

Transmission Lines





The electric grid is the biggest and most complex machine ever built

Transporting power from where it is generated to where it is needed

The flow of power

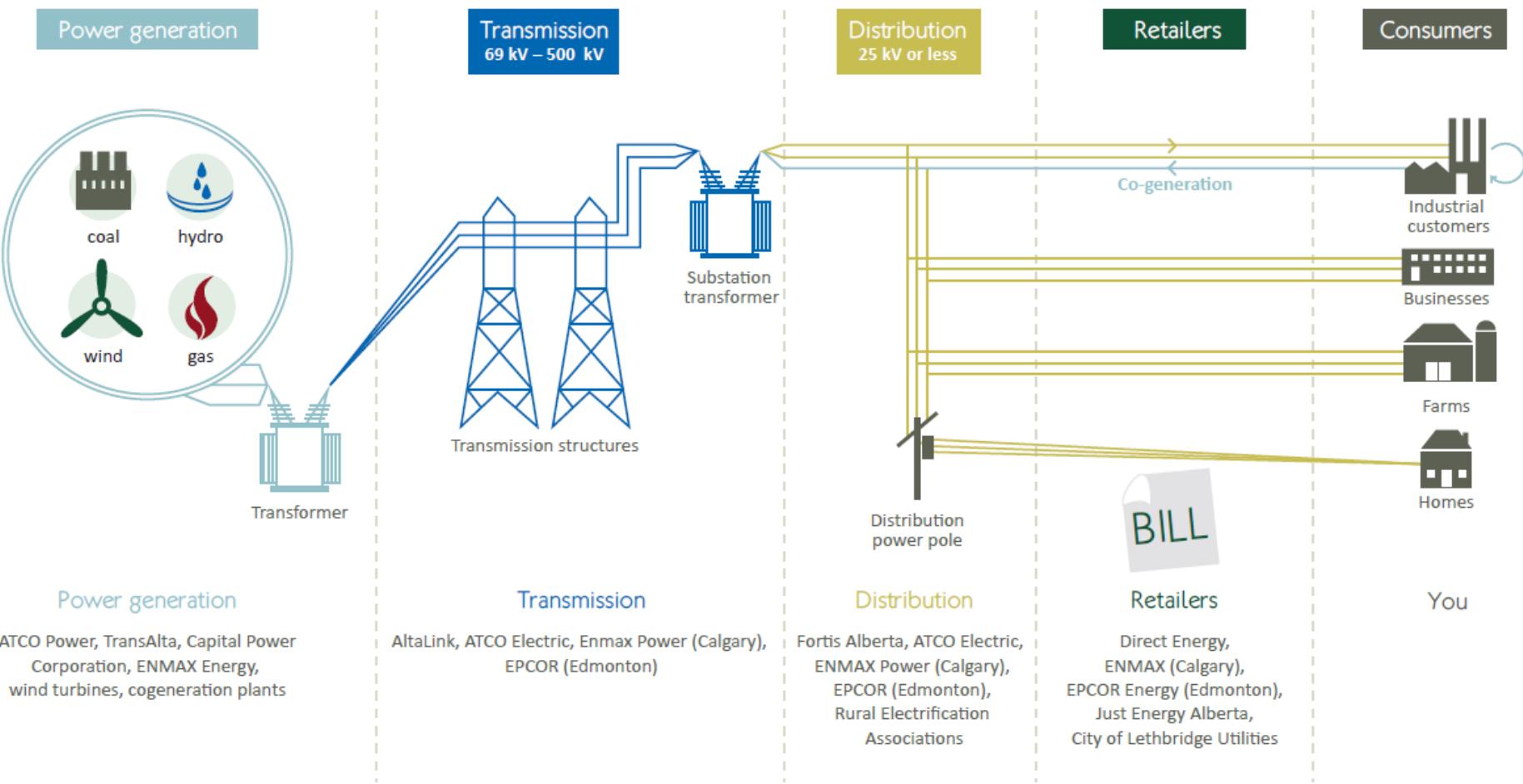
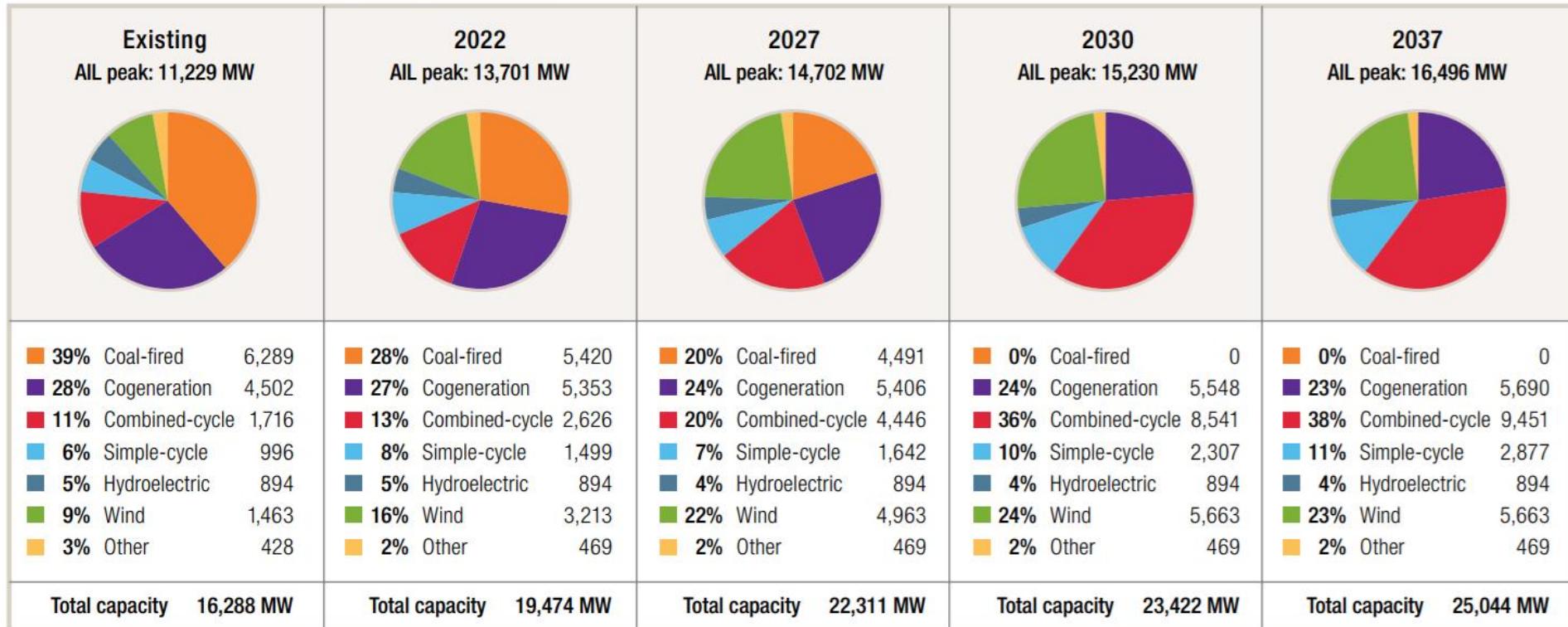
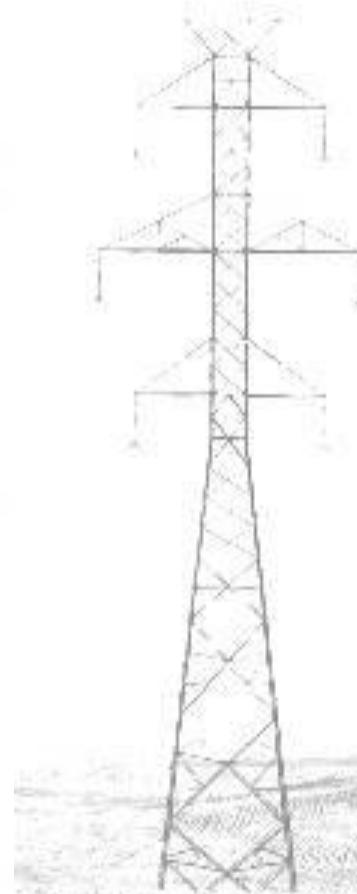
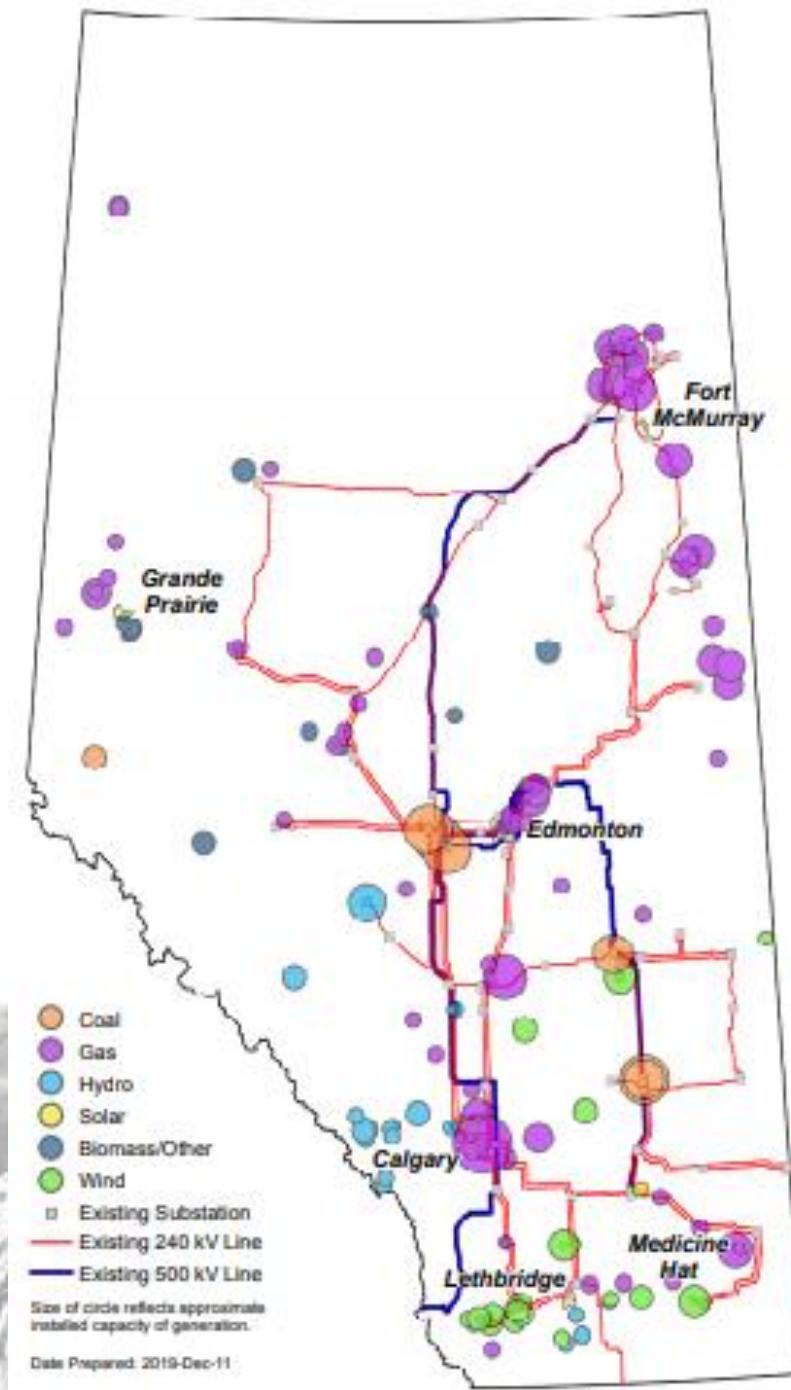


