

# Distribution System Loss Caps



**DRAFT RULES**



# Outline



- Summary of Proposed Rules for Distribution System Loss Caps
- Determination of DSL Caps
- Performance and Incentive Schemes for Distribution System Efficiency
- Implementation Schedules
- Reportorial Requirements



# Distribution System Loss Assessment and Reporting



- Technical and Non-Technical loss components shall be calculated monthly and reported quarterly
- Technical Loss in sub-transmission and substation separate from Technical loss in feeders
- Technical losses shall be calculated using three-phase power flow for unbalanced systems



# Feeder Technical Loss Caps



<b>Cluster ID</b>	<b>Feeder Technical Loss Cap</b>
<b>Cluster 1</b>	7.00%
<b>Cluster 2</b>	5.50%
<b>Cluster 3</b>	3.25%
<b>Cluster 4</b>	2.75 %



# Distribution Utilities by Cluster



## Cluster 1

BANELCO	FICELCO	MOPRECO	SIASELCO
BASELCO	IFELCO	OMECCO	SULECO
BATANELCO	KAELCO	ORMECO	TAWELCO
BISELCO	LUBELCO	PALECO	TIELCO
CASELCO	MARELCO	PROSIELCO	TISELCO
CELCO	MARIPIPI	ROMELCO	
DIELCO	MASELCO	SIARELCO	



## Cluster 2

ABRECO	CASURECO I	ILECO III	NEECO II - AREA II	SAMELCO II
AKELCO	CASURECO II	INEC	NOCECO	SOLECO
ALECO	CASURECO III	ISECO	NONECO	SORECO I
ANECO	CASURECO IV	ISELCO I	NORECO I	SORECO II
ANTECO	CEBECO I	ISELCO II	NORECO II	SUKELCO
ASELCO	CEBECO II	LANECO	NORSAMELCO	SURNECO
AURELCO	CEBECO III	LASURECO	NUVELCO	SURSECO I
BATELEC I	CENPELCO	LEYECO I	PANELCO I	SURSECO II
BENECO	COTELCO	LEYECO III	PANELCO III	TARELCO I
BILECO	DANECO	LEYECO IV	PELCO I	TARELCO II
BOHECO I	DASURECO	LEYECO V	PELCO II	ZAMECO I
BOHECO II	DORECO	LUELCO	PELCO III	ZAMECO II
BUSECO	ESAMELCO	MAGELCO	PRESCO	ZAMSURECO I
CAGELCO I	FIBECO	MOELCI I	QUEZELCO I	ZAMSURECO II
CAGELCO II	FLECO	MOELCI II	QUEZELCO II	ZANECO
CAMELCO	GUIMELCO	MORESCO II	QUIRELCO	
CANORECO	ILECO I	NEECO I	SAJELCO	
CAPELCO	ILECO II	NEECO II - AREA I	SAMELCO I	

# Distribution Utilities by Cluster



## Cluster 3

BATELEC II	CENECO
MORESCO I	LEYECO II
PENELCO	SOCOTECO II
SOCOTECO I	ZAMCELCO



# Distribution Utilities by Cluster



## Cluster 4

AEC	ILPI
BLCI	LUECO
CEDC	MECO
CELCOR	MERALCO
CEPALCO	PECO
CLPC	OEDC
DECORP	SFELAPCO
DLPC	TEI
BELS	VECO
IEC	SUBIC EZ





# Non-Technical Loss Caps



- 4.50 % for Electric Cooperatives
- 1.25 % for Private Distribution Utilities



# Distribution System Loss Recoverable Through System Loss Charge



Cluster ID	Total Loss Cap
Cluster 1	$TL_{ST+SS} + 11.50 \%$
Cluster 2	$TL_{ST+SS} + 10.00 \%$
Cluster 3	$TL_{ST+SS} + 7.75 \%$
Cluster 4	$TL_{ST+SS} + 4.00 \%$

Note:  $TL_{ST+SS}$  is the simulated Sub-Transmission and Substation Technical Loss



# Determination of Distribution System Loss Caps



# Determination of System Loss Caps



- Sub-Transmission and Substation Technical Loss
- Feeder Technical Loss
- Non-Technical Loss



