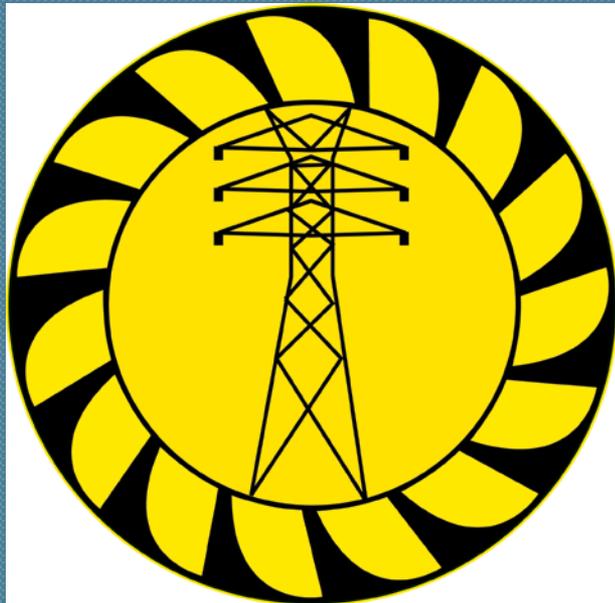


# LOSS REDUCTION PACKAGE FOR SUSTAINABLE ELECTRIFICATION



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Colombo City

May 2012

# TOPICS

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1. MANAGEMENT OF ELECTRICITY DISTRIBUTION LOSSES IN COLOMBO CITY.
2. MODELING OF DISTRIBUTION LOSSES .
3. DESIGN OF NEW PROGRAMS.
4. ANALYSIS OF BARRIERS AND STRATEGIES FOR NON-TECHNICAL LOSS REDUCTION.

# FACTORS CONTRIBUTING TO HIGH TECHNICAL LOSSES

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- ⦿ The low investment on T&D.
- ⦿ The funds were mostly used for development works which comprised giving new connections without adequate reinforcement.
- ⦿ Large scale rural electrification programs resulted in long LT lines and extension of distribution network.
- ⦿ Poor workmanship.
- ⦿ Poor quality of equipment.

# FACTORS CONTRIBUTING TO HIGH TECHNICAL LOSSES.                      CONTED...

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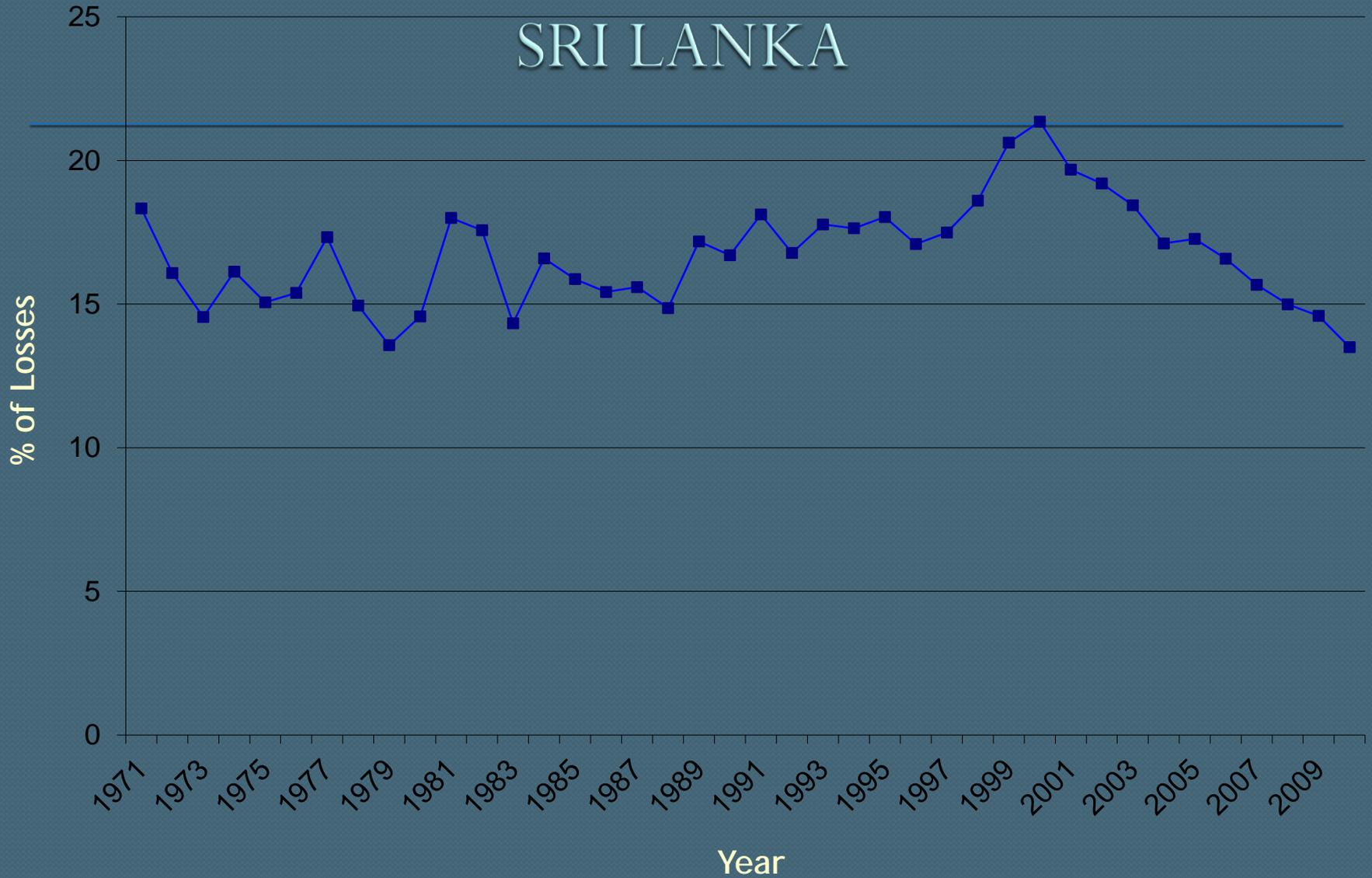
- ⊙ Due to pumping load, air conditioners, coolers and industrial loads in urban areas, the system has a low power factor.
- ⊙ Improper management of the load has led to overloading of conductors and transformers.

