To: Clean Environment Commission
MMTP

Reducing Adverse Impact of Transmission, Line Capacity & Land Use

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for

Manitoba Wildlands

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A Time when Transmission Lines were Welcomed

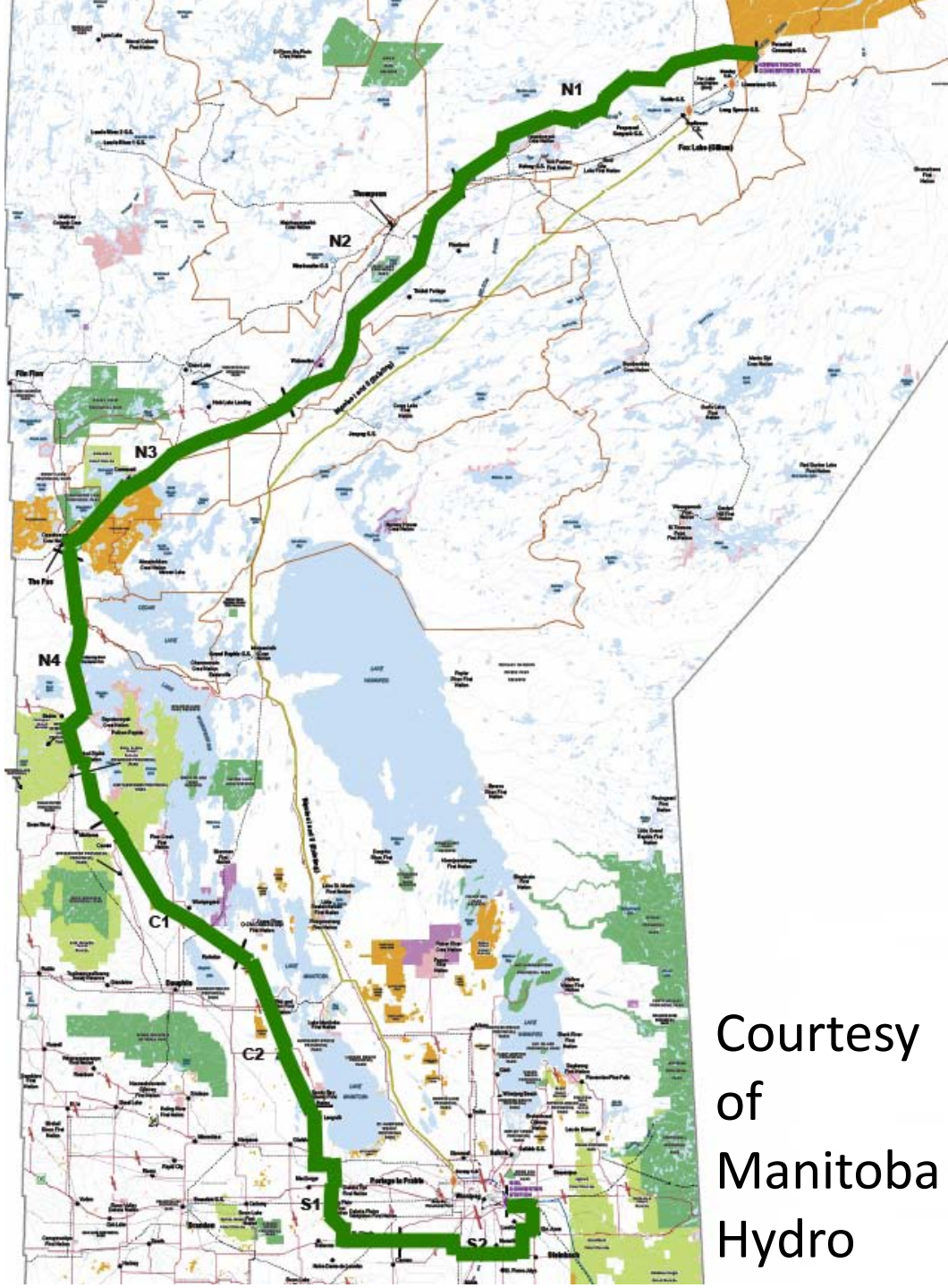
Figure 1

Google Earth

And then, public acceptance began to change

Figure 2 – M602F in the US near Warroad

Along came Bipole III and Social Acceptance got Worse



Courtesy of Manitoba Hydro

Figure 3 – West side route

Today, Transmission Lines Need Social Acceptance

Figure 4 – New Tubular tower in Denmark

Other Tubular Steel Aesthetic 500 kV Tower Designs

Figure 5 – New tubular towers in the US

Conflicts in costing tubular monopole vs lattice towers

Manitoba Hydro: “Total cost of a tubular line is higher–by 40%” Appendix B

Valmont US: “Monopole structures are 30% lower than the lattice towers” Appendix C

