

# Cigre Paris Meeting 2010

TAG-04

FREE Presentation

Electrical losses monitored at 138 kV OHTL in  
Brazil during one year

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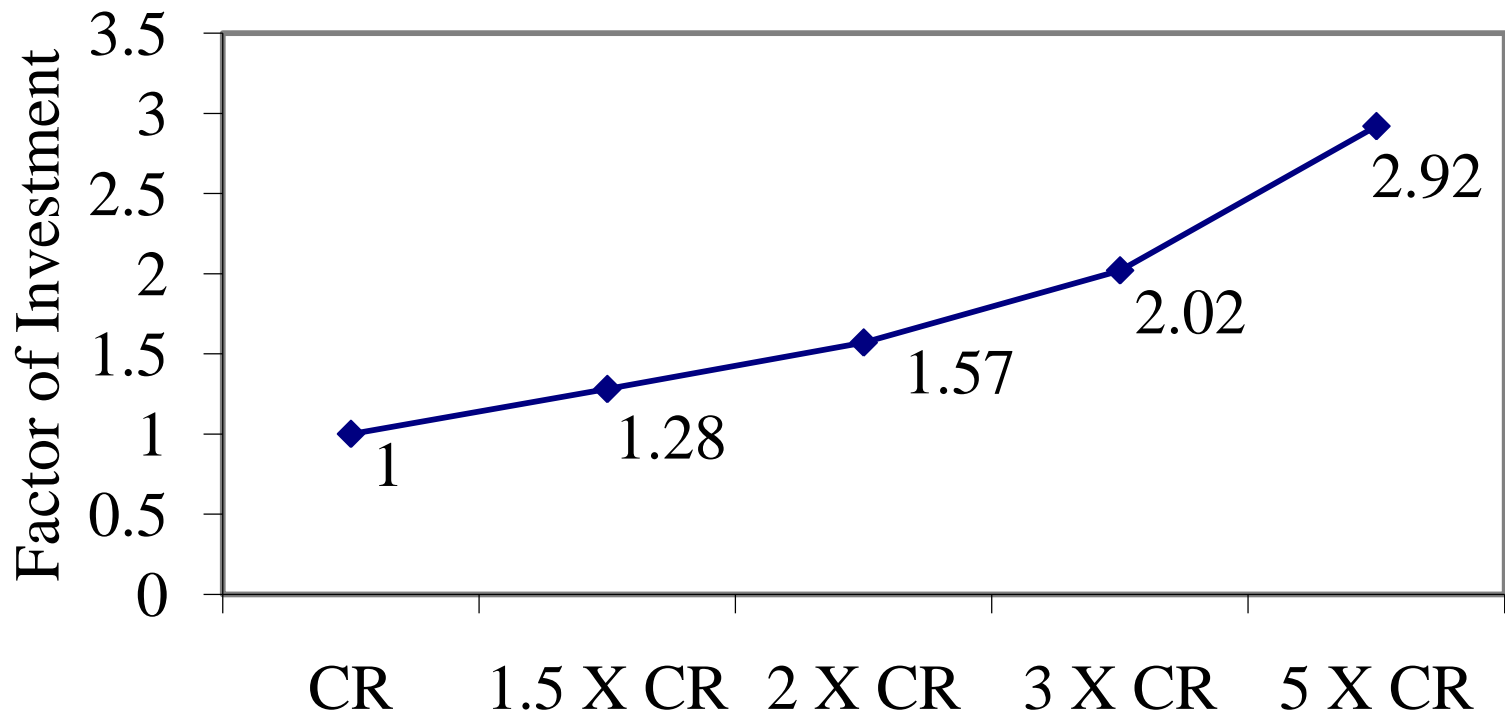
# Cost of OHTL

$$C_i = C_{Fix} + C_{Var}$$

- Variable inputs:
  - ✓ conductors;
  - ✓ tower e foundations
  - ✓ Worker (construction tower and foundations
  - ✓ Electrical losses
- Fix inputs
  - ✓ design, isolation, land.

$$C_i = C_{Fix} + C_{Var}$$

$$C_i = C_{Fix} + F_i \cdot C_{Var} + F_l \cdot C_l$$



CR = Cost of Reference

conductor ACSR Linnet 336

## Cost of Electrical losses

$$C_i = C_{Fix} + F_i \cdot C_{Var} + F_l \cdot C_l$$



Sensor Power Donut  
temperature e current

## Cost of Electrical losses

$$Losses_D = N_{phases} \cdot R_{Tcond} \cdot (F_l \cdot I_{N,Tcond})^2$$

$Losses_D$  : deterministic losses W/km of OHTL;

$N_F$  : number of phases (ex.: three phases,  $N = 3$ );

$F_l$  : Load Factor between 0 e 1;

$R_{tcond}$  : resistance AC ( $\Omega$ /km) at temperature of conductor;

$I_{N,Tcond}$  : current (A) at temperature of conductor.