# ECONOMIC AND FINANCIAL GAINS

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- The reduction of technical losses makes it possible to cut down generation.
- The reduction of non-technical losses helps increase the sales revenue and reduce generation.
- The main benefits of reduction of non-technical losses may be as follows:
  - reduction of cost prices
  - improvement of the quality of supply and service offered to customers.
  - optimization of investments and improvement of the environment

# VARIATION OF SYSTEM LOSSES IN SRI LANKA



# MANAGEMENT OF ELECTRICITY DISTRIBUTION LOSSES IN COLOMBO CITY

# VARIATION OF COLOMBO CITY DISTRIBUTION LOSSES



# MEASURES FOR REDUCTION OF TECHNICAL LOSSES

- The technical loss component of the distribution loss in the Colombo City has been addressed by adopting system improvement measures with the implementation of Medium Voltage Development Proposals.
- The fixing of capacitors for the feeder pillars have been initiated in order to reduce the reactive current drawing within the distribution system.



# ESTABLISHMENT OF ENERGY MANAGEMENT UNIT FOR COLOMBO CITY

- ~~Energy Management Unit for Colombo City was formed in order to address the non-technical losses in Colombo City in the month of August 2004.~~
- One engineer, one office worker and one field worker were assigned to the Unit.
- The distribution losses in Colombo City at that time was 12.5%.
- As the first step non billed consumers were identified and accounts were opened for them.
- Zero consumption meters were inspected and action was initiated to replace faulty meters.

# REASONS FOR NONTECHNICAL LOSSES

- Non performing and under performing of meters-
  - Meters are tampered, damaged or bypassed to read lower values. Do not read correct energy as the meters are old, poor quality.
- Errors in meter readings.
  - Assessment of meter readings by the meter readers due to meter being defective or inaccessibility to the meter or intentional erroneous readings by the meter readers.
- Theft by direct tapping of electricity.
  - Tap from bare overhead conductors, street lamp circuits, cut outs or other exposes locations.
- Unaccounted energy
  - unauthorized street lamps, public illuminations, and unbilled temporary supplies.

# SOCIO ECONOMIC REASONS FOR NON-TECHNICAL LOSS

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- ⦿ High Tariff for commercial and domestic consumers.
- ⦿ Due to non availability of proper ventilation or sunlight even during the day time, houses in the slums have to switch on lights and fans even during the day time and they get high electricity bills which cannot afford to them .
- ⦿ Without knowing the gravity of the offence people tends to get their meters adjusted.