FIGURE 7: Generation capacity mix comparison



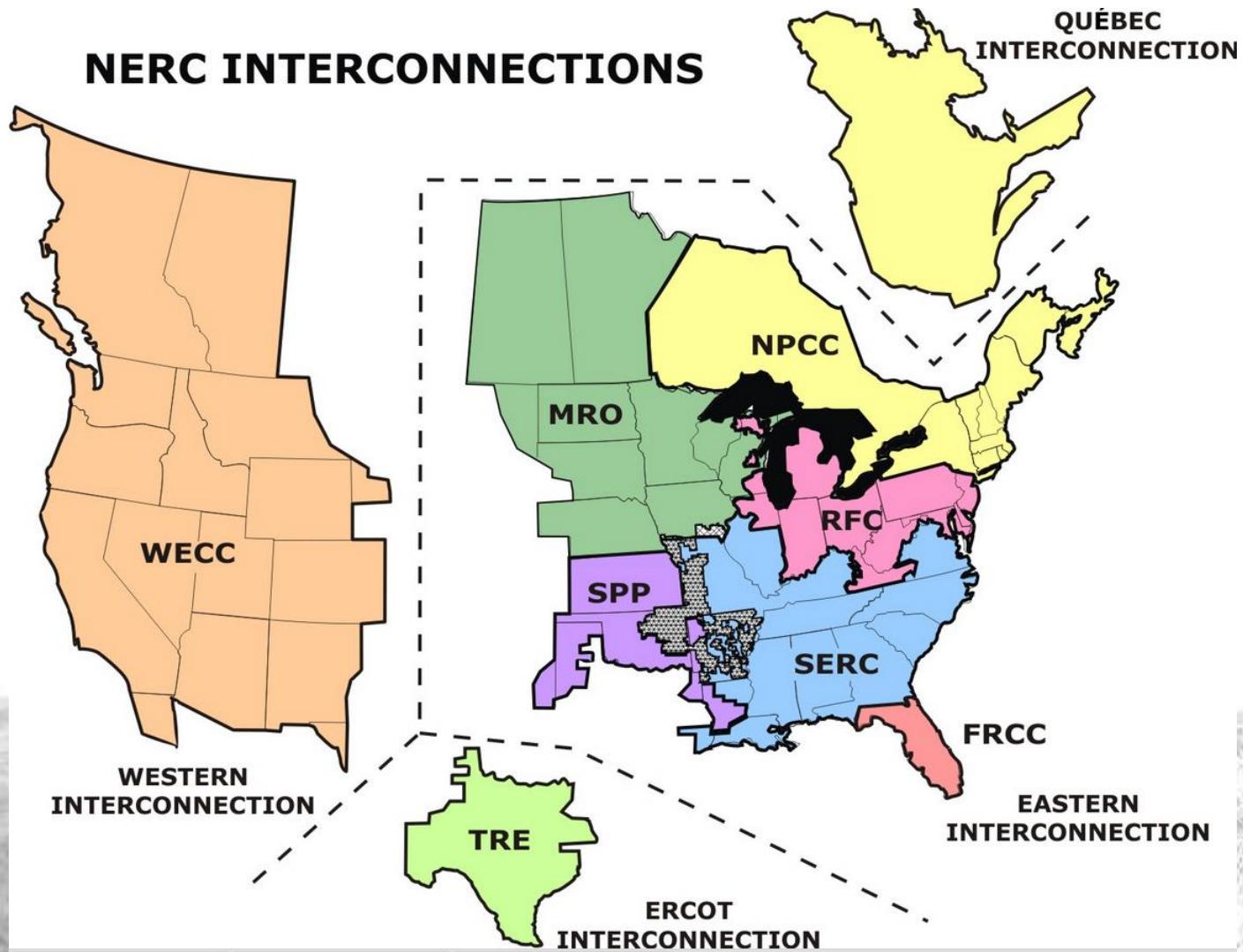


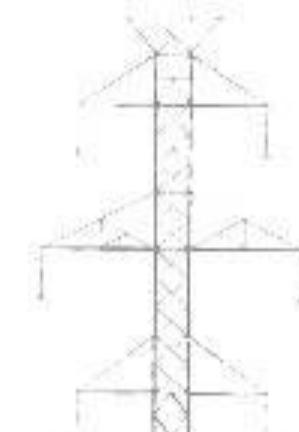
Knowyourpower.ca

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NERC INTERCONNECTIONS







ALATALINK

EPCOR

ATCO
Electric



It is the TFO's responsibility to build, operate and maintain facilities within their service area.



Transmission Facilities Owner

We are responsible for all aspects of the transmission grid

Substations

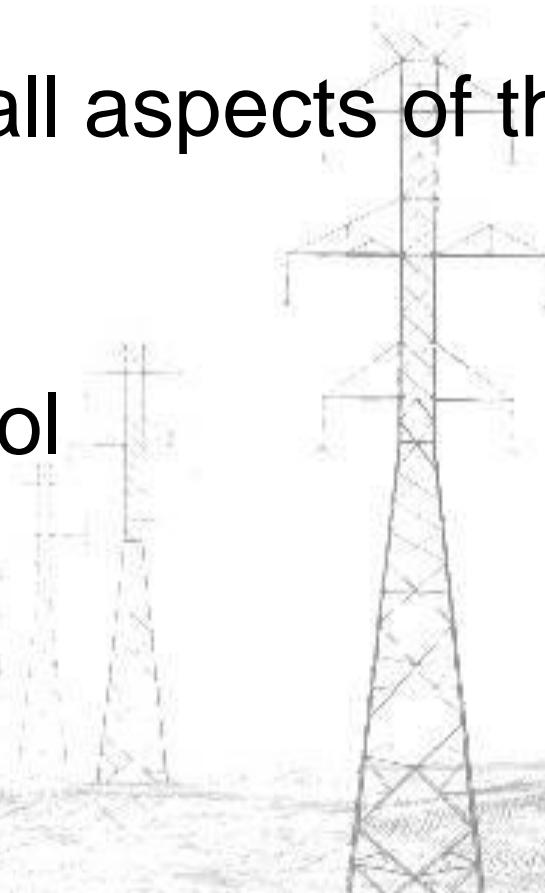
Protection and Control

Telecom/Scada

Transmission Lines

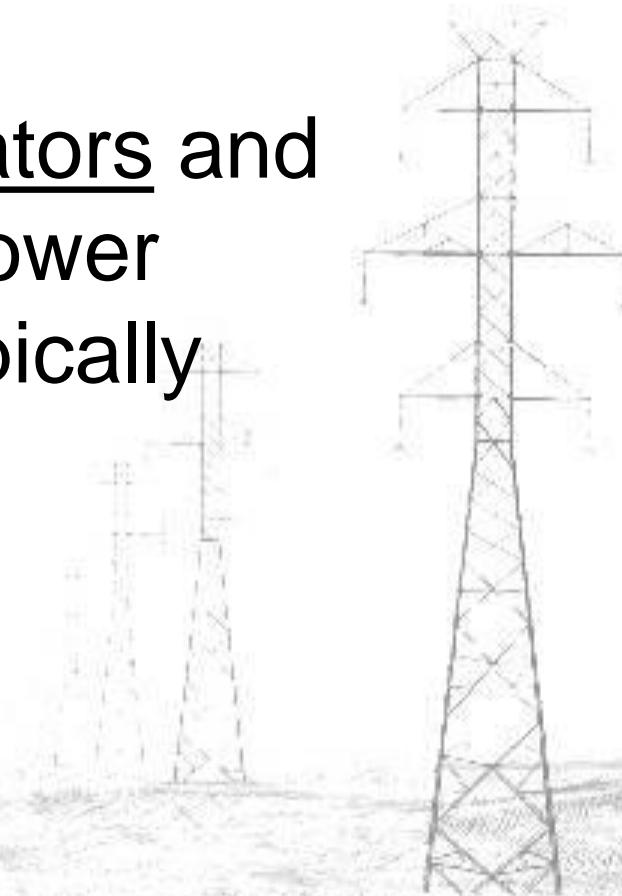
Maintenance

Operations



What is a Transmission Line?

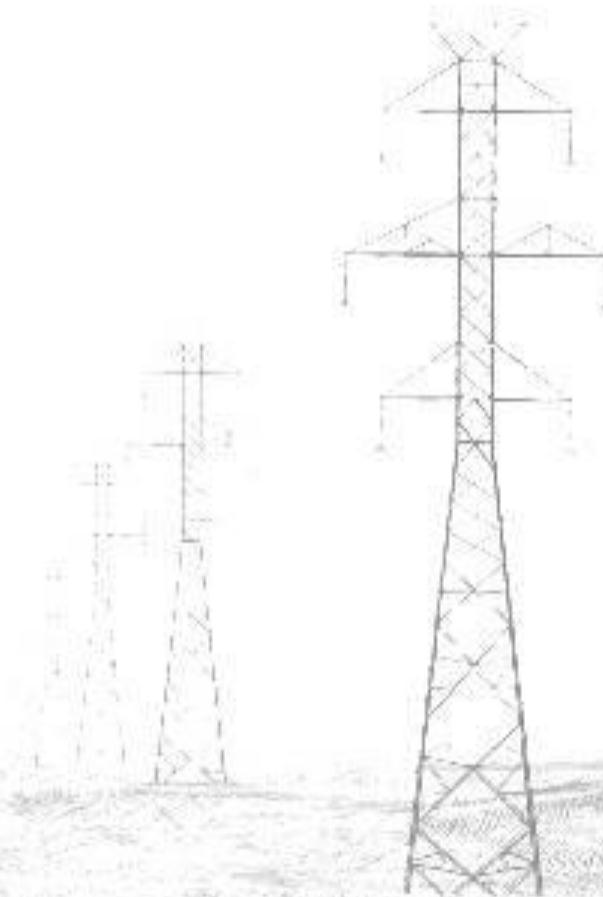
Collection of wires, insulators and
structures to transfer power
between two points, typically
source to load.