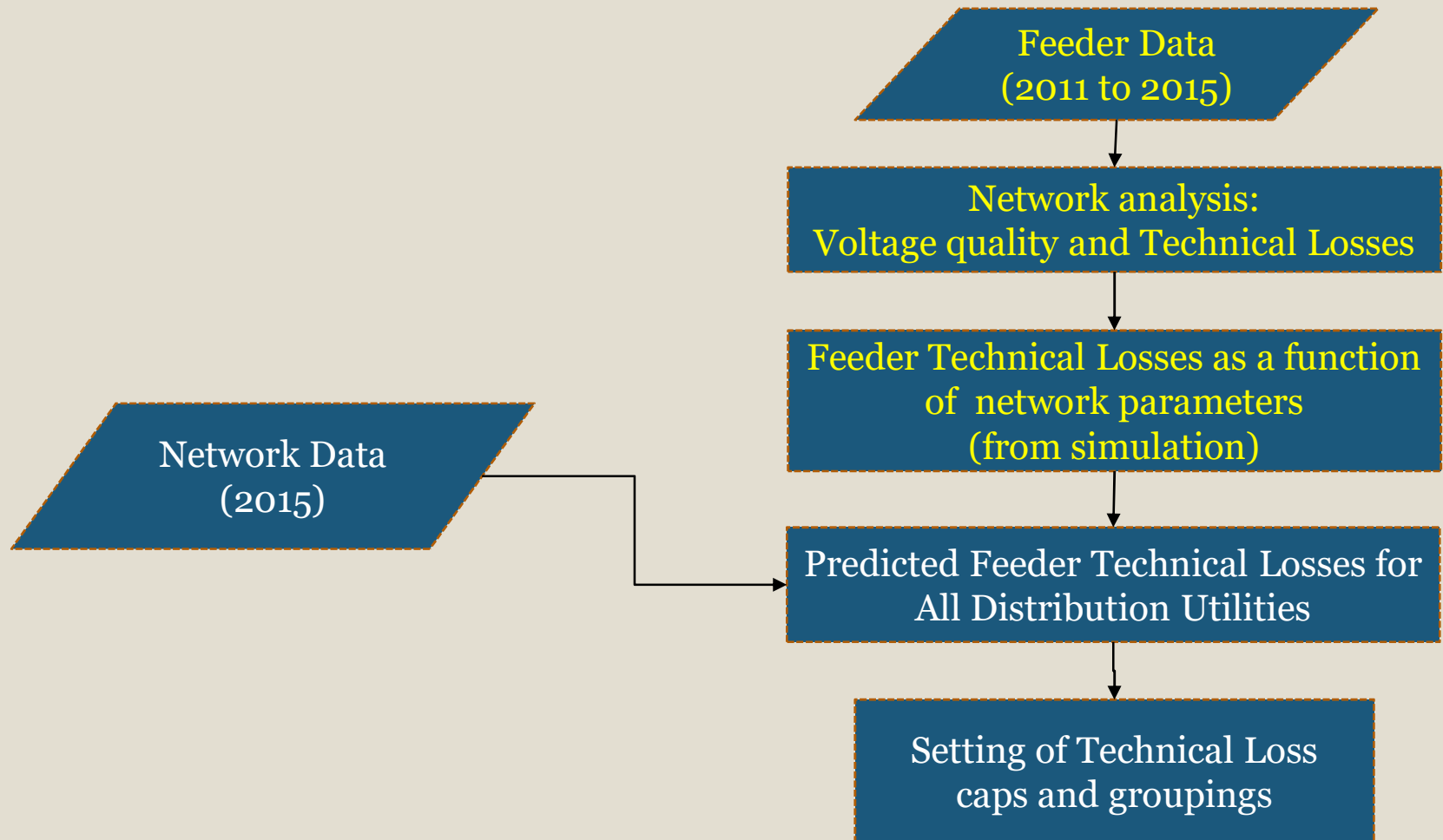
# Sub-Transmission and Substation Technical Loss



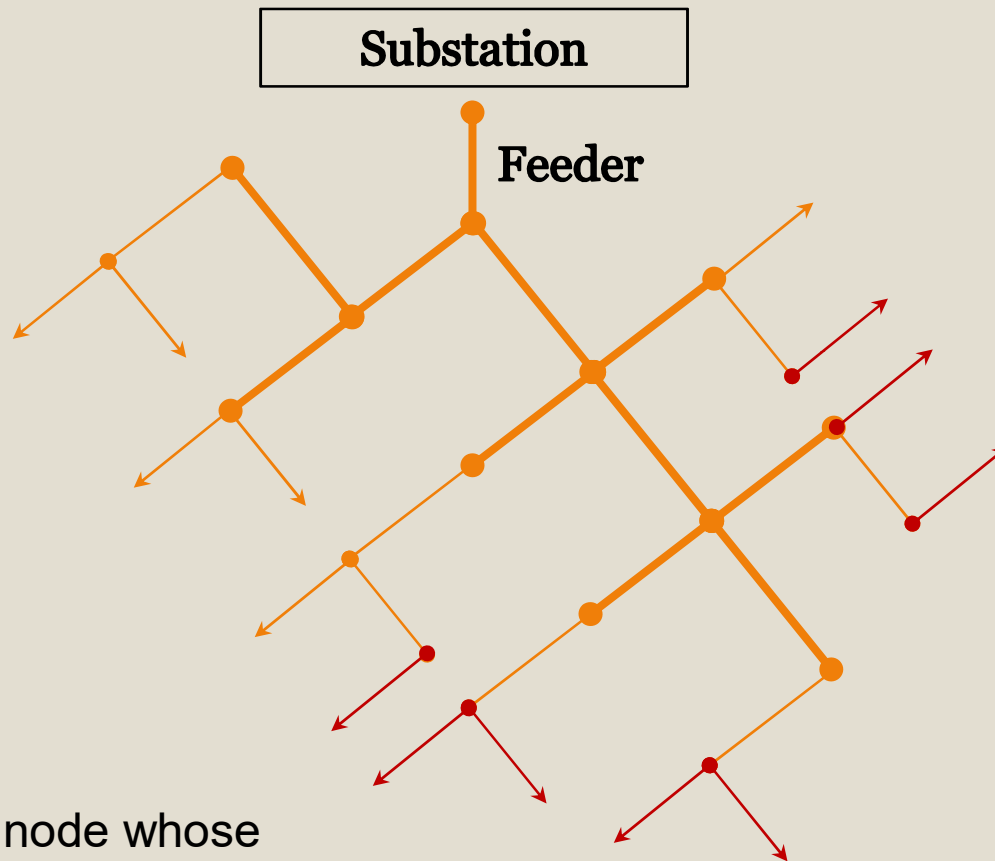
- Can be passed on to Customers
- Design of this section of the network has been justified during CAPEX planning
- There are other considerations in designing this section of the network aside from system loss
  - Constraints with Grid Exit points
  - Projected network-wide load growth and expansion