# STRATEGIES ADOPTED FOR NON-TECHNICAL LOSS REDUCTION IN COLOMBO CITY

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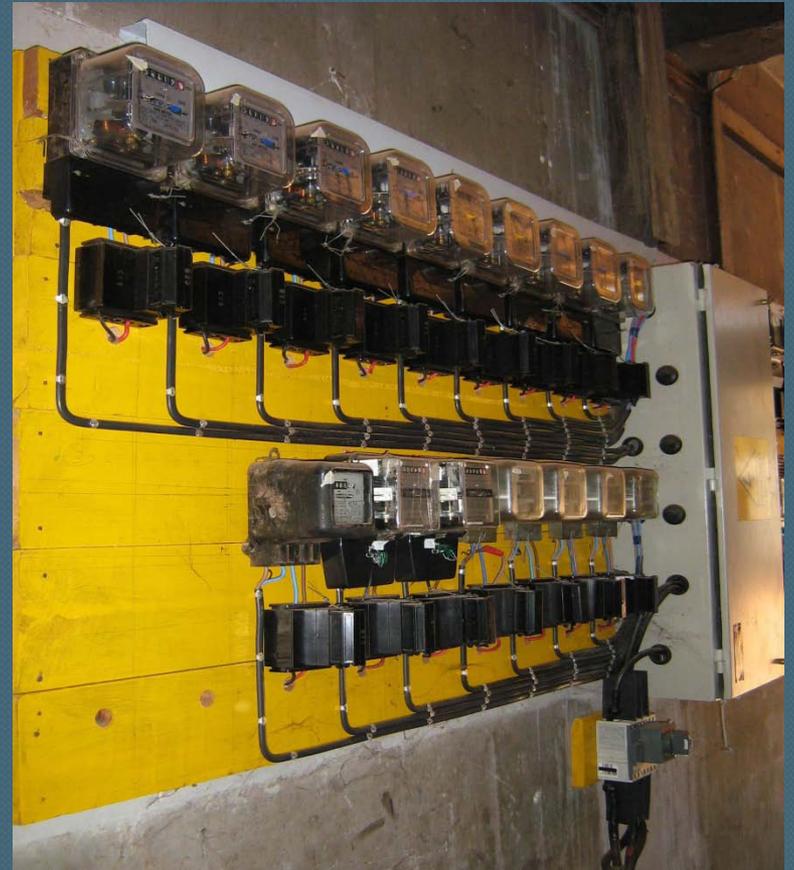
- Identify the consumers who do not receive electricity bills (Unbilled Consumers).
- Rehabilitation of Meter Rooms of Flats and Shopping Complexes.
- Investigation
  - Places where the electricity consumption is zero
  - Finalise accounts with bill arrears.
  - Meter Reader Complains
  - Complains received from general public and CEB staff.
  - Selected meter reader walking orders.
- Meter Testing Programs.
- Replacement of Meters-defective, tampered ,old.

# REHABILITATION OF METERROOMS

Before Rehabilitation



After Rehabilitation



# STRATEGIES ADOPTED CONTD...

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- ⦿ Fixing of Meter Enclosures- 1 ph. and 3 ph.
- ⦿ Auditing meter readings.
- ⦿ Purchasing of good quality equipment
- ⦿ Rehabilitation of LV net work of estates (slum colonies) with small bundle conductors and GI pipes.
- ⦿ Attending to billing errors and other commercial requirements of the customers.