# Cost of Electrical losses

$$C_i = C_{Fix} + F_i \cdot C_{Var} + F_l \cdot C_l$$

$$L_{Real} = \sum_{n=1}^{8.760} \left( 3 \cdot L \cdot R_{Tm,n} \cdot I_n^2 \right) \cdot \Delta t \cdot 10^{-6}$$

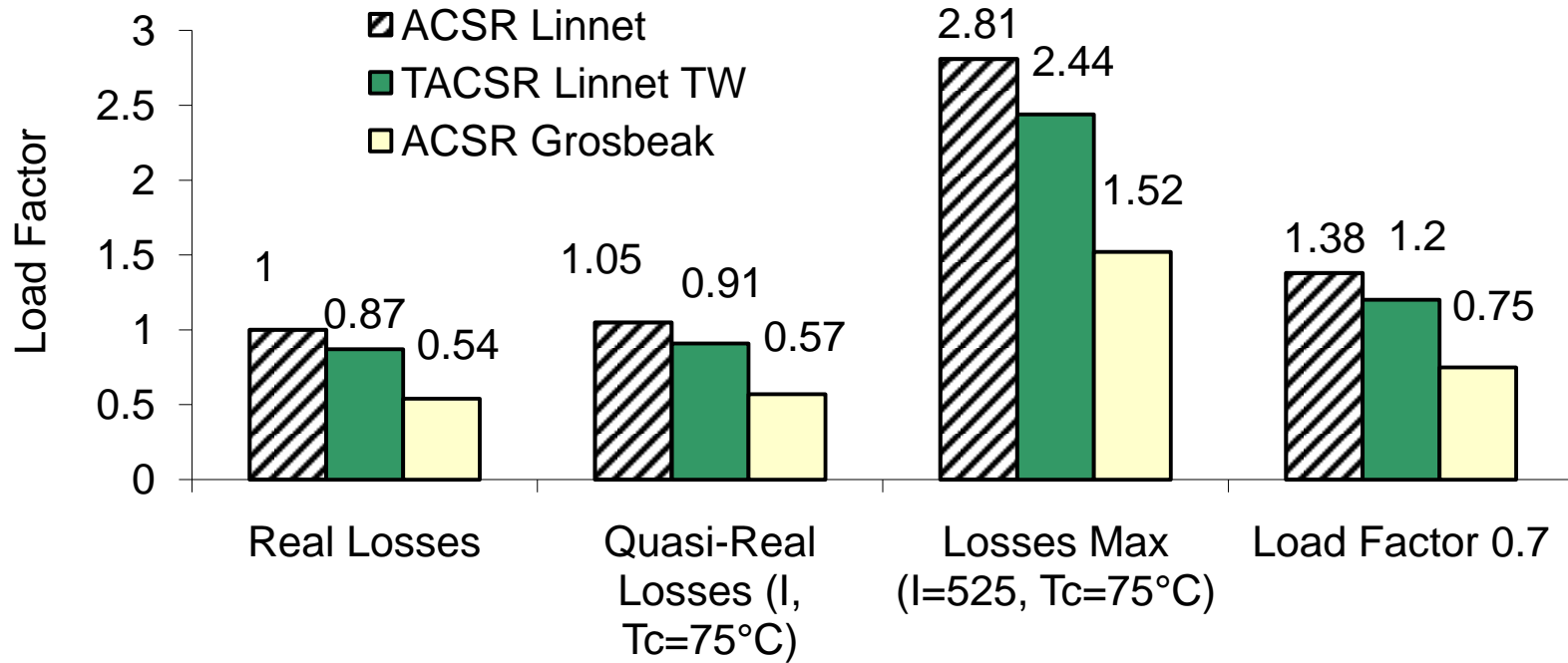
$$C_{Losses} = \sum_{m=1}^{Time} L_{R,m} \cdot C_{1MWh} \cdot (1-i)^m$$



- $L_{Real}$  : electrical losses by year (MWh), based on monitoring;
- $L$  : length of IOHTL (km);
- $R_{Tm}$  : electrical resistence AC ( $\Omega$ /km) get at conductor temperature;
- $I_n$  : hour average current of conductor (A);
- $\Delta t$  : period of integration (1 hour);
- $n$  : period of acumulation (1 year = 8760 hours);
- $C_{losses}$  : cost of electrical losses for 30 year (U\$);
- $m$  : period of time (30 years);
- $C_{MWh}$  : final cust of losses (U\$/MWh), in Brazil U\$ 80 MWh
- $i$  : internal hate of return (12% year in Brazil).