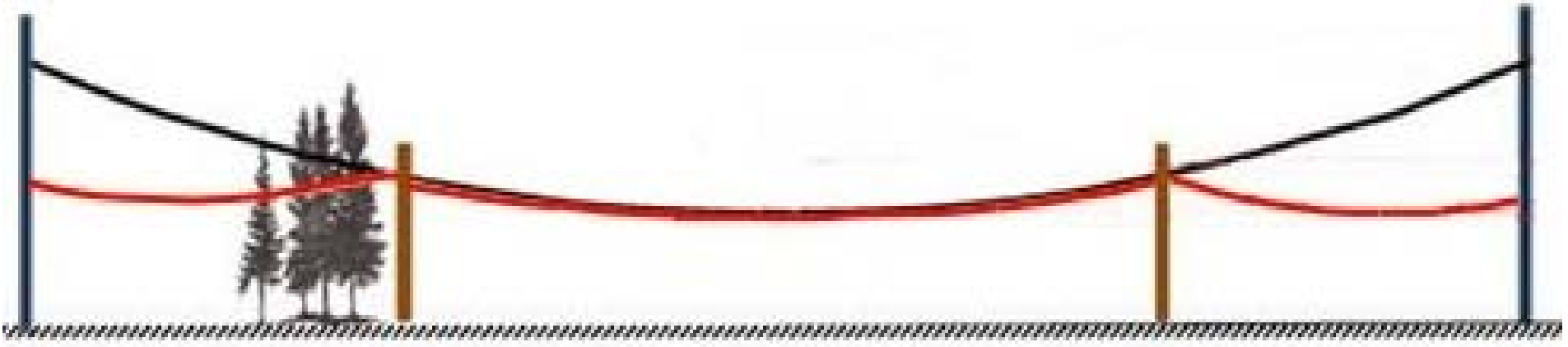
Figure 6 – Tower costing

Conflicts in costing tubular monopole vs lattice towers

Bystrup of Denmark would welcome working with Manitoba Hydro to compare cost comparisons between the MMTP lattice design and a tubular steel design
Appendix C

Figure 7 – Tower design and costing help

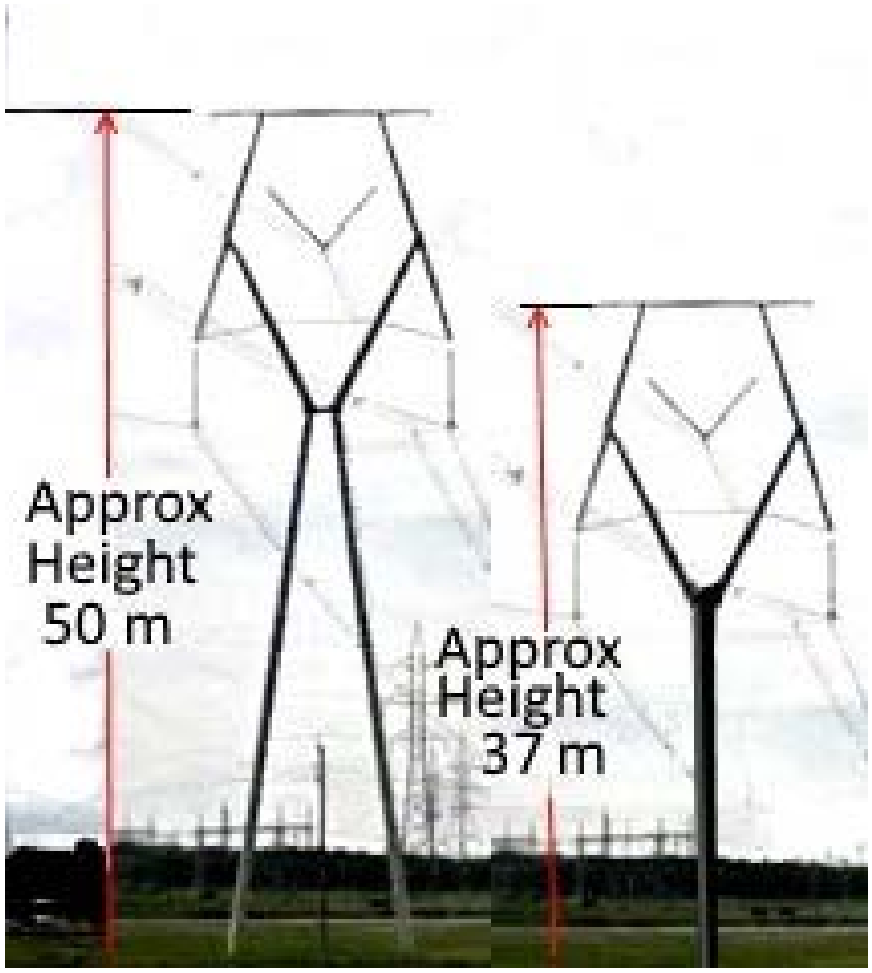
Are There Benefits in Lower and Better Looking Towers?