# Feeder Technical Loss



# Feeder Technical Loss



Red indicates node whose voltage falls beyond the threshold



# Feeder Technical Loss as a Function of Network Parameters

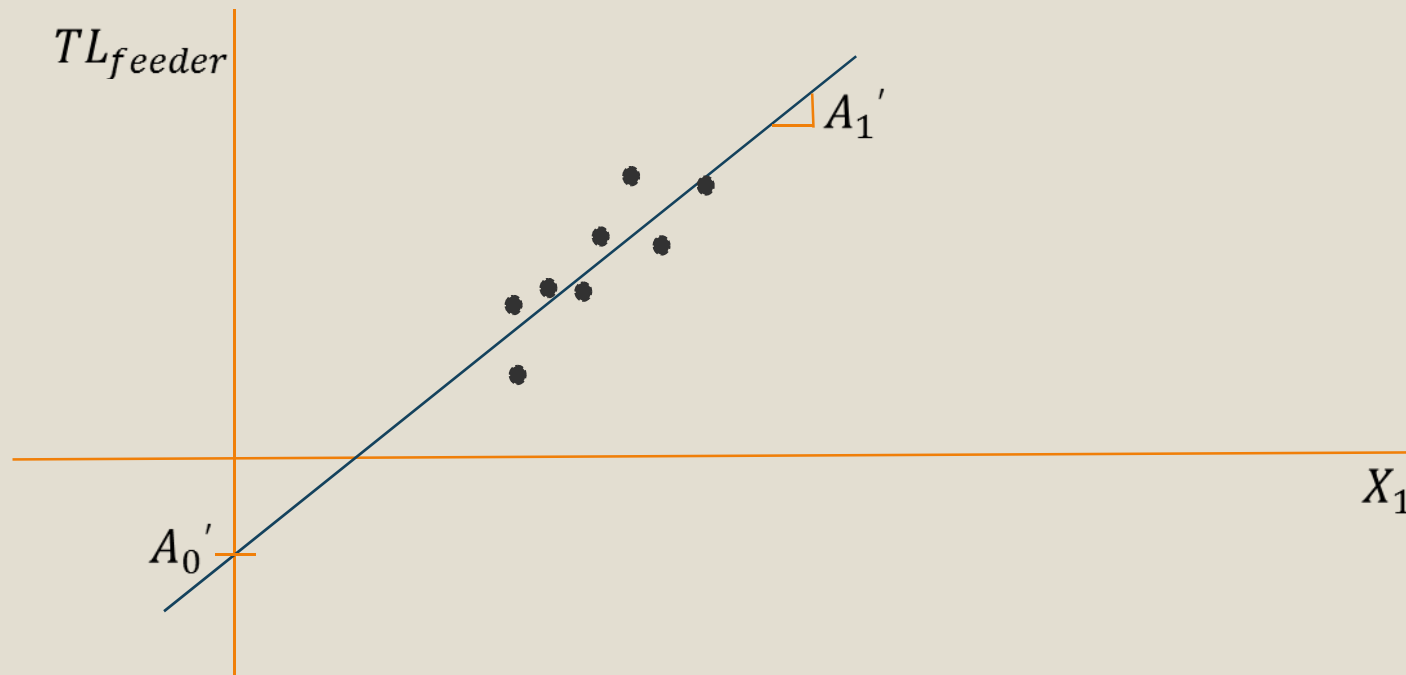


- Energy sales to HV customer (in kWh)
- Energy sales to LV customers and Residential Customers (in kWh)
- Total secondary line lengths (in km)
- Peak Demand (in MW)

$$TL_{feeder} \approx A_0 + A_1 \cdot EnergySales_{HV,kWhr} + A_2 \cdot EnergySales_{LV,kWhr} + A_3 \cdot Length_{SecLine,km} + A_4 \cdot Demand_{Peak,MW}$$