# SINGLE PHASE ENCLOSURE



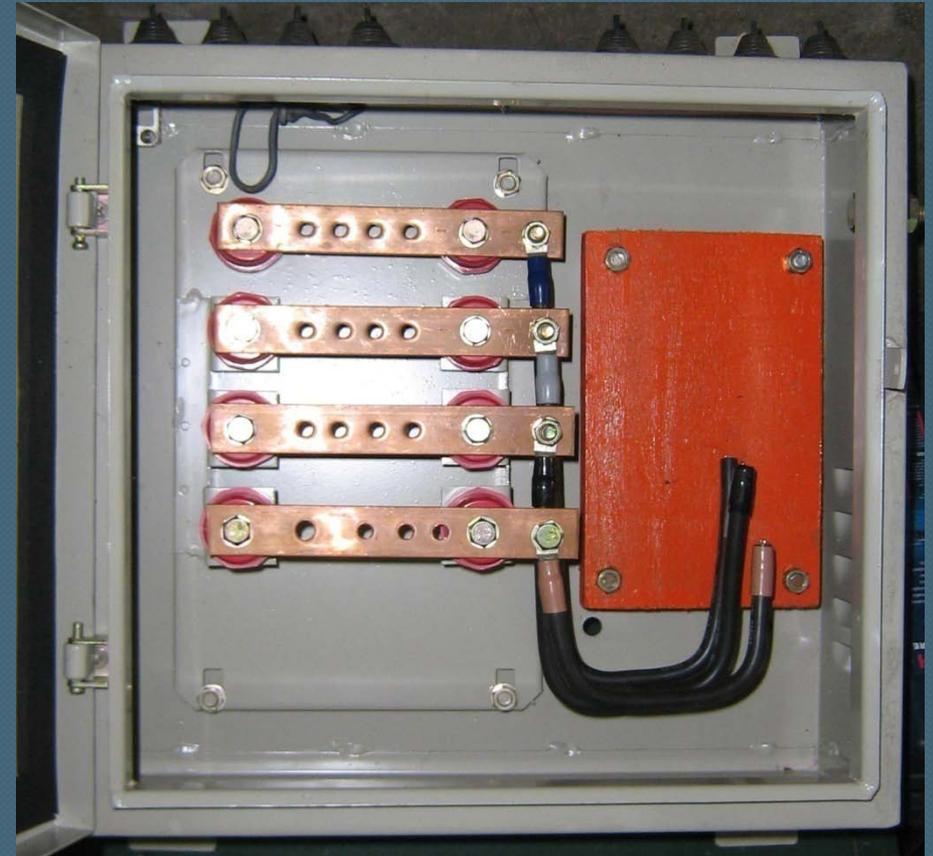
# SINGLE PHASE ENCLOSURE VERTICAL TYPE



# TWO TYPES OF THREE PHASE ENCLOSURES



# BUS BAR UNIT FOR 3 PH. SERVICES



# STRATEGIES ADOPTED CONTD...

## ◎ Implementation of Seal Management System.

- New plastic seal with serial numbers.
- Special padlocks for three phase meter enclosures.



# SEAL MANAGEMENT SYSTEM FOR ROTARY TYPE SEALS

CC 0097125



**CEYLON ELECTRICITY BOARD - COLOMBO CITY**

Area EE's Copy

SEALING OF SINGLE PHASE METER ENCLOSURE / METER TERMINAL COVER / CUT-OUT / MCCB

Account No.

Area - Colombo East / North / South / West

Name of the Customer : .....

Meter No. .... Meter Reading : ..... Cut-out / MCCB No. ....

New Seal No. / Security label No. : Enclosure ..... Terminal Cover .....

Meter Cover : ..... Cut-out / MCCB .....

Removed Seal Nos. ....

Reason to remove seals : .....

Fixed by : ..... Designation : ..... Signature : .....

*I accept that the seals fixed in the Meter, Meter Enclosure and Cut-out / MCCB are intact.*

Name of the Customer / Representative : .....

Signature : ..... Date : ..... Time : .....

# STRATEGIES ADOPTED – BULK SUPPLIES

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- ◎ Replacing of all electro-mechanical meters with PPM meters with remote reading facility.
- ◎ Fixing Bulk Supply Enclosures.

# BULK SUPPLY ENCLOSURE



# BULK SUPPLY ENCLOSURE (WITH THE BREAKER INSIDE )



# IMPACT ON DISTRIBUTION LOSSES ON ECONOMICS OF A DISTRIBUTION UTILITY

Year 2010	Scenario 01 (If distribution losses are 12.2%)	Scenario 01 (If distribution losses are 6.4%)
Energy for losses (GWh)	156	80
The expenditure on losses (Rs Million)	3026	1486