1. Saves environmental footprint and ROW
2. Reduces weed control costs
3. Less maintenance & faster installation
4. **Better landscape and visual effects**

Figure 8 – Benefits to tubular towers

The Impact of Tower Height



1. Lower wind forces on the conductors even with same mid-span clearance to ground
2. In forest, the trees will provide more wind shelter with lower average conductor height

Figure 9 – Lower height & nicer landscape

Why is MMTP Rated so Large?

1. Keeyask is only 695 MW. Is not MMTP rated at about 1500 MW? Why?
2. What is the justification for this costly extravagance?

Figure 10 – 1500 MW capacity of MMTP

Why is MMTP Rated so Large?

1. Is it because of drought? But we have survived droughts before – without Keeyask. The drought risk is financial – not energy
1. There are other export opportunities to the west possible – Can MMTP be at 230 kV?

Figure 11 – 1500 MW capacity of MMTP

Keeyask is Delayed-Why Not Delay MMTP as Well?

HYDROGRAM

March 9, 2017 | Volume 46, Number 48

Keeyask delayed 21 months from Nov 2019 to August 2021 (and its control budged increased from $6.5 billion to $8.7 Billion) – Appendix F Why not delay MMTP from May 2020 to at least November 2021?

Figure 12 – 18 months to redesign line

Can MMTP be 230 kV?

Tower top of 420 kV tubular line in Norway

Existing R50M 230 kV line to Minnesota Power

Tubular 230 kV for MMTP?

Figure 13–Tubular tower for 230 kV MMTP

With Keeyask Just for Export

Regional Electricity Cooperation and Strategi Infrastructure Initiative (RECSI) a possibility – Should not finalize an MMTP agreement until the likelihood of RECSI is known

