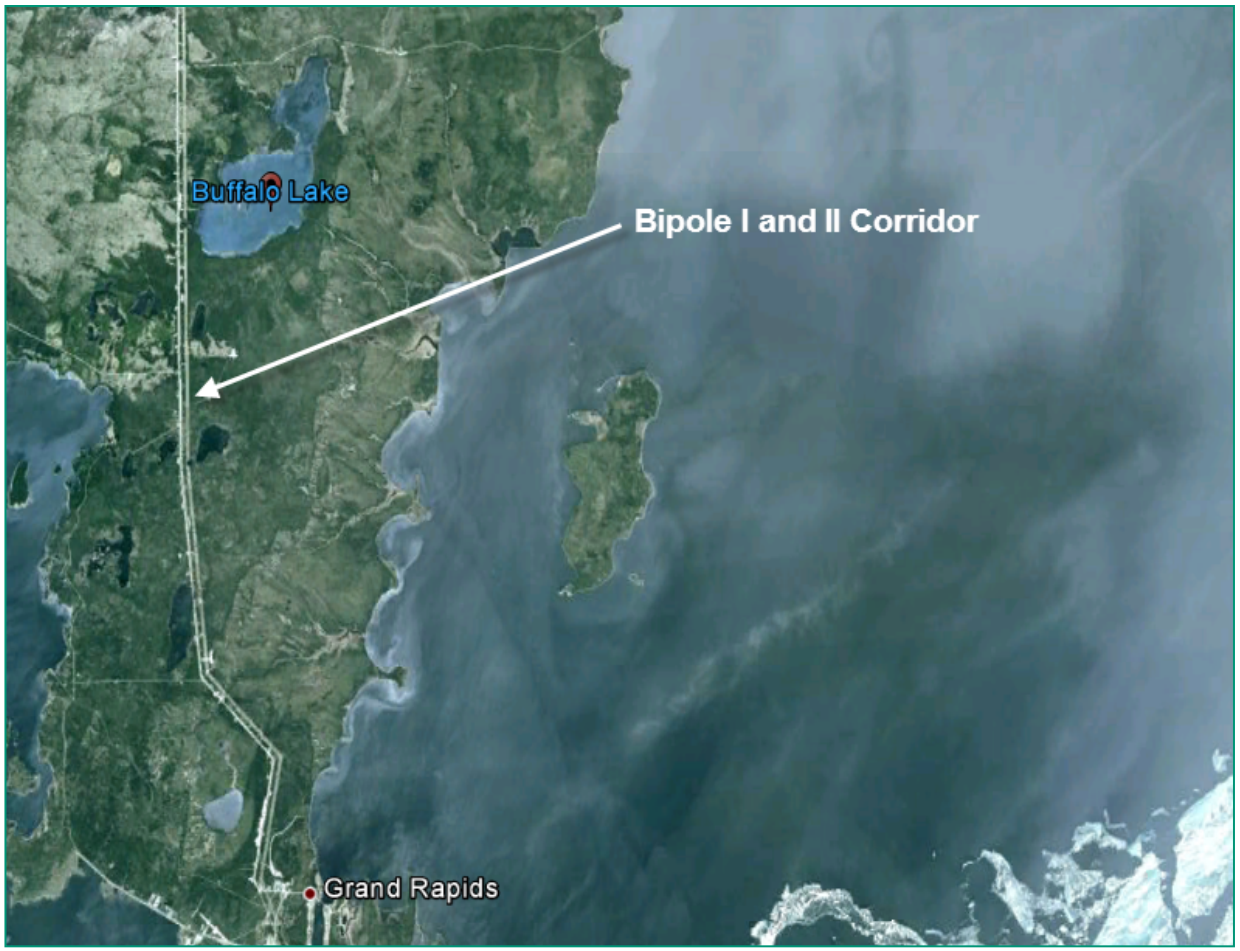
Guy attached to anchor (left) and guyed wire tower base (right)

January 2011 - Towers in Ice in Northern Manitoba (video)