# Feeder Technical Loss as a Function of Network Parameters



$$TL_{feeder} \approx A_0 + A_1 \cdot EnergySales_{HV} + A_2 \cdot EnergySales_{LV} + A_3 \cdot Length_{secLine} + A_4 \cdot Demand_{Peak,MW}$$

# Feeder Technical Loss as a Function of Network Parameters



Groupings for  
Rules for Setting Electricity Cooperatives' Wheeling Rates (RSEC-WR)

<b>Group ID</b>	<b>Sales per Customer (MWHr)</b>
<b>EC Group A</b>	< 0.65
<b>EC Group B</b>	0.65 to 1.1
<b>EC Group C</b>	1.1 to 1.5
<b>EC Group D</b>	1.5 to 1.9
<b>EC Group E</b>	1.9 to 2.3
<b>EC Group F</b>	2.3 to 3.25
<b>EC Group G</b>	> 3.25

Castalia Strategic Advisors 2015



# Feeder Technical Loss as a Function of Network Parameters



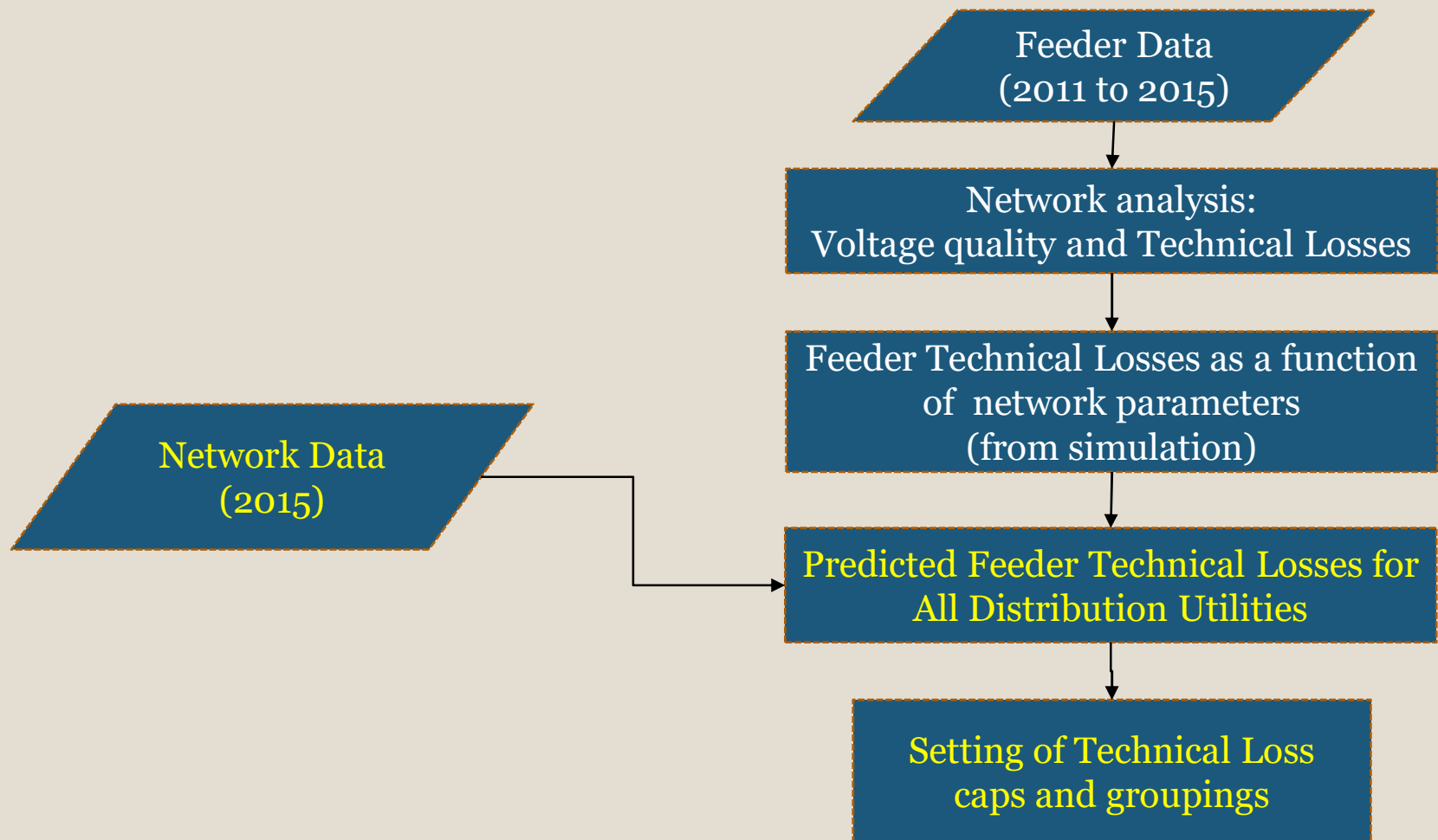
$$TL_{feeder} \approx A_1 \times EnergySales_{HV} + A_2 \times EnergySales_{LV} + A_3 \times Length_{secLine} + A_4 \times Demand_{peak,MW}$$