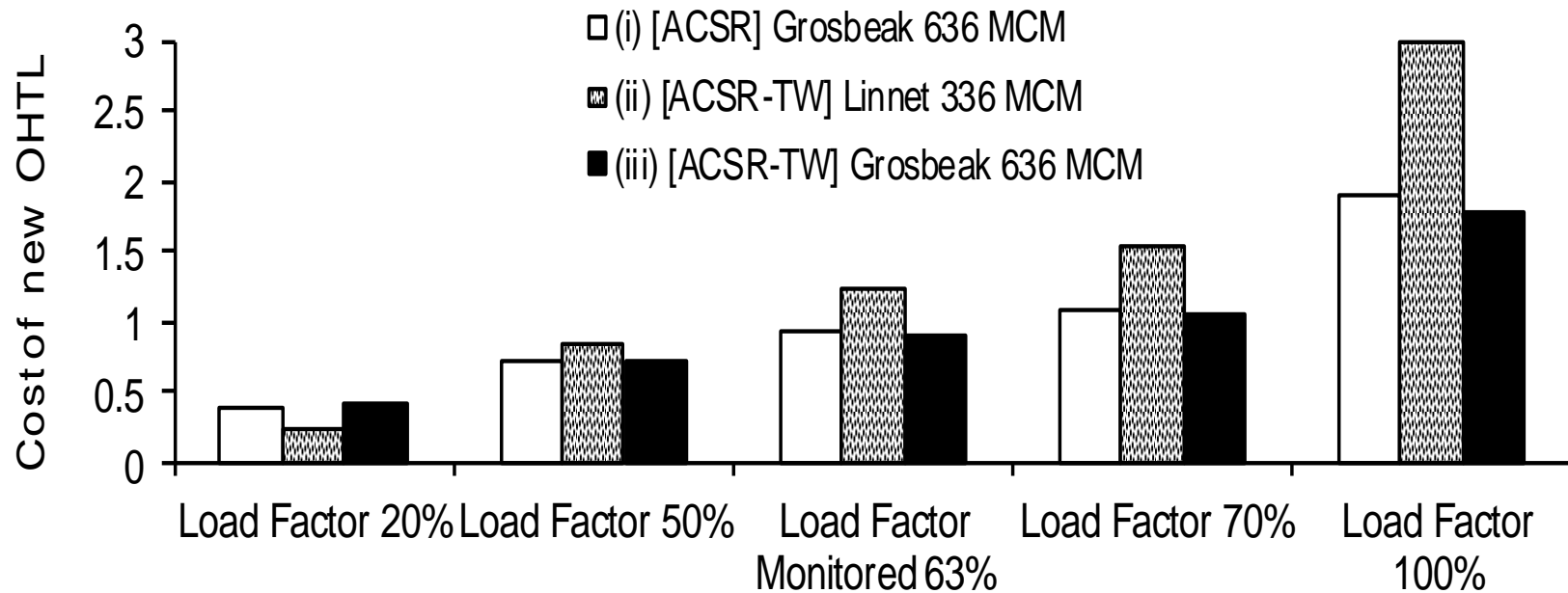


$$C_i = C_{Fix} + F_i \cdot C_{Var} + F_l \cdot C_l$$



OHTL 138 kV and 125 MVA monitored for one year

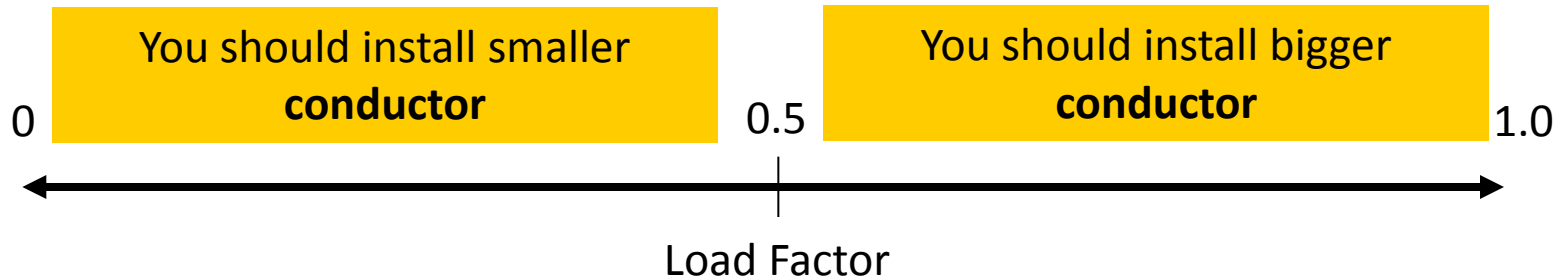
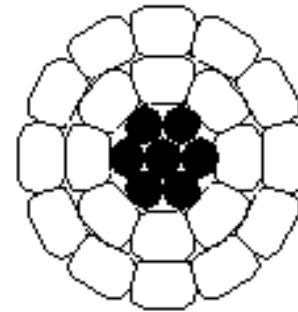
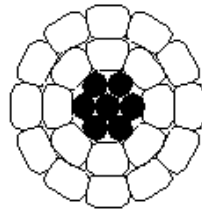
## Upgrading 138 kV from 125 MVA to 220 MVA



- Conductors (ii and iii) have double price to (i) at same weight.
- Conductor (ii) use the same tower.
- Conductors Grosbeak (i) and (iii) require new towers.