May 2008 – Marchand Fire

Tripped 500kV Dorsey to Forbes line

June 2008 – Buffalo Lake Forest Fire



June 2008 – Buffalo Lake Forest Fire

- 3 poles tripped
- ¾ of power on the DC system lost

June 2008 – Buffalo Lake Forest Fire

May 2012 – South Eastern Manitoba Forest Fires

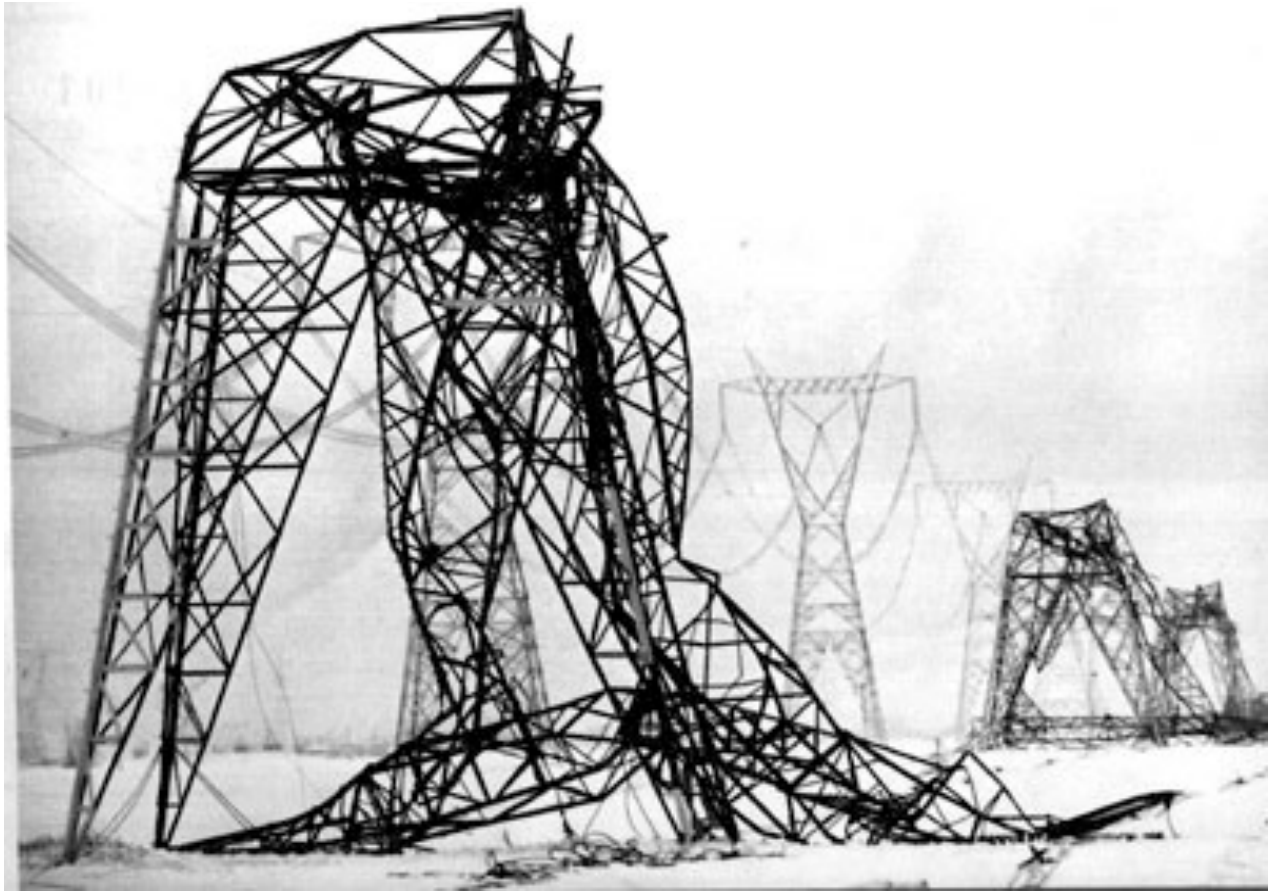
May 2012 – South Eastern Manitoba Forest Fire