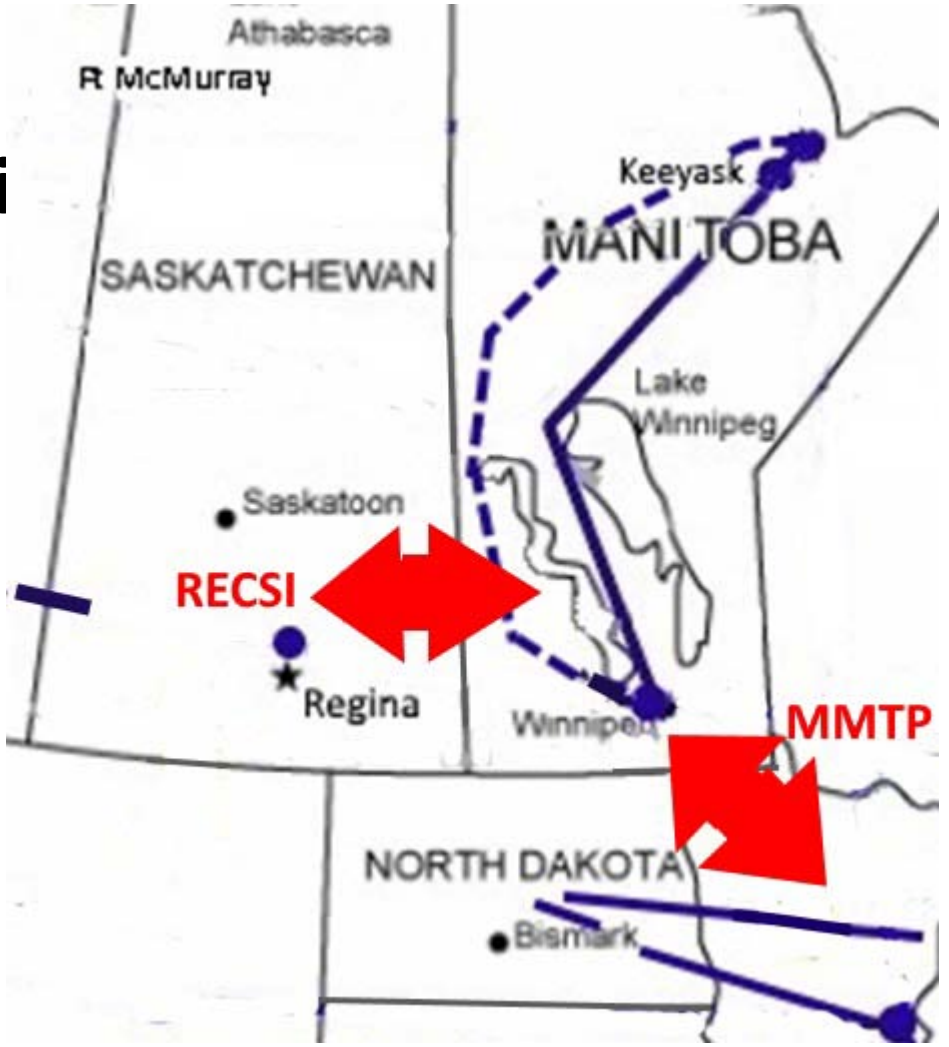


Figure 14 – Other export possibilities

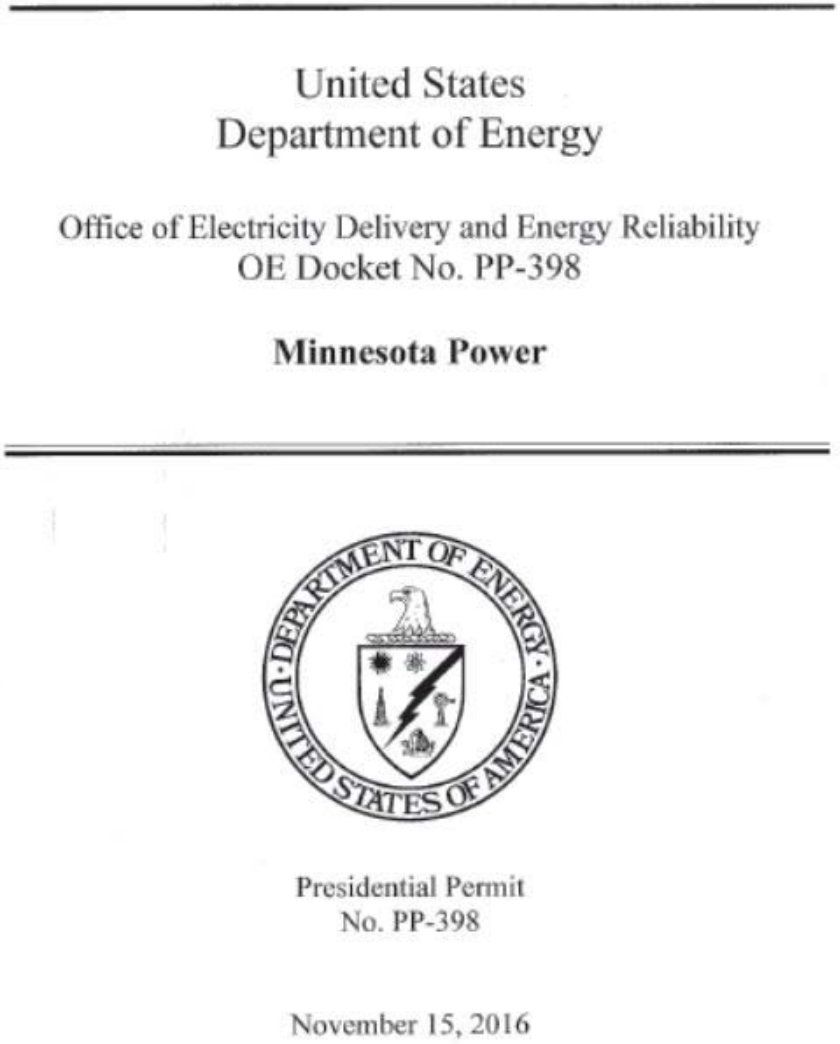
Considerations for a 230 kV MMTP

1. Less cost when Manitoba Hydro is strapped financially
2. Combined with existing R50M, export capacity with a 230 kV MMTP could be 600 MW
3. Consider the 100 MW agreement with SaskPower and possibility of RECSI
4. Narrower ROW, less destruction of forest

Figure 15–Tubular tower for 230 kV MMTP

US Presidential Permit for the GNTL (MMTP)

1. For 500 kV line the PP allows for 883 MW export to the US & 750 MW import
2. The MMTP contracts may be lower so 230 kV feasible?



United States
Department of Energy

Office of Electricity Delivery and Energy Reliability
OE Docket No. PP-398

Minnesota Power

Presidential Permit
No. PP-398

November 15, 2016

Figure 16– US Permit

The Growing Need for Innovative New Structures

The Centre for Energy Advancement through Technological Innovation (CEATI) Has out a request for proposal: "Innovative New Structures (Visually Pleasing) for Better Public Acceptance"

This is a subject now being taken seriously

Figure 17 – CEATI Proposal T163700-33115

Live Line Maintenance
A Major Concern

An essential aspect of low profile aesthetic designed transmission lowers

Insulated bucket truck and hot stick live line repairs

Figure 18 – Tubular live line maintenance

Live Line Maintenance
A Major Concern

Manitoba Hydro (Appendix B) expressed concern that a compact line would not allow safe clearances for live line work

<u>Low profile transmission does not necessarily mean compact transmission</u>

Figure 19 – Low profile - compact line

Live Line Maintenance
A Major Concern

However in Appendix A:
Terms of Reference for Working Group B2.63 *Compact AC Transmission Lines* The International Council of Large Electric Systems (CIGRE) indicate a point under study:

f) Live-line maintenance techniques

Figure 20 – International development

Right-of-Way Width

Built	
Proximity to Buildings	10.0%
> 800 m	1
400 - 800 m	2.7
100 - 400 m	6.5
ROW - 100 m	9
Building Density	15.0%

The EPRI-GTC process ROW fixed at 100 m.