Transmission Voltage

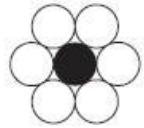
69kV	345kV
115kV	500kV
138kV	795kV
144kV	1000kV
230kV	1200kV
240kV	



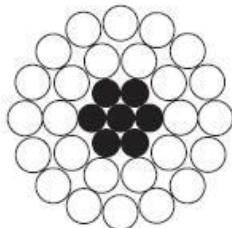
5 Best Conducting Materials

Material	Resistivity	Cost*
Silver	15.87 nΩ·m	\$460/kg
Copper	16.78 nΩ·m	\$4.5/kg
Gold	22.14 nΩ·m	\$51,950/kg
Aluminum	26.50 nΩ·m	\$0.75/kg
Calcium	39.1 nΩ·m	

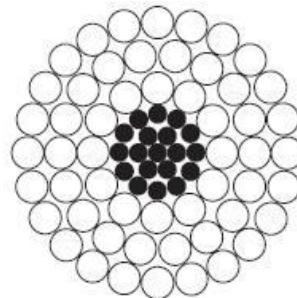
*Average/Approximate Prices



6/1 ACSR



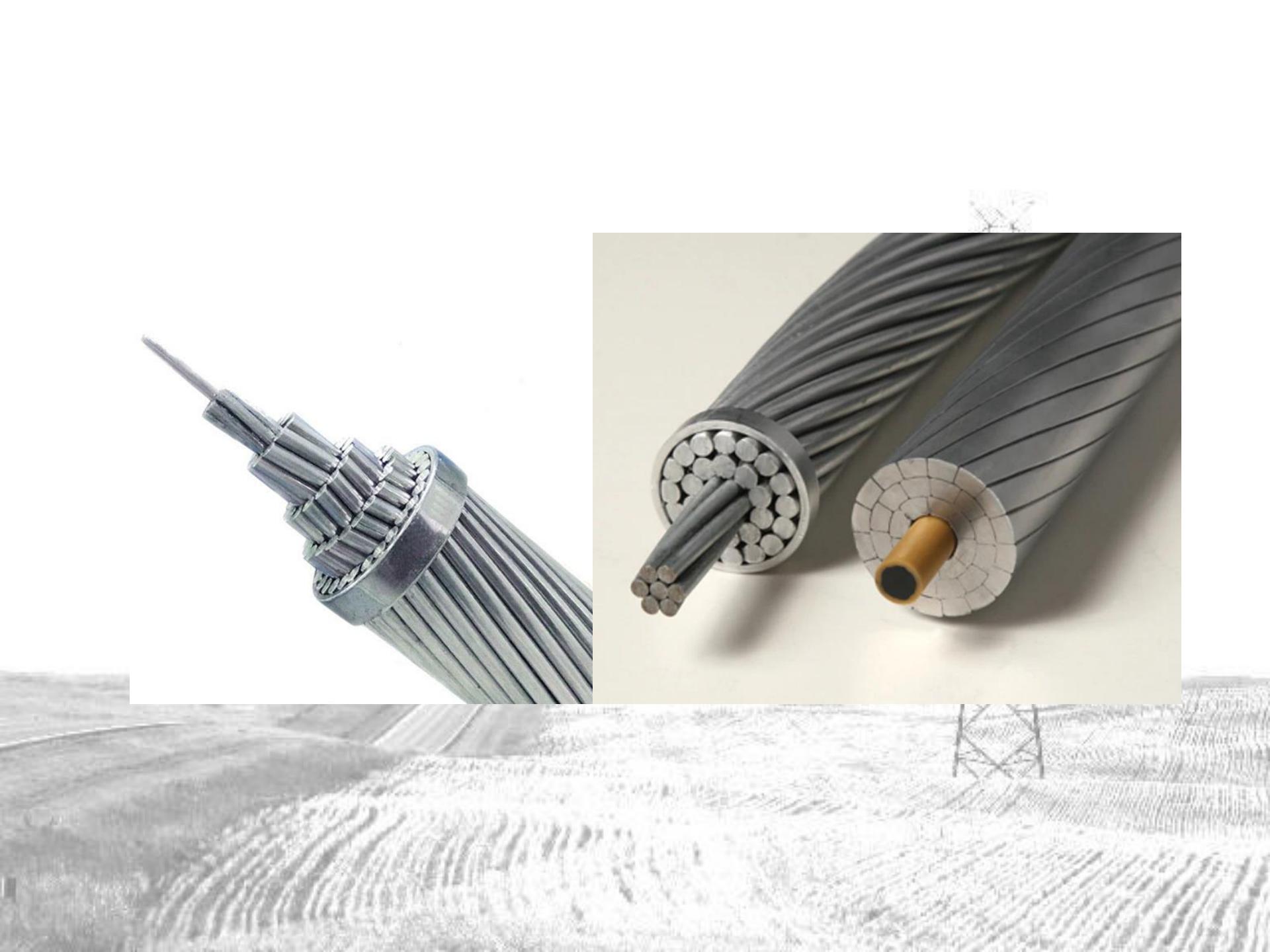
26/7 ACSR



54/19 ACSR



- Aluminum wires around a steel core
- More aluminum = lower resistance
- More steel = higher strength
- Larger conductor = Larger forces