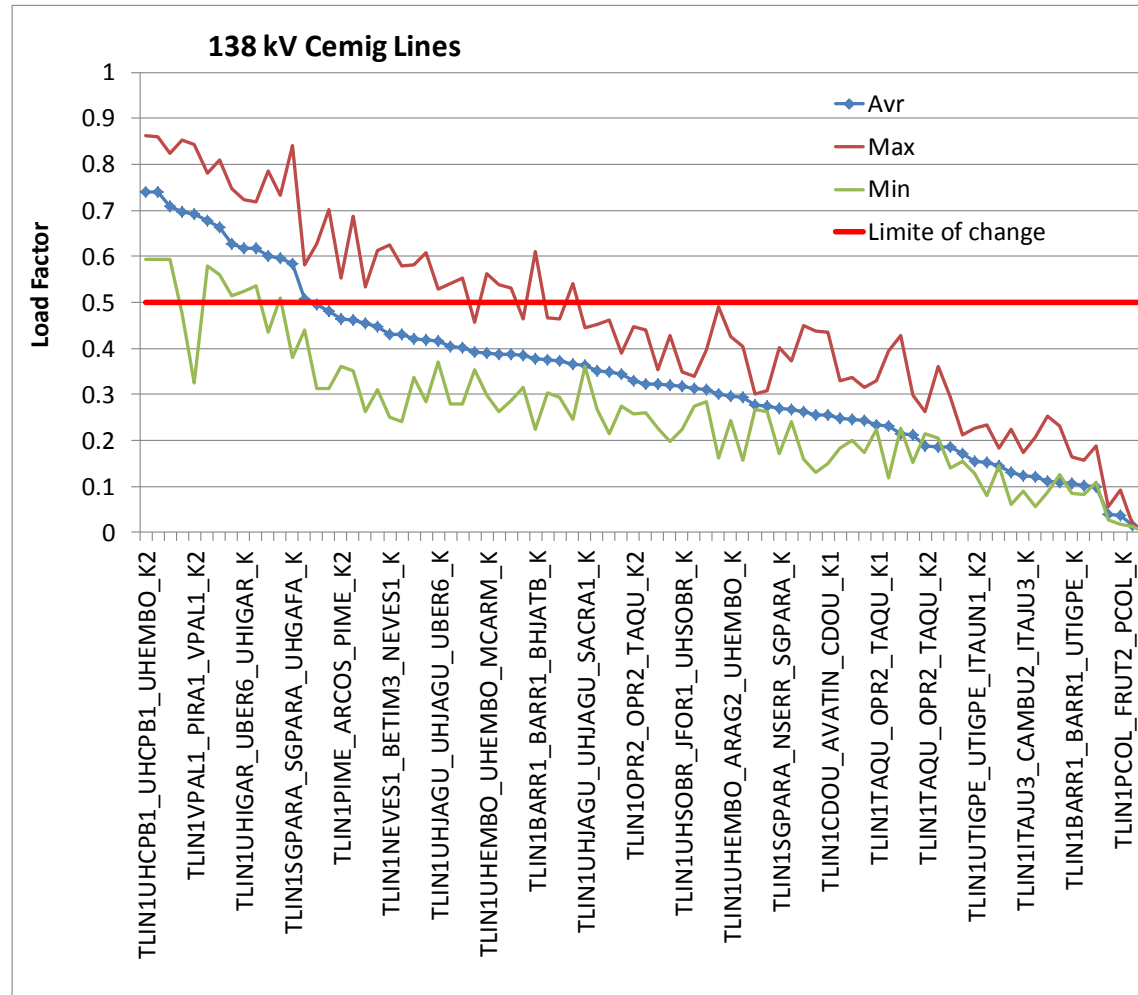
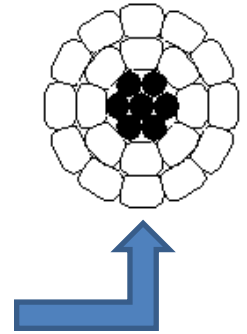
# Conclusion

We can retiring  
conductor  
round wire!



# Load Factor Monitored at Station around 20000 km

You should  
install bigger  
conductor



You should  
install  
smaller  
conductor