Width of ROW not significant – considered to be of little value (Appendix B)

Figure 21 – EPRI-GTC consideration of ROW

Right-of-Way Width

Built	
Proximity to Buildings	10.0%
> 800 m	1
400 - 800 m	2.7
100 - 400 m	6.5
ROW - 100 m	9
Building Density	15.0%

Input from individuals most impacted by the MMTP line were diluted by the multitude of inputs that are fed into the EPRI-GTC methodology. Manitoba Hydro vigorously defended the EPRI-GTC methodology in its response (Appendix J)

Figure 22–EPRI-GTC consideration of ROW

Right-of-Way Width Factors

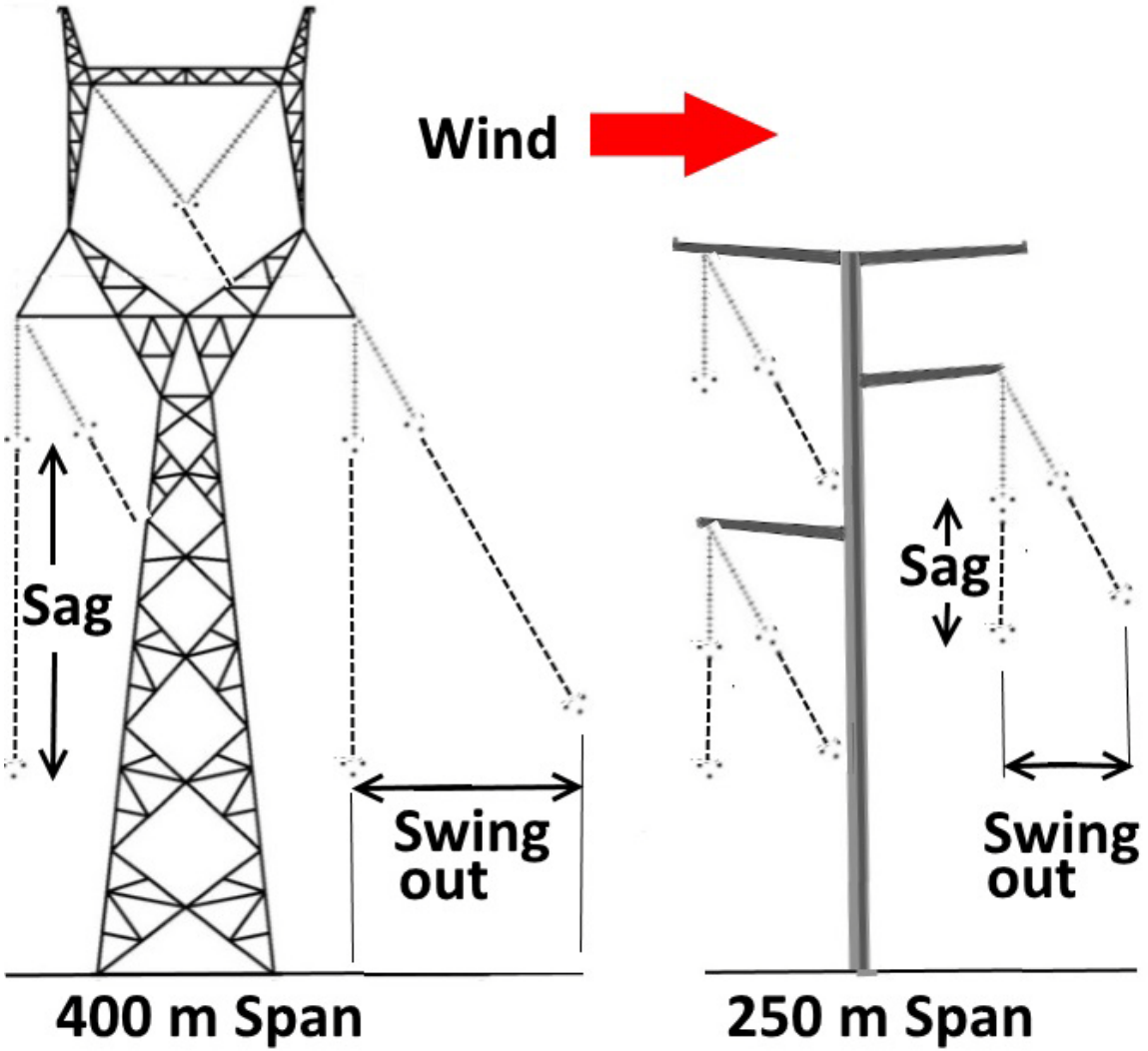
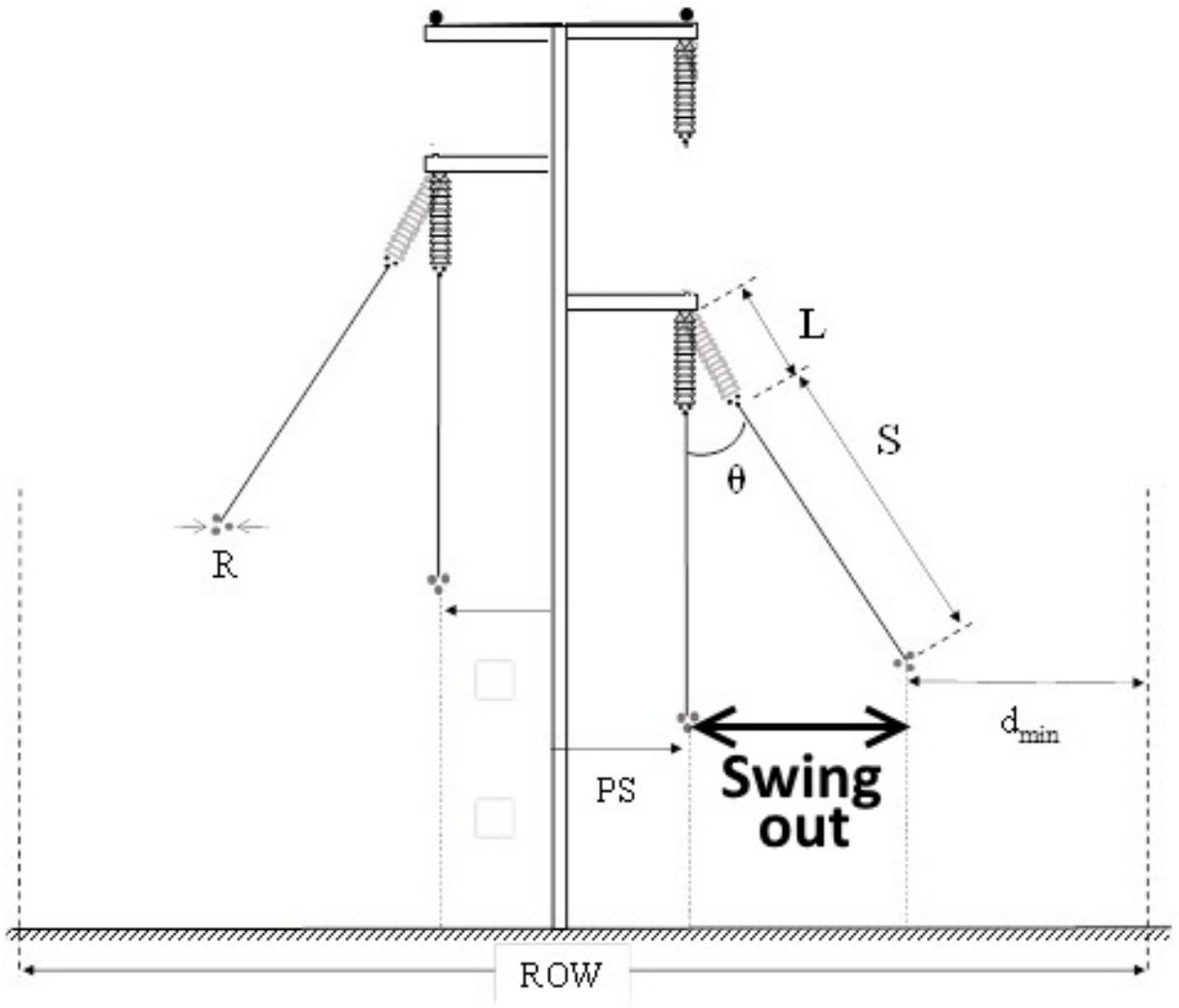