Shield Wires

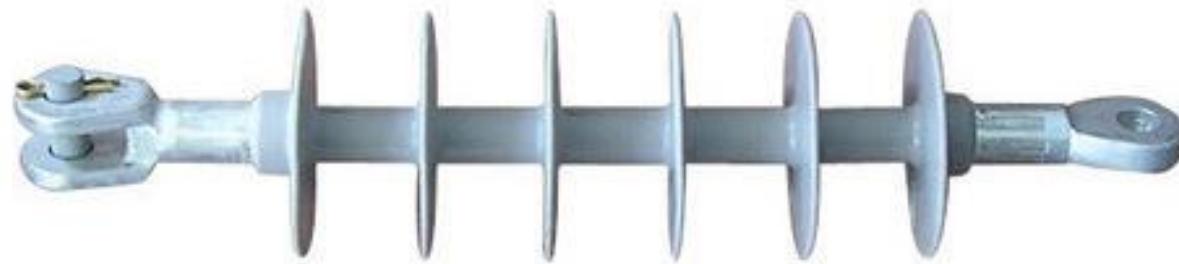
- OHSW
- OPGW



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Insulation

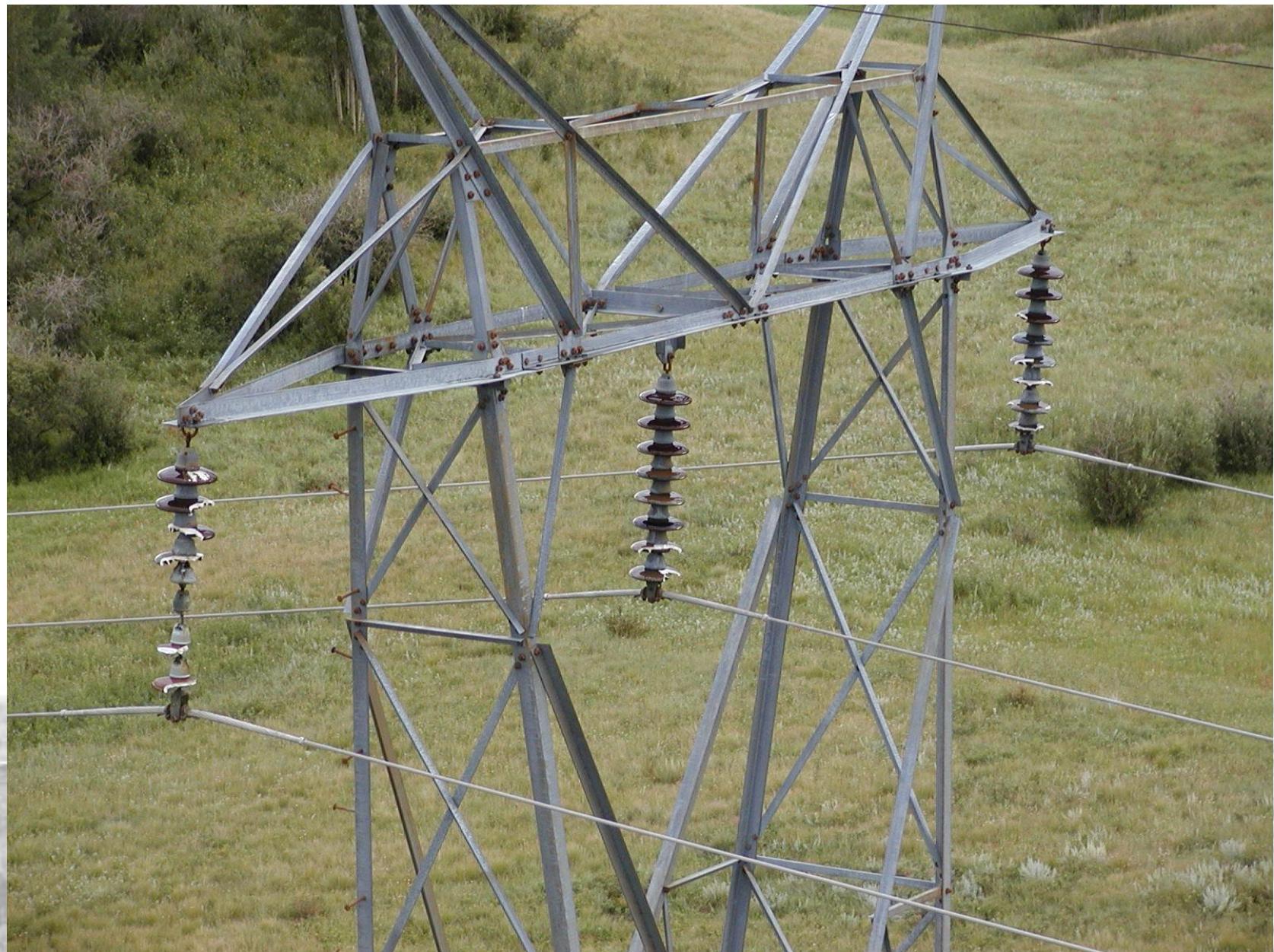
- Porcelain, Glass or Silicon Polymer
- Chosen for mechanical and electrical properties
- Electrical = BIL and Leakage Distance
- Mechanical = Strength and Other





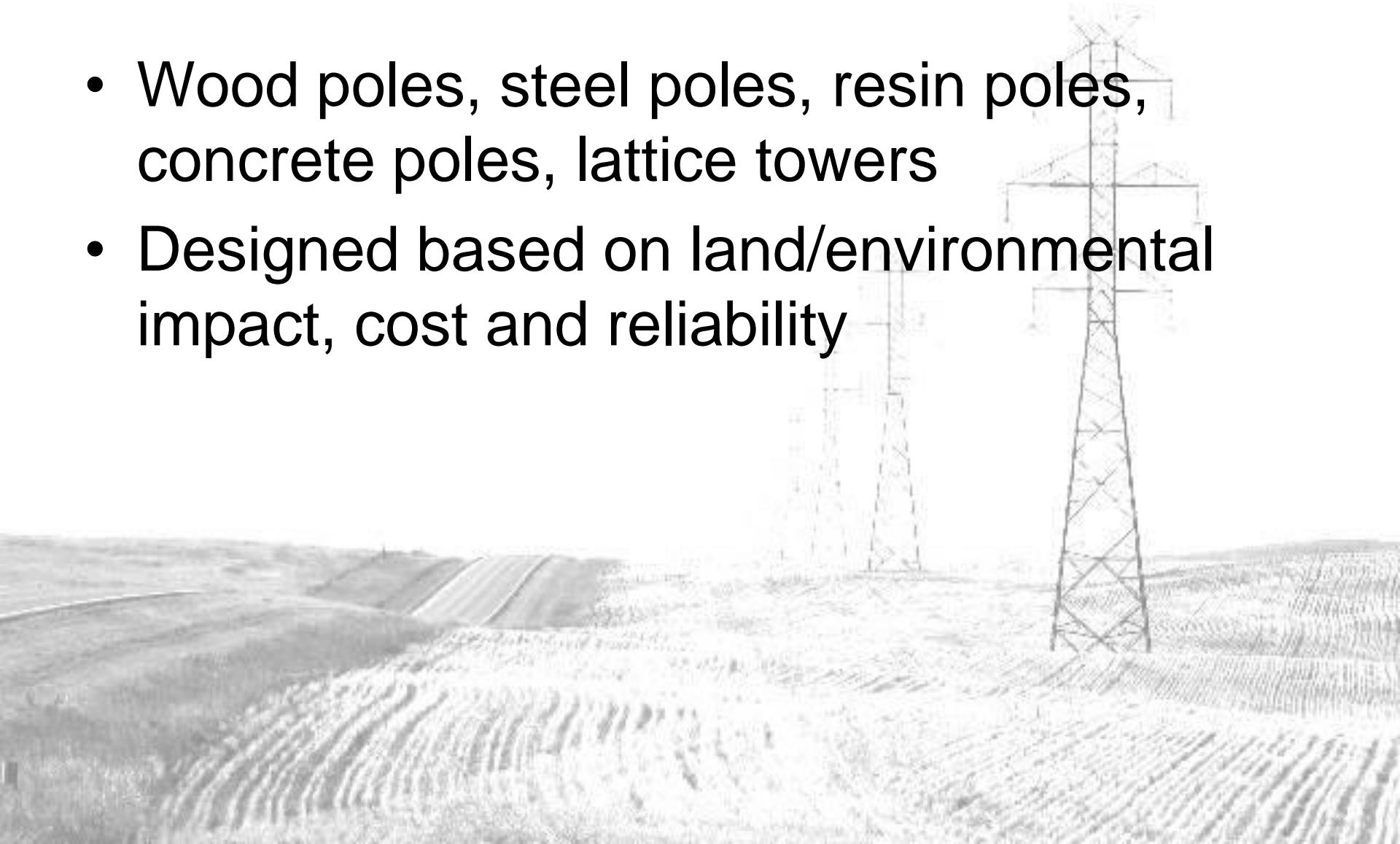
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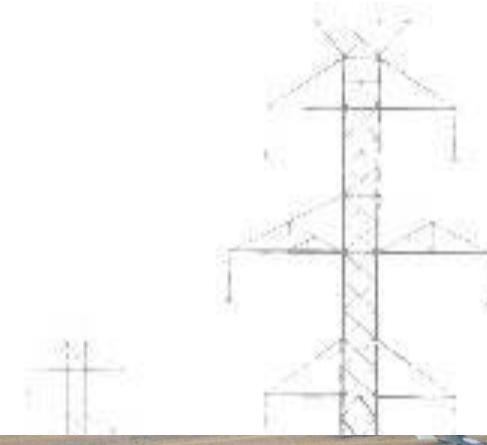
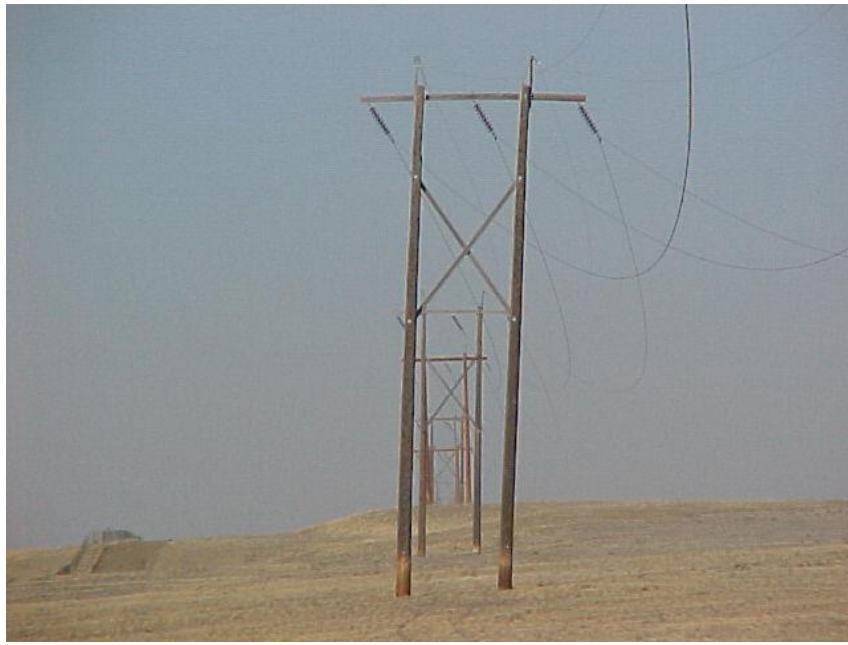
Structures