Group ID	A1	A2	A3	A4
<b>Off-Grid DU</b>	0.03124	0.02102	0.01922	0.01707
<b>EC Group A</b>	0.04653	0.03906	0.00742	0.01315
<b>EC Group B</b>	0.03352	0.02583	0.02934	0.00936
<b>EC Group C</b>	0.01163	0.02469	0.01603	0.01107
<b>EC Group D</b>	0.03058	0.03352	0.01870	0.00809
<b>EC Group E</b>	0.02707	0.03653	0.00787	0.00950
<b>EC Group F</b>	0.00943	0.03048	0.02150	0.00507
<b>EC Group G</b>	0.02707	0.02016	0.05179	0.00608
<b>Private DU</b>	0.00943*	0.02016*	0.00742*	0.00507*

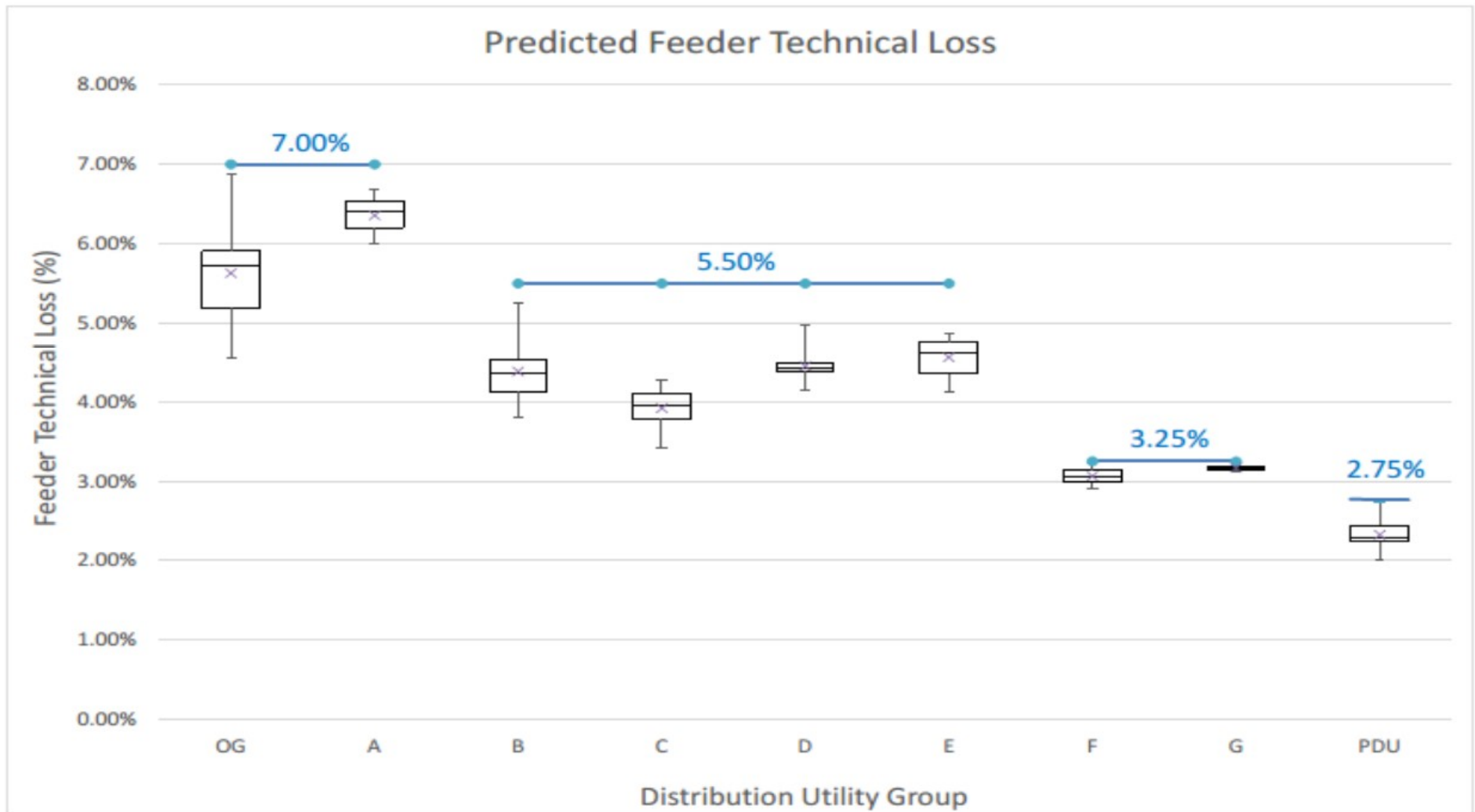
\*in the absence of feeder data, this coefficient is the minimum within the column



# Feeder Technical Loss



# Feeder Technical Loss According to Groups



# Non-Technical Loss



Annual Report on  
Distribution System  
Loss (2015)