Figure 23 – Shorter span - less swing out

Right-of-Way Width Factors



Swing out adds to ROW width

400 m span ≈ 32 m swing out

250 m span ≈ 15 m swing out

ROW 34 m less (32-15)x2=34 m

Figure 24 – Shorter span - less swing out

Right-of-Way Width Factors

Figure 25 – Avoid property damage

Right-of-Way Width Factors

- A 500 kV MMTP line with a 46 m ROW will have some electromagnetic field effects (EMF) that are higher than an 80 m ROW
- If an EMF effect such as audible noise is higher than standards allow, then ROW will be increased or the line redesigned
- Manitoba Hydro have not indicated EMF is the defining factor for an 80 m ROW

Figure 26 – Reduce EMF effects

Right-of-Way Width Factors

In Appendix B, Manitoba Hydro state: "*From a purely structural perspective, you could design a low profile transmission structure that would meet the D604I structural requirements, but more structures would be required, increasing the property, bio-security and agricultural impacts as well as the overall cost.*"

Figure 27 – Compliance with standards

Right-of-Way Width Factors

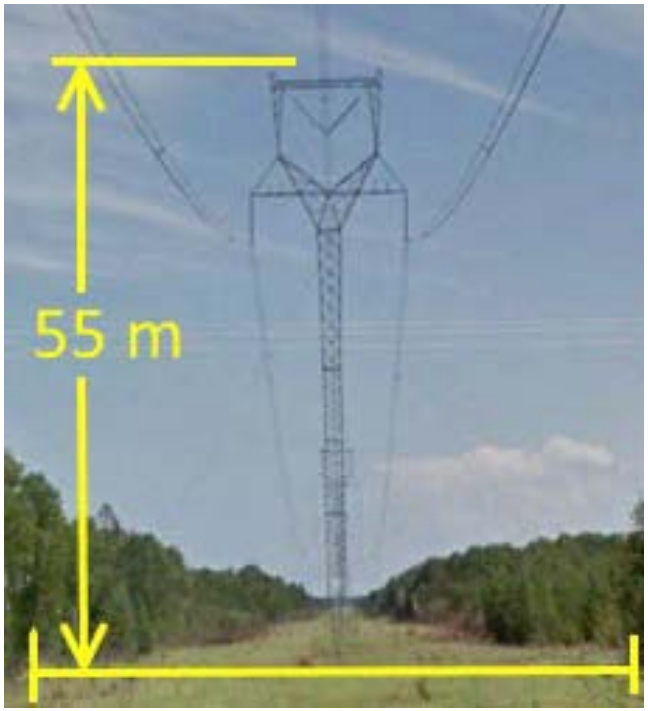
In Appendix C, Bystrup respond: "*In some cases probably yes! But if public acceptance, reduced height, reduced corona noise, less footprint, easy installation (less than 10 parts pr. Pylon), reduced maintenance etc are interesting to get the project approved, accepted and executed, then the monopole structures are a feasible alternative.*"

Figure 28 – Compliance with standards

Right-of-Way Width Factors

Is access requirement the determining factor needing an 80 m ROW? Consider:

500 kV Arizona



M602F near Piney

Figure 29 – Access requirements

Right-of-Way Width Factors

- **In EIS Chapter 2. P20 it states: "*Steel lattice towers allow for longer span lengths, thereby reducing the number of obstacles that land owners may need to avoid..*"**

- **However, no landowners were consulted**

100 square m base **5 square m base**

Figure 30 – Comparison of footprints

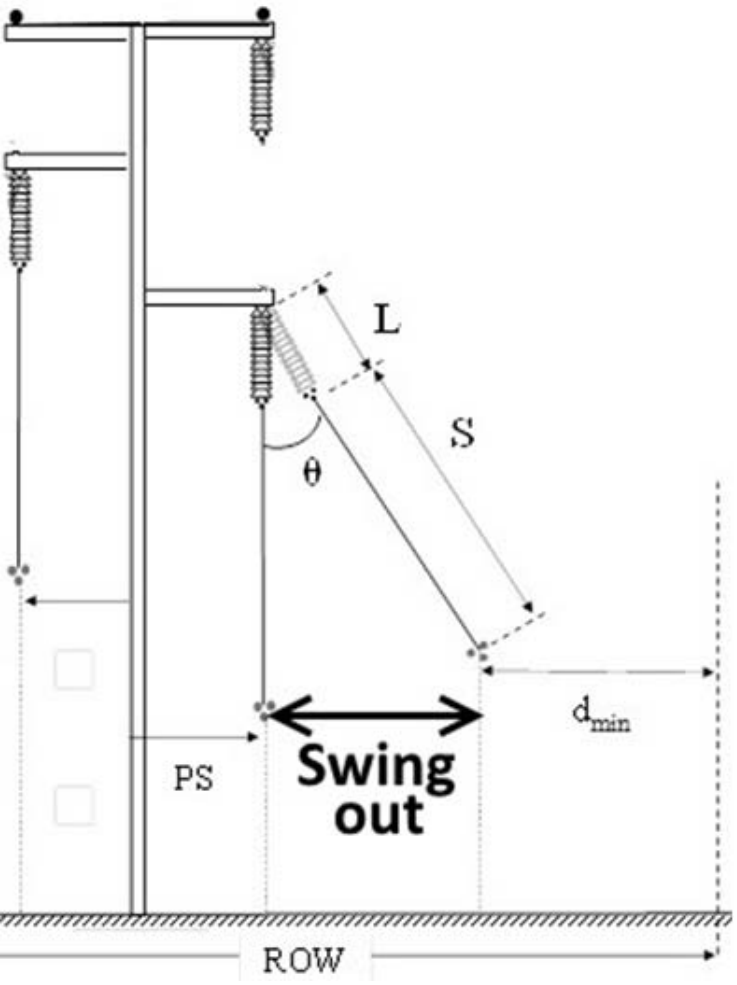
Right-of-Way Width Factors

The width of ROW is a critical factor, both for environment when passing through wild lands and for agriculture. Lower profile transmission towers allow for a narrower ROW