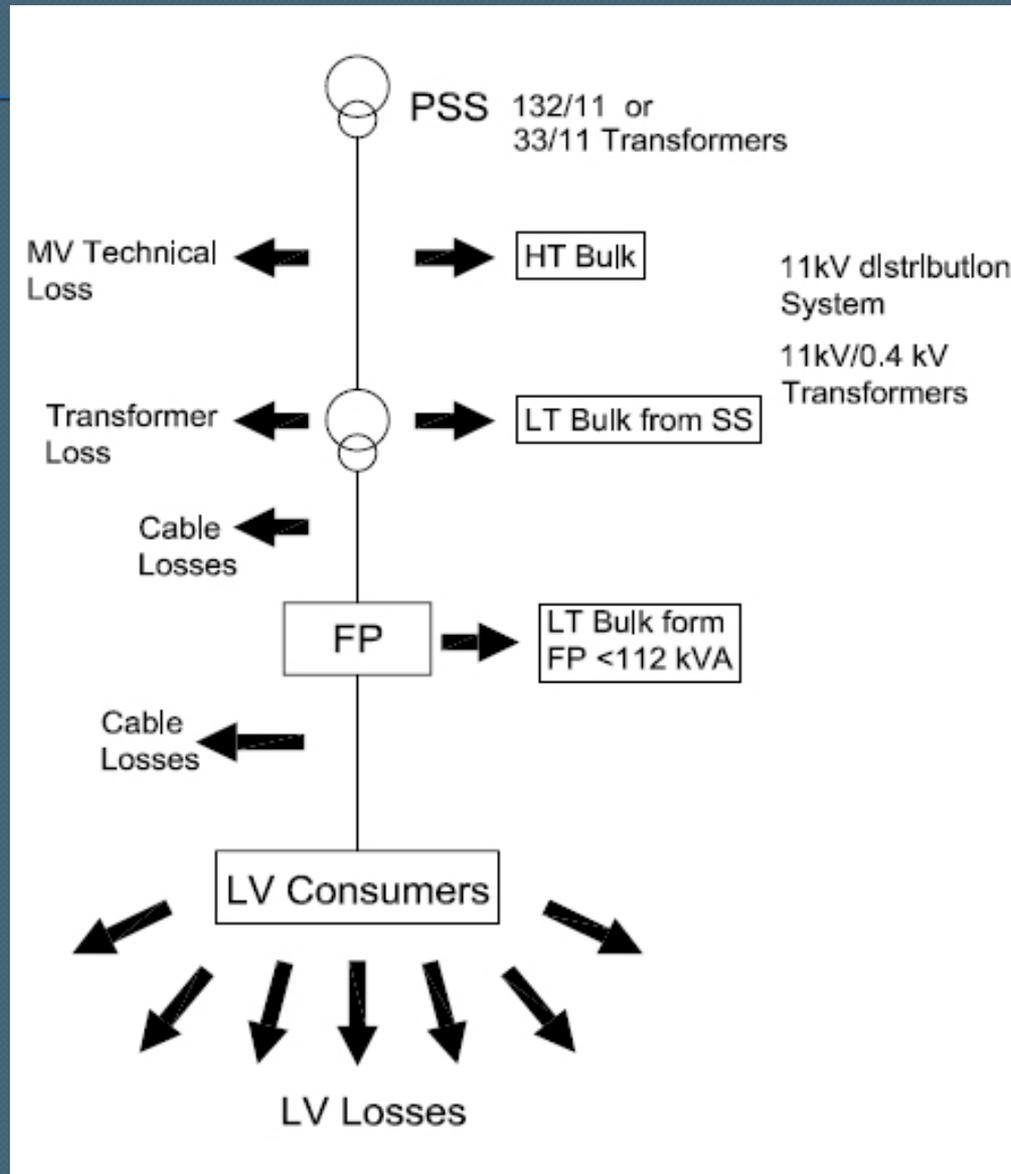
# COST BENEFIT ANALYSIS

	Saving	Expenditure
	Rs. M	Rs. M
<b>2005 - Loss (12.2% - 9.8%)</b>		
Recoveries-ordinary	10.5	
Savings due to LR	303	
Costs		est.8
<b>2006 - Loss (9.8% - 8.4%)</b>		
Recoveries-ordinary	17.3	
Savings due to LR	606	
Costs		est.12
<b>2007 - Loss (8.4% - 7.7%)</b>		
Recoveries-ordinary	16.1	
-bulk	22.7	
Savings due to LR	901	
Material cost		7.8
Other costs (salaries, Trans, etc)		12.5