- Wood poles, steel poles, resin poles, concrete poles, lattice towers
- Designed based on land/environmental impact, cost and reliability



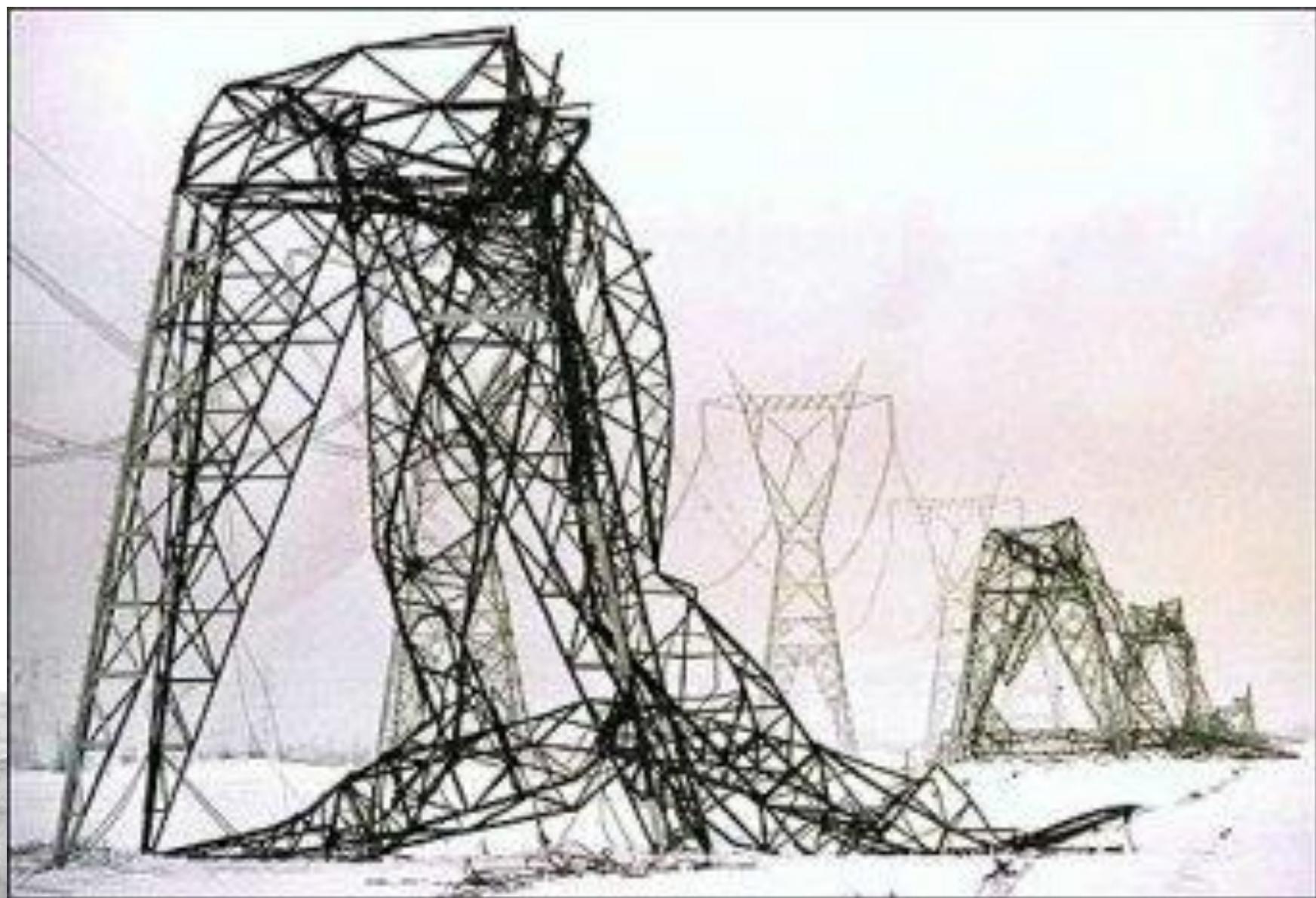
Reliability Requirements

- Safety
- Security of Supply
- Impacts of Outages
- Environmental Loadings
- Reliability is typically specified as a return period (ie. Can withstand a 1 in 100 year event)









