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Revenue Protection as part of Utility Financial Sustainability

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SARPA 29 July 2010

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Synopsis

'Revenue Protection is an integral part of a holistic approach to achieve utility financial sustainability. '

- *Losses value chain & the quantification of losses, and integrated approach in minimising losses.*
- *What efforts should management make to improve the business economics of the electricity utility?*
- *Benchmarking: What is happening elsewhere?*

Agenda

- Introduction
- Losses value chain
- Losses Quantification
- Holistic approach to financial sustainability
- Gains for the utility from managing losses
- Conclusion

Introduction

- Financial sustainability – what does it mean?
  - *Cash returns* from operations are *sufficient* to pay for all cash expenses
  - *Cash coverage ra… equal to 1* or better
- Integrated approac…ning
  - Understandin…s that affects cash flow
  - *Maximise revenu…*
    - Improve cash colle…ducing cash losses
    - C… non technical losses
    - Increase tariffs
  - *Minimise* operational cost
    - Least cost generation
    - Reduce overall losses losses
    - Increase operational efficiencies
    - Improve quality of supply

Cash returns

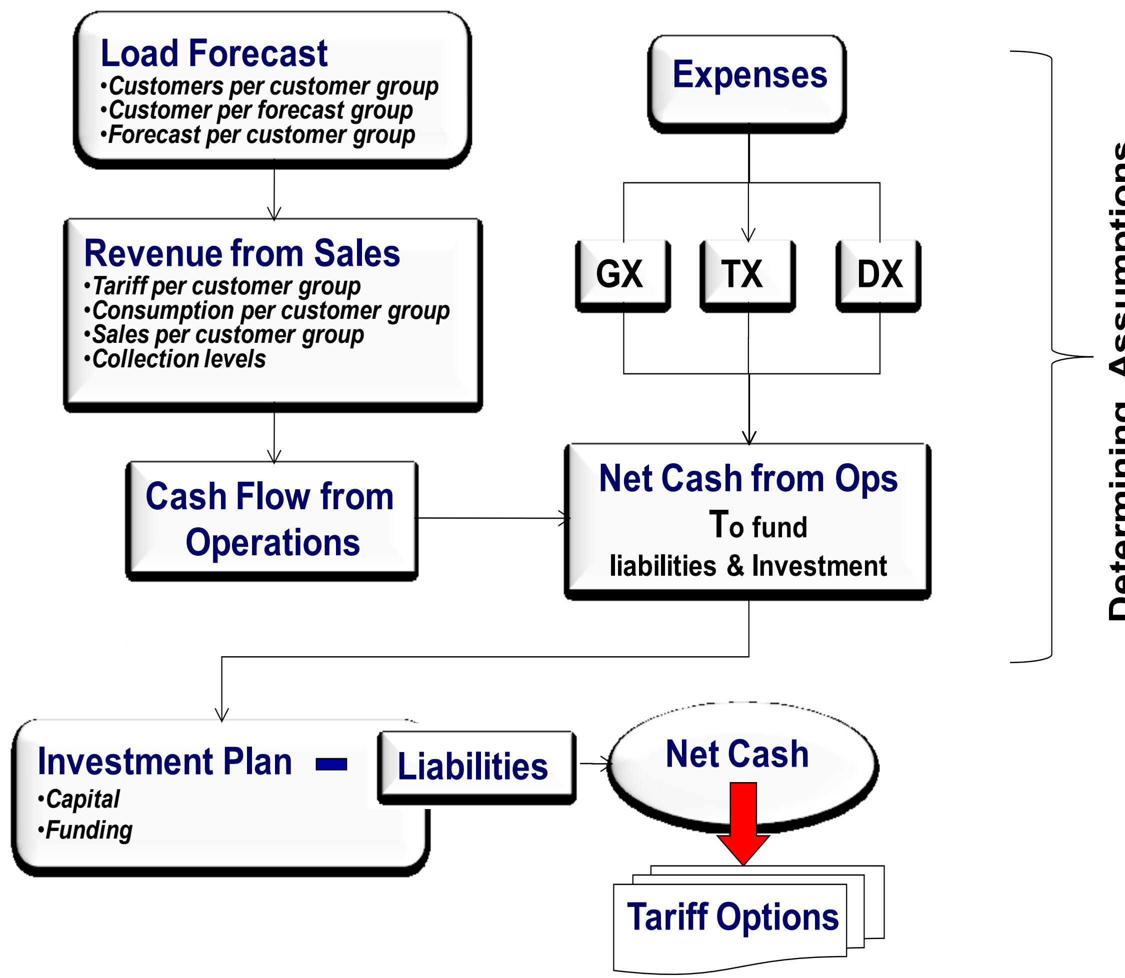
Financial sustainability – what does it mean?