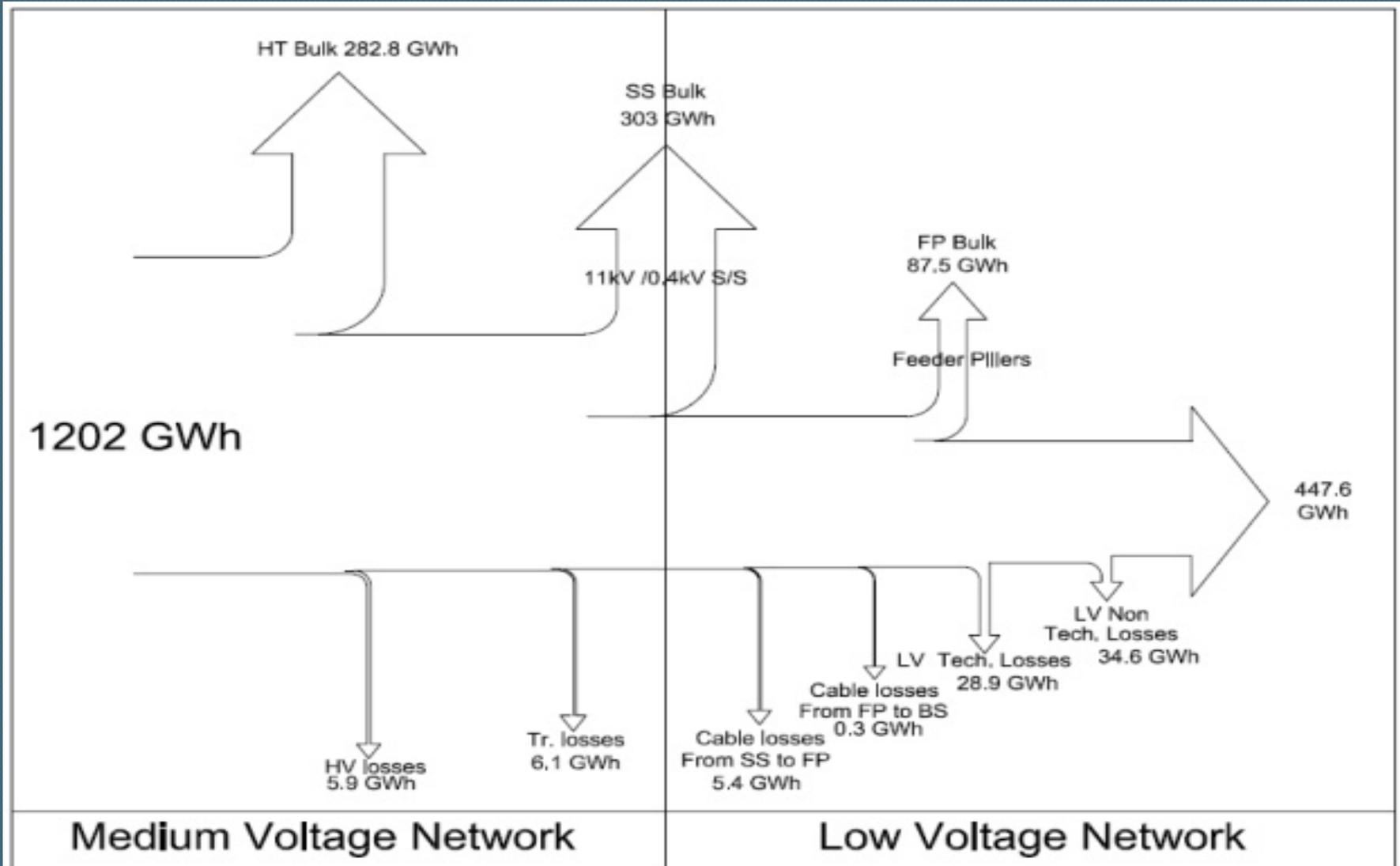
# COST BENEFIT ANALYSIS Contd..