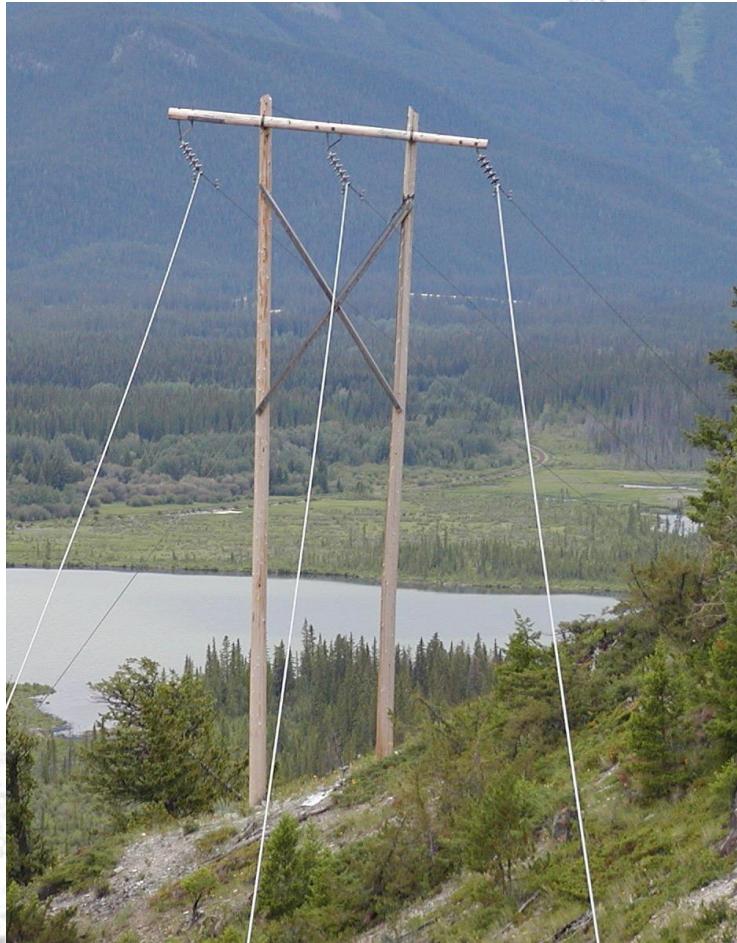
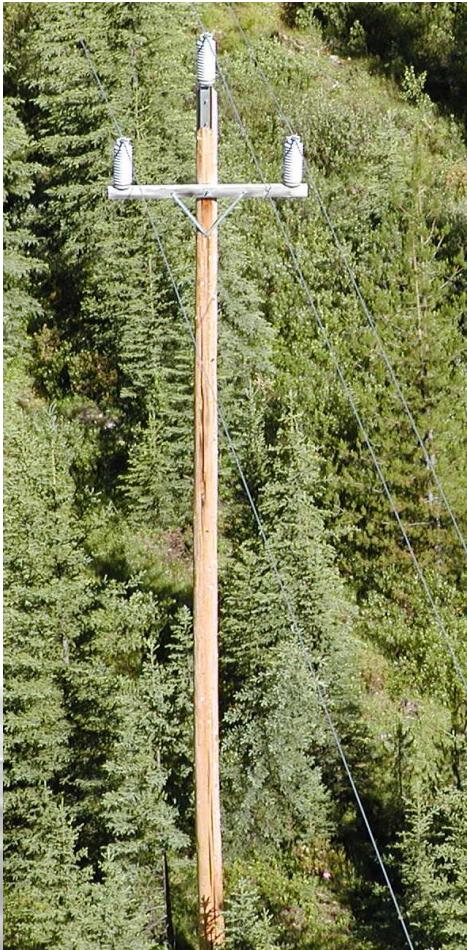
Reliability Requirements

Higher Reliability = Higher Initial Cost

Lower Reliability = Higher maintenance costs

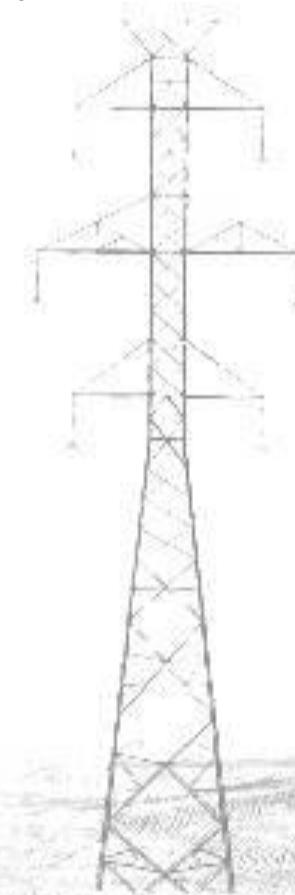
69kV Structures

(Pin Top or ~5 bells)



138kV Structures

(Post Insulators or ~7-8 Bells)









240kV Structures

(~12-16 Bells)