Weighted Average of Reported  
Non Technical Loss

$$NTL_{X,\%} = \frac{\sum NTL_{i,kWhr}}{\sum Energy\ Input_{i,kWhr}} \cdot 100\%$$

# PIS for Distribution System Efficiency



# Outline



- Goals
- Proposed Reward and Penalty Structure of PIS for Distribution System Efficiency
  - Private DUs
  - ECs





# Goals of the PIS



- Reduction of customer costs related to distribution system losses
- Long-term improvement of distribution system efficiency



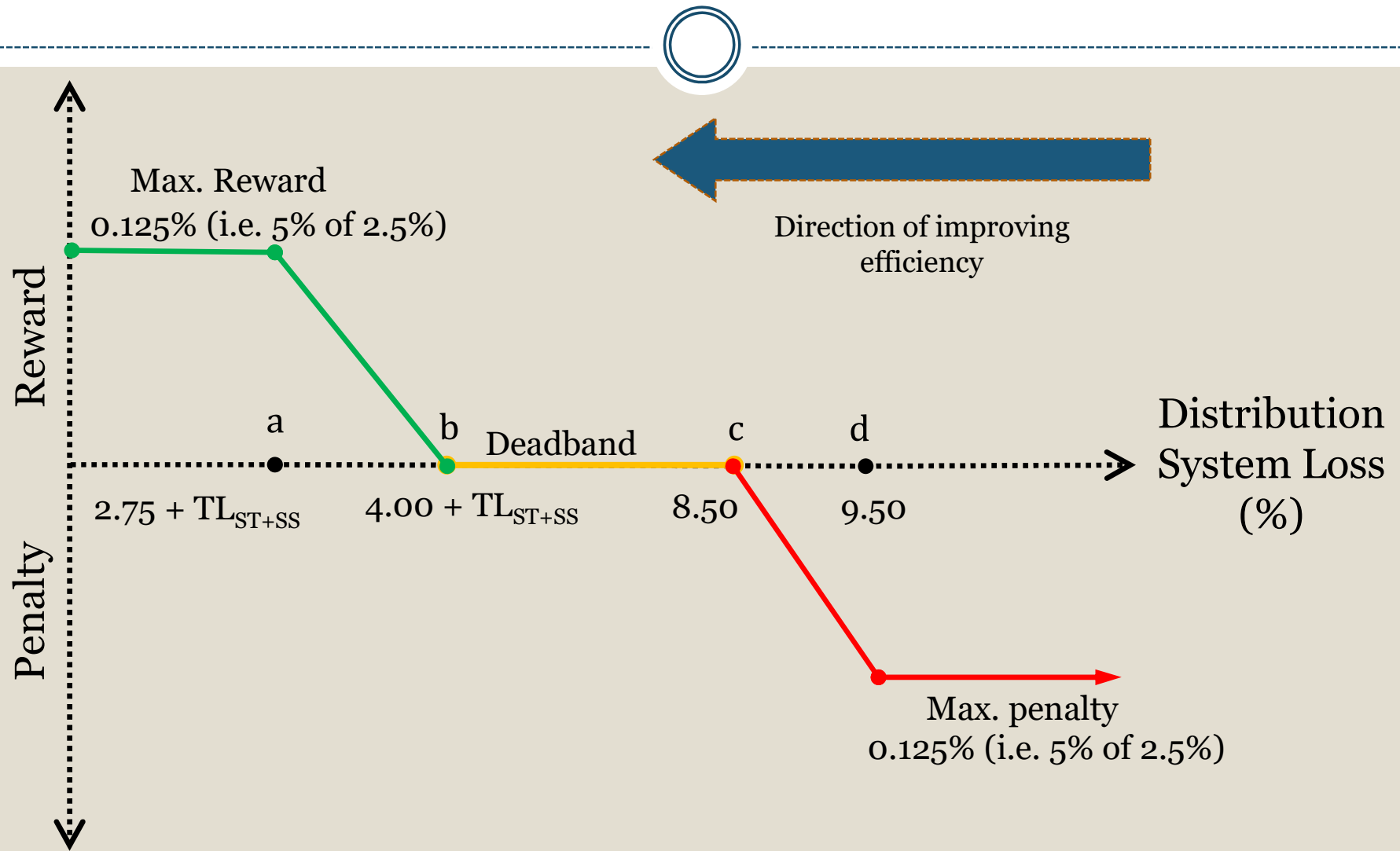
# Proposed PIS Structure



- **Non-PIS incentives**
  - A private DU has financial incentive to include system loss reduction programs in its CAPEX plan, since it would be able to get reasonable return on this.
  - There is no such incentive for the non-profit EC.
- **Non-PIS penalty**
  - Both private DU and EC have financial penalty from high system loss since it will be unable to pass on power costs (G+T) of losses above the system loss cap.