ROW width & land area not considered significant by Manitoba Hydro and the EPRI-GTC process (Appendix B)

Figure 31 – Width of ROW & Environment

Benefits of a Narrower ROW

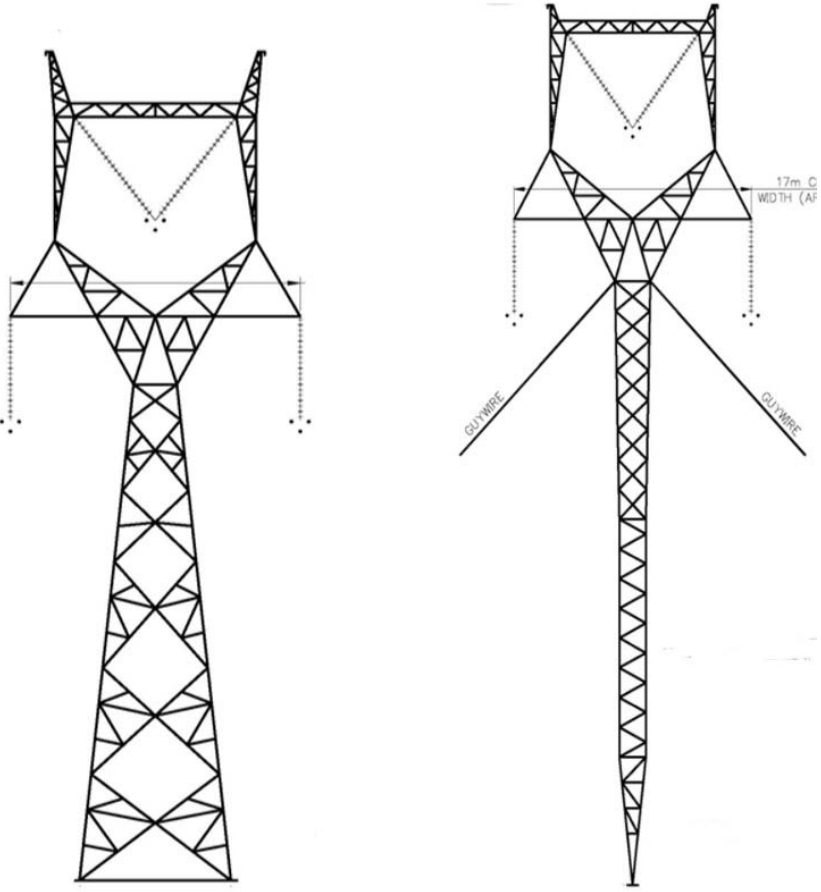


Fewer trees cut down in forested areas – more CO_2 sequested and less disturbance to environment and agriculture

More pleasing visual appearance and to the landscape enabling greater social acceptance

Figure 32–Reducing environmental impact

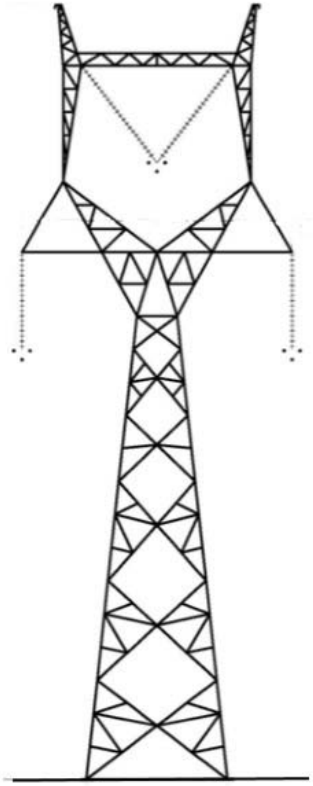
Transmission Alternatives Presented to Public



- The only transmission line presented to the public
- Impacted persons not consulted on transmission line design
- Recent trend is to allow choice of towers to public

Figure 33– The MMTP transmission towers

Options for those Impacted



Model T

Tesla S

230 kV?

Figure 34– Comparing transmission towers

Tubular Low Profile Line

Is it possible to go roadside like a typical 66 kV rural feeder?

Figure 35– Going roadside with MMTP

Conclusions & Recommendations

1. **Take advantage of the 21 month delay of Keeyask and delay MMTP**
2. **Since Manitoba Hydro's Preferred Development Plan is not materializing as planned and since the RECSI study for transmission to SaskPower is due end of 2017 then:**

Take time available to determine the most economical way forward

Figure 36

Conclusions & Recommendations

3. **Use the delay time available work with international transmission line design experts to design a more aesthetic and cost effective transmission line to improve social acceptance of the MMTP interconnection including a detailed review of its rating and costs**

Figure 37

Conclusions & Recommendations

4. **Where MMTP adversely impacts communities, landowners and the environment then:**

Take time available to examine the advantage a low profile transmission line offers and reconsider its route and ROW and consult on designs to improve social acceptance and reduced environmental impact

Figure 38


Thank you