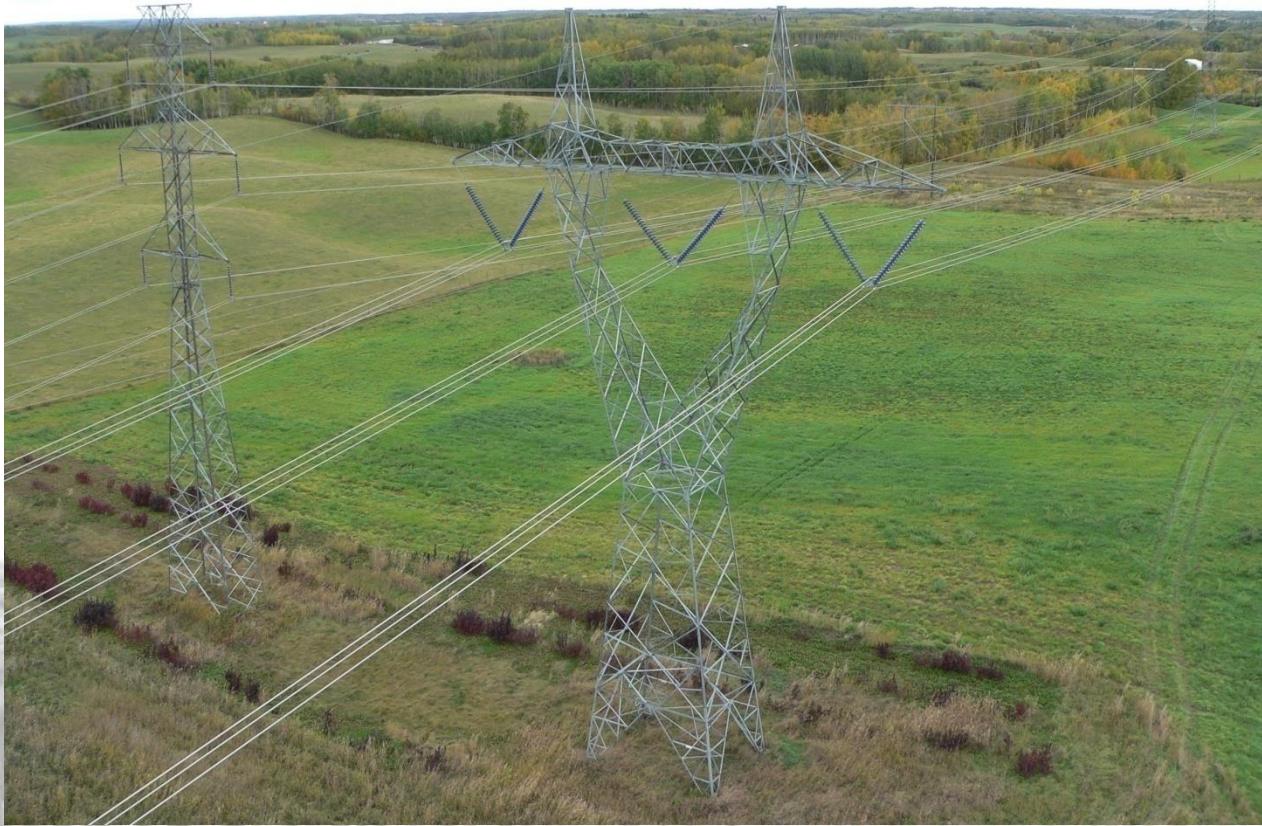


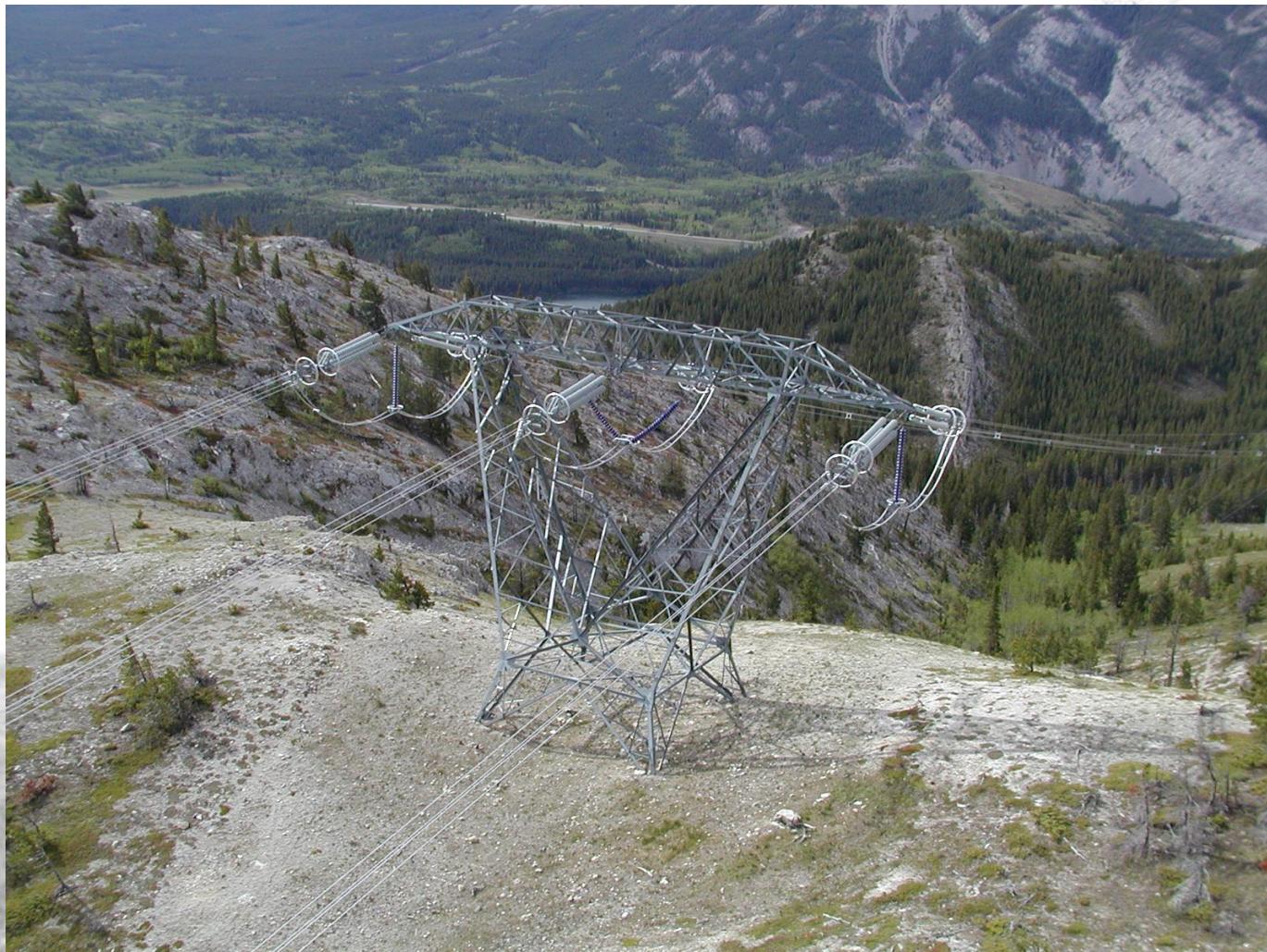




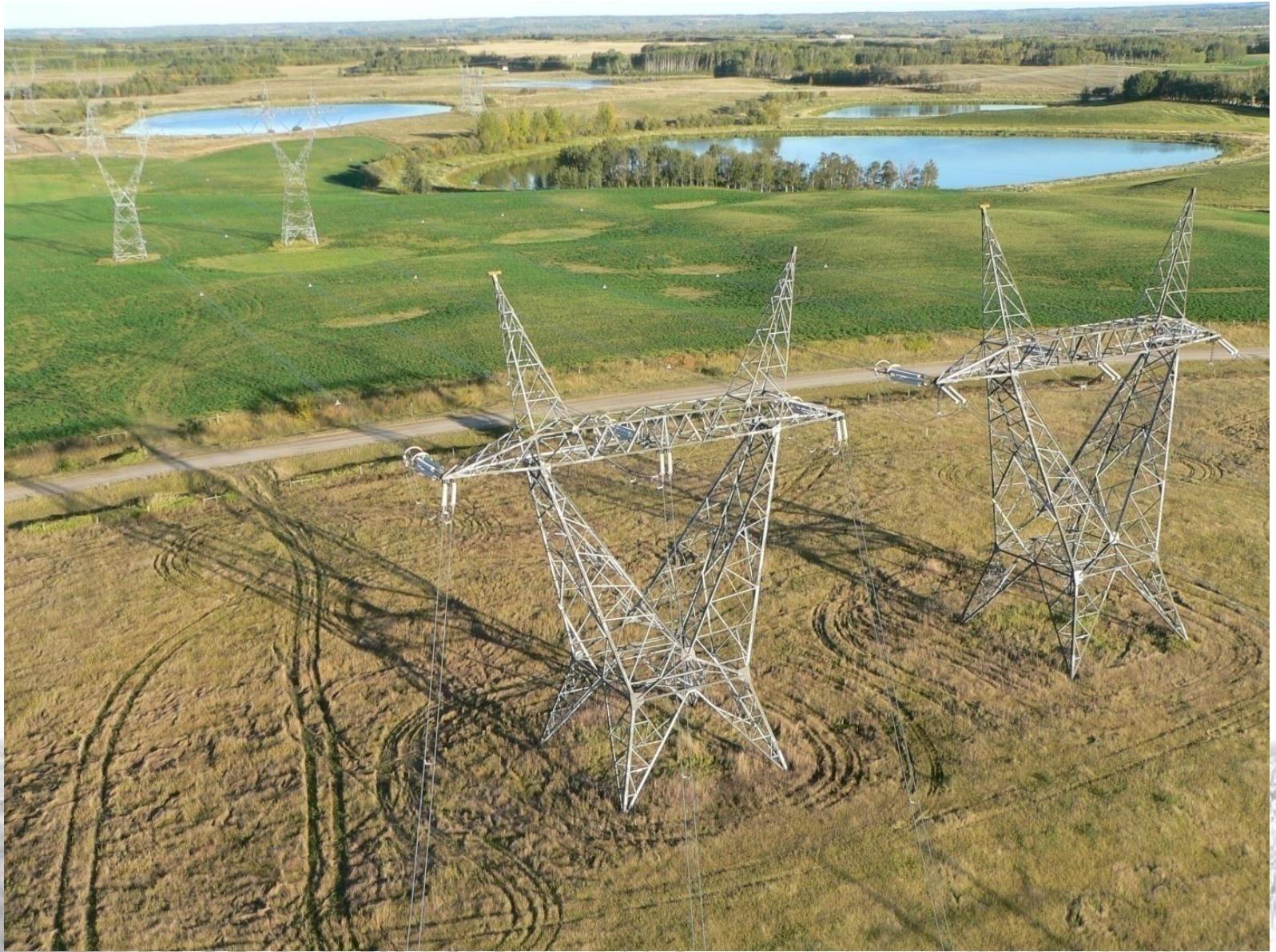


500kV (Lots of Insulators)









Questions??