# Proposed PIS Structure for Private DUs



# Proposed PIS Structure for Private DUs



$$S_{Sysloss,t} = W_{Sysloss} \times Perf_{Sysloss,t-1}$$

PIS Region (Private DUs)	Value of DSL	Value of $Perf_{Sysloss,t-1}$
<b>Maximum reward</b>	$a \geq DSL$	$Perf_{Sysloss,t-1} = +1.0$
<b>Proportional reward</b>	$b \geq DSL > a$	$Perf_{Sysloss,t-1} = +1.0 \times \left( \frac{b - DSL}{b - a} \right)$
<b>Deadband region</b>	$c \geq DSL > b$	$Perf_{Sysloss,t-1} = 0.0$
<b>Proportional penalty</b>	$d \geq DSL > c$	$Perf_{Sysloss,t-1} = -1.0 \times \left( \frac{DSL - c}{d - c} \right)$
<b>Maximum penalty</b>	$DSL > d$	$Perf_{Sysloss,t-1} = -1.0$

- Similarities to existing PIS on distribution efficiency for private DUs (in RDWRs of different entrant groups)
  - $W_{Sysloss} = 5\%$
  - $Perf_{Sysloss,t-1}$  ranges from +1.0 to -1.0
- Max. reward and penalty, in % of the MAP of the private DU, remains the same (5% of 2.5% = 0.125%)

\* Values for loss caps, weights, max. reward and penalty may be later updated by the ERC.

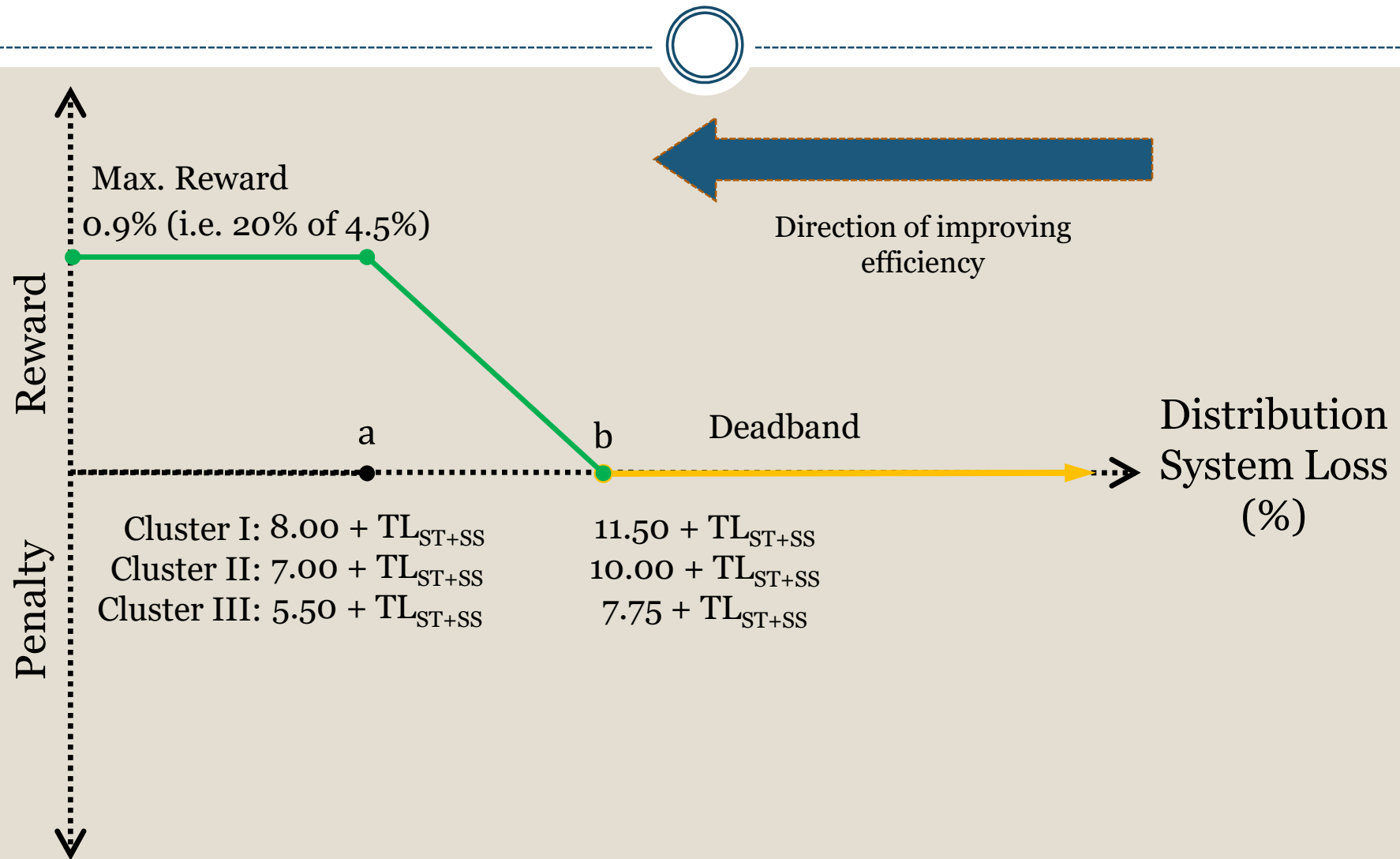
# Proposed PIS Structure for Private DUs



- **Reward**: If the Private DU beats the system loss cap, they are rewarded in the PIS.
  - Reward and penalty lines are continuous (ramps).
  - Consultation with stakeholders may bring back the currently existing ladderized (steps) version.
- **Deadband**: If the Private DU is unable to beat system loss cap, but is still within 8.5% (the current DSL cap), they get NO reward and NO penalty in the PIS.
- **Penalty**: If the Private DU is unable to beat 8.5% system loss, they are penalized in the PIS.
  - Existing PIS has no penalty region.
  - Penalty line is steeper than reward line.