	Saving Rs. M	Expenditure Rs. M
<b>2008 - Loss (7.7%- 7.4%)</b>		
Recoveries-ordinary	13.9	
-bulk	8.6	
Savings due to LR	1222	
Material cost		21.6
Other costs (salaries, Trans, etc)		16.5
<b>2009 - Loss (7.4%- 6.7%)</b>		
Recoveries-ordinary	11.3	
-bulk	11.3	
Savings due to LR	1400	
Material cost		27.8
Other costs (salaries, Trans, etc)		21.2
<b>2010 - Loss (6.7%- 6.4%)</b>		
Recoveries-ordinary	7.9	
-bulk	5.8	
Savings due to LR	1540	
Material cost		24.6
Other costs (salaries, Trans, etc)		26.2
<b>Total</b>	<b>6097.4</b>	<b>178.2</b>

# DISTRIBUTION MODEL



# DEVELOPMENT OF ENERGY FLOW DIAGRAM FOR COLOMBO CITY



# DESIGN OF NEW PROGRAMS

# DESIGN NEW PROGRAMS FOR FURTHER REDUCTION OF DISTRIBUTION LOSSES

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## ◎ Technical Loss Reduction

- Rehabilitation of the distribution network in under served settlements-  
Rs.8.22
- Phase Balancing- Rs.8.23
- Fixing of capacitors for Feeder pillars and Government Installations in  
order to improve the power factor.Rs.10.31
- Replacing Low Accuracy CT's with High Accuracy CT's of Bulk Supplies  
with High Consumption -Rs.15.44

# DESIGN NEW PROGRAMS FOR FURTHER REDUCTION OF DISTRIBUTION LOSSES

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## ○ Non- Technical Loss Reduction

- Energy Auditing-Rs.16.46
- Meter Testing and replacement of defective meters and fixing meter enclosures- Rs.8.35
- Special Investigation Unit with Permanent Police and Legal Support to carry out Investigations
- Amendment to the Sri Lanka Electricity Act
- Publicity campaign to educate the public on repercussions of illegal electricity tappings and to promote the complaints made by the general public on illegal usage of electricity.

## COMPUTATION OF OPTIMUM LOSS LEVEL

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- ◎ The optimum loss that could be achieved by implementation of above mentioned programs is 4.2% with the implementation of Rs.560 million worth programs during 4 years period.
- ◎ The expected saving would be Rs. 1500 million .
- ◎ Rs 70 million would be required yearly to maintain the above loss level.

# ANALYSIS OF BARRIERS AND STRATEGIES FOR NON-TECHNICAL LOSS REDUCTION.

# BARRIERS

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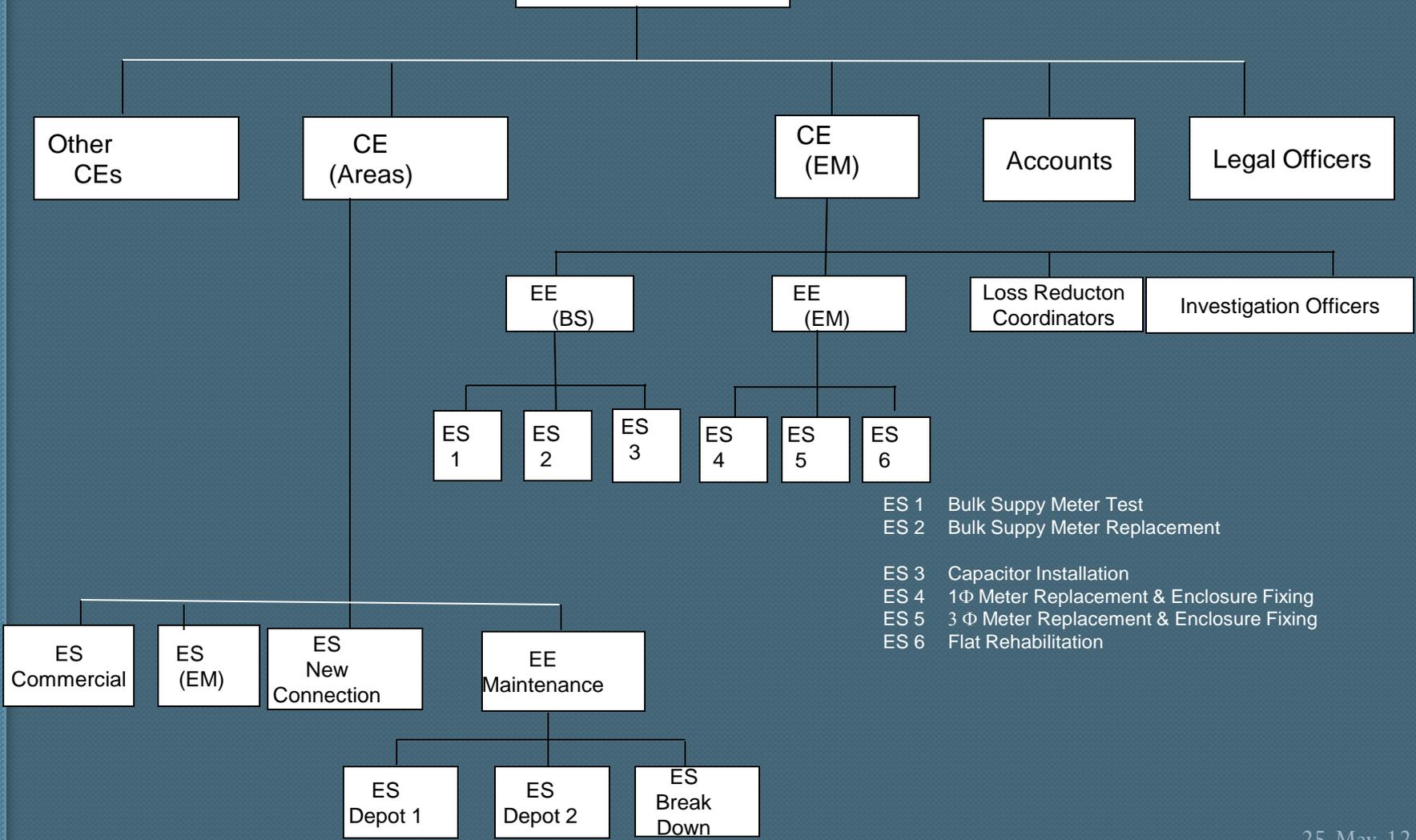
- ⦿ New Electricity Act
- ⦿ Regulations of the Sector-Public Utilities Commission.
- ⦿ Institutional Structure
- ⦿ Police Support
- ⦿ Skills and Capacity Gaps of the staff
- ⦿ Technical Constraints