Ice storms

- April 27, 1984
- 12 - 230kv AC steel towers failed

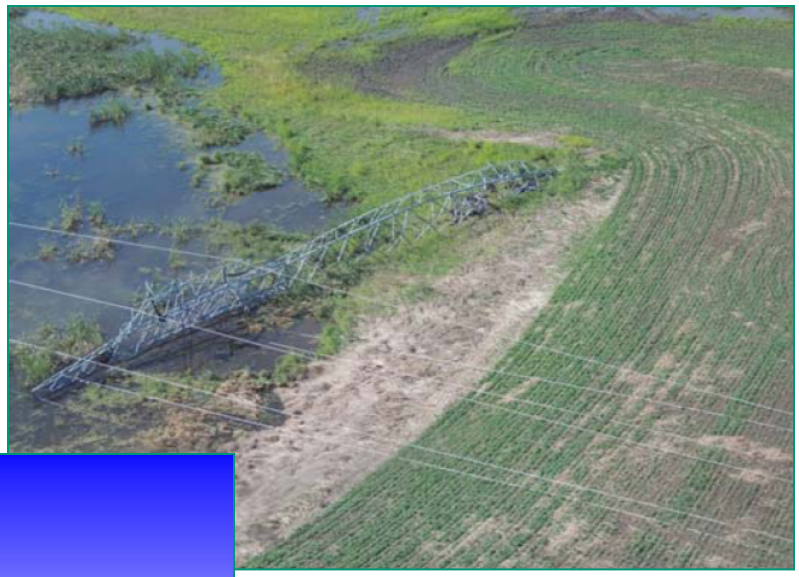
500kV Line near Dorsey Galloping

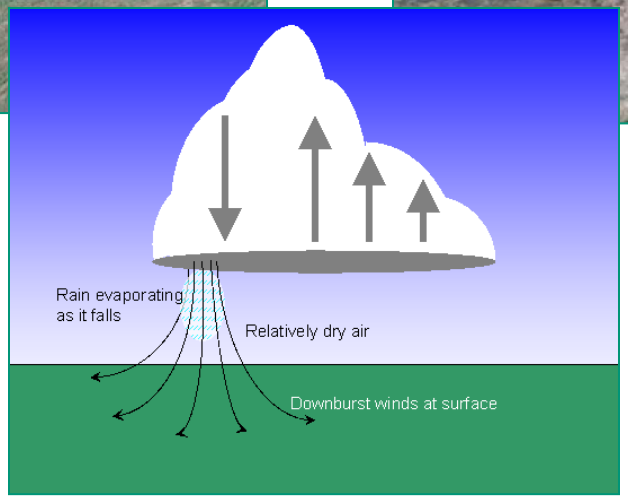
Eastern Ice Storm Hydro Quebec



- Hydro Quebec 1998
- Thousands of customers out of power for the month of January

June 2012 – Saskatchewan Power Corporation System





8 towers failed near Prince Albert

Prince Albert out of power for one day

Catastrophic Consequences DC Lines Fail

- Maximum outage of up to two months to restore is a conservative estimate
- Depends on season and location
- In winter between November and March rotating outages in southern Manitoba 2 hours at a time
- In summer south, east, and west interconnections and all local generation may supply Manitoba Load