# Proposed PIS Structure for ECs



# Proposed PIS Structure for ECs



$$S_{Sysloss,t} = W_{Sysloss} \times Perf_{Sysloss,t-1}$$

PIS Region (ECs)	Value of DSL	Value of $Perf_{Sysloss,t-1}$
<b>Maximum reward</b>	$a \geq DSL$	$Perf_{Sysloss,t-1} = +1.0$
<b>Proportional reward</b>	$b \geq DSL > a$	$Perf_{Sysloss,t-1} = \left( \frac{b - DSL}{b - a} \right)$
<b>Deadband region</b>	$DSL > b$	$Perf_{Sysloss,t-1} = 0.0$

- Similarities to existing PIS on distribution efficiency for ECs (in TGP Rules)
  - $W_{Sysloss} = 20\%$  for 1<sup>st</sup> Reg. Period and 10% for succeeding Reg. Periods
  - $Perf_{Sysloss,t-1}$  ranges from +1.0 to -1.0
- Harmonizes  $S_{Sysloss,t}$  of TGP Rules with that of RDWR
- Max. reward and penalty, in % of distribution rate of ECs, remains the same
  - 20% of 4.5% = 0.9% for 1<sup>st</sup> Reg. Period; and
  - 10% of 4.5% = 0.45% for succeeding Reg. Periods)

*\* Values for loss caps, weights, max. reward and penalty may be later updated by the ERC.*

# Proposed PIS Structure for ECs



- **Reward**: If the EC beats the system loss cap, they are rewarded in the PIS.
  - Reward and penalty lines are continuous (ramps).
  - Consultation with stakeholders may bring back ladderized (steps) version.
- **Deadband**: If the EC is unable to beat the loss cap, they get NO reward and NO penalty.
  - Existing PIS also has no penalty region.





# Other Points



- The technical loss in the subtransmission and substation ( $TL_{ST+SS}$ ) is zero if the DU is unable to substantiate any other value.
- The lower efficiency threshold (the penalty side) of the deadband region may later be reduced to drive the distribution sector towards improving efficiency.

# Implementation Schedules



# Implementation Schedules



<b>Private DU Entrant Group</b>	<b>Implementation Date</b>	<b>Date of First Reg. Period (ERC Res. 10 Series of 2010)</b>
<b>A</b>	01 July 2019	01 July 2007
<b>B</b>	01 April 2021	01 April 2009
<b>C</b>	01 July 2022	01 July 2010
<b>D</b>	01 October 2023	01 October 2011



# Implementation Schedules



<b>Electric Coop Entrant Group</b>	<b>Implementation Date</b>	<b>Date of First Reg. Period (ERC Res. 8, Series of 2011)</b>
<b>1</b>	01 January 2020	01 January 2011
<b>2</b>	01 January 2021	01 January 2012
<b>3</b>	01 January 2022	01 January 2013
<b>Off-grid*</b>	01 January 2023	* Reg. Period not yet set



# Implementation Schedule



- Follows Regulatory Periods of entrant groups:
  - Private DUs: nearest multiple of 4 years from date of first Regulatory Period
    - ✦ Private DU Regulatory Period is 4 years.
    - ✦ Implementation at exact start of the new Regulatory Period.
  - ECs: nearest multiple of 3 years from date of first Regulatory Period
    - ✦ EC Regulatory Period is 6 years.
    - ✦ Implementation at exact midpoints of the Regulatory Periods.
    - ✦ Off-grid ECs come in after the last entrant group of on-grid ECs.
- Low regulatory risk to the DUs.
  - Gives some lead time for DUs to adjust to the new regulation, particularly the new loss caps.



# Reportorial Requirements



# Reportorial Requirements



- **Monthly ERC DSL Data**
  - Per Feeder
  - For the Sub-Transmission Network
  - Simulated Losses in Subtransmission lines and equipment
  - Simulated Losses in Substation
  
- **Annual submission**
  - Energy Input (Purchased and Generated)
  - Energy Sales, total for DU and for each customer class
  - Energy for Distribution Utility Use
  - No. of customers, total for DU and for each customer class
  - Peak Demand
  - Circuit length, for primary and secondary distribution
  - Calculated Technical Loss and Non-Technical Loss
  - Total Distribution Transformer No-Load Loss
  - CAPEX and OPEX Programs related to System Loss Reduction



# End of Presentation



**THANK YOU**