# NEW STRATEGIES FOR FURTHER REDUCTION

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- ◉ Amendments for New Electricity Act.
- ◉ Structure of the Institution.
- ◉ Reward system for information on electricity theft.
- ◉ Benefit of loss reduction for employees.
- ◉ Development of relationship with the Police.
- ◉ Energy Auditing of substations.
- ◉ Technical training to the operating personnel
- ◉ Government Loan Schemes for Low Income Groups for New Service Connections

# DGM PROVINCE



- ES 1 Bulk Suppy Meter Test
- ES 2 Bulk Suppy Meter Replacement
- ES 3 Capacitor Installation
- ES 4 1Φ Meter Replacement & Enclosure Fixing
- ES 5 3 Φ Meter Replacement & Enclosure Fixing
- ES 6 Flat Rehabilitation

# STATERGIES CONTD..

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- Policy Level Decisions to Avoid Electricity Theft
  - use of bundle conductors only for the LV overhead lines.
  - Coaxial cables for garden and housing schemes.
  - Introduction of Seal Management System.
  - Use of tamper proof meters (Only PPM)
  - Remote metering.
  - Improve the quality of Material.
  - High accuracy meters and CTs

# CONCLUSIONS

# SUMMARY OF RESULTS

- ⦿ Approximately 10% of ordinary meters are defective and out of them 4% used electricity illegally.
- ⦿ Unauthorized usages with in bulk supply consumers are very minimum. Out of all 27 bill revisions which were carried out due to meter errors, so far only 5 cases have been identified for tampering meters. Some of these bill revisions had been done due to bad workmanship in giving in meter connections.
- ⦿ Electricity theft is high in domestic and small scale commercial establishments due to high cost of electricity and due to unawareness of the gravity of offence.

## SUMMARY OF RESULTS CONTD.....

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- ◎ Distribution network in an urban environment which has mainly under ground cable system technical losses (theoretical) is around 3.9%. Around 0.4 to 0.5% loss could be allocated for the loss due to contact resistance
- ◎ Further 2.5% of NTL could be reduced by investing Rs.560 million in Colombo City.
- ◎ Barriers for NTL reduction.
- ◎ Strategies for NTL reduction.

# CONCLUSIONS

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- ◎ According to the analysis done, the information gathered and measurements obtained, it is possible to reduce distribution losses to below 5% in Colombo City by pin pointing losses, continuous monitoring, having required regulatory and legal support with the commitment of staff and the blessing of top management.

THANKYOU