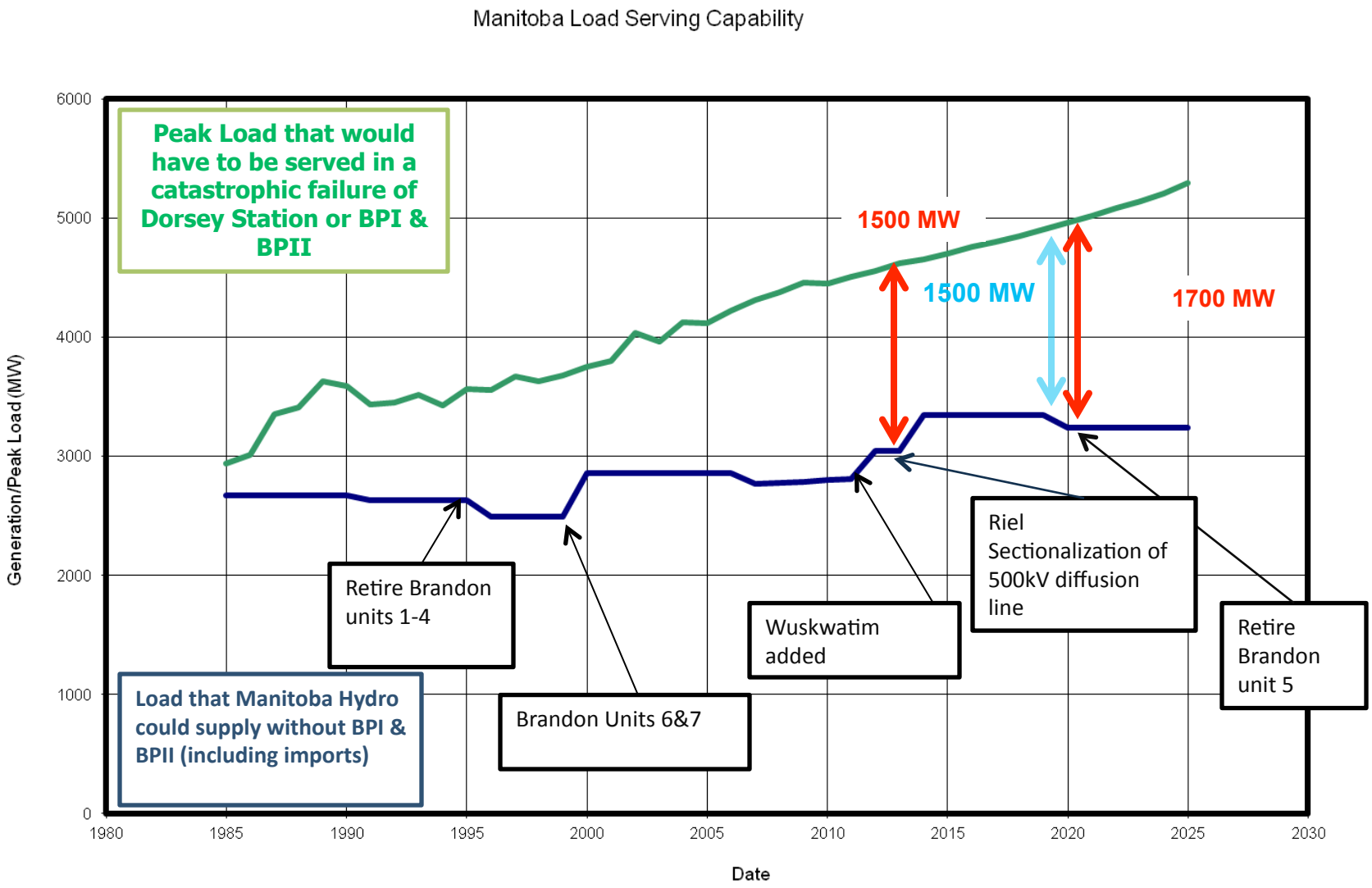
Catastrophic Outage to Dorsey

- 3600 MWs lost from northern Manitoba hydro generation
- Time to restore or rebuild entire converter station at Dorsey – 3 years
- Devastating to provincial economy, our society, public safety, integrity and reputation – cannot be tolerated

The Problem We Have Today

- ***Lack of redundancy*** in the HVDC system and insufficient emergency backup resources
- ***Load serving deficiency*** under catastrophic contingencies
- The ***deficiency gap grows*** with time due to load growth and the resources capacity is relatively constant

Deficiency Upon Loss of Dorsey



Manitoba Hydro Act

"The purposes and objectives of this Act are to provide for the continuance of a supply of power adequate for the needs of the province …"

Dorsey June 2010

Thank you