Cash expenses

Introduction

- Holistic view to balance ***net cash***
- ***Tariff*** adjustments are the ***last resort*** to balance cash

Balancing Cash with Revenue



Losses reduction

Reduction in Technical Losses

- Reduce cost of generation and imports
- Normally reduces the most expensive generation if least cost generation strategy is followed

Reductions in Non Technical losses

- Will convert into additional sales
- Or will reduce the cost of additional generation if it cannot be converted into sales
- Or both

DEF= ***Revenue protection is all those utility activities that ensure that losses are minimised, both from a revenue and a cost perspective***

Losses Value chain

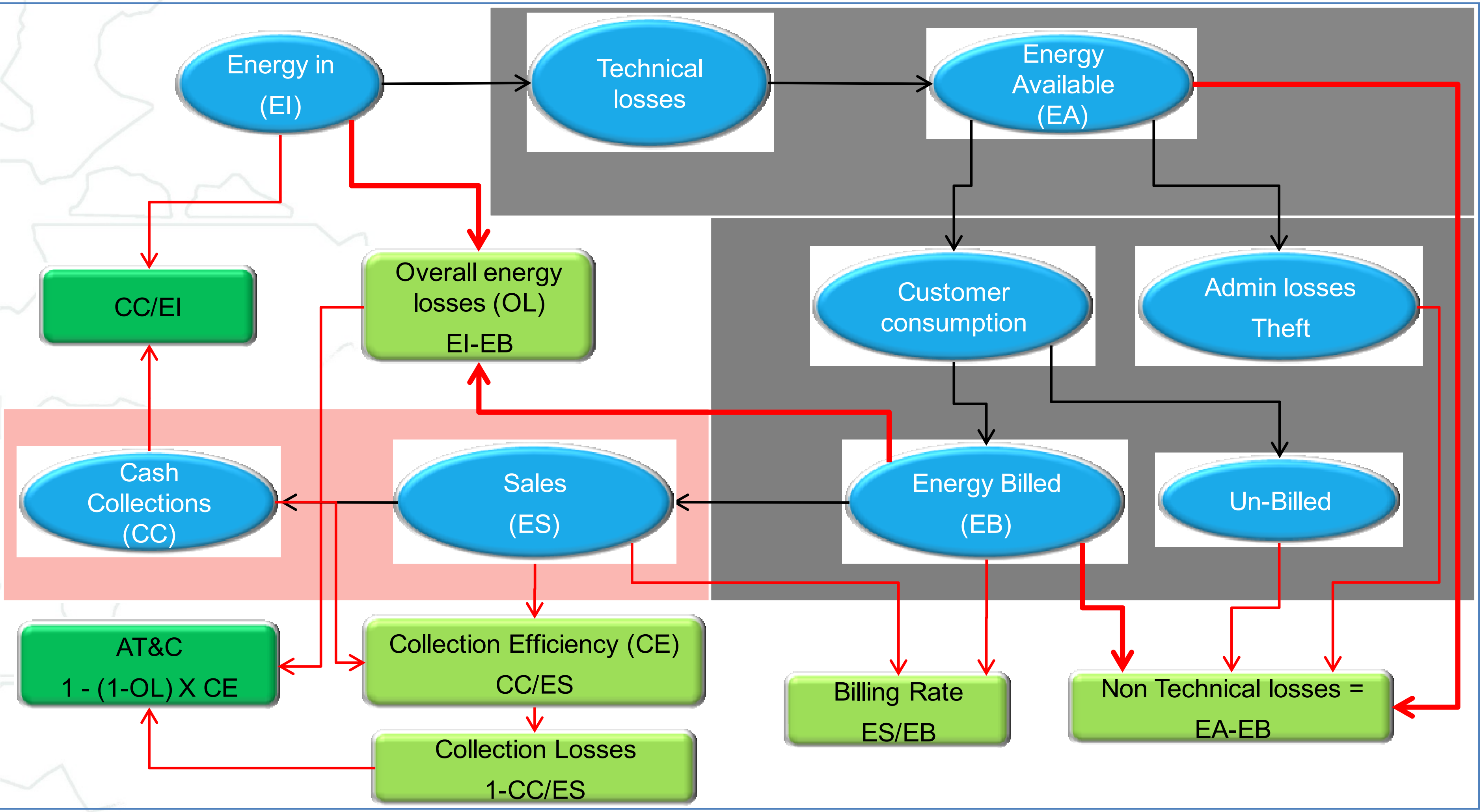
Energy In	Technical losse	Consumption	Non Technica losses	Sales	Cash Collected
Energy available from Generation and imports	Electrical losses on the network	Energy consumed and billed	Energy consumed but not billed	Revenue from energy billed	Cash collected from energy billed

- Energy in
- Technical losses
- Consumption
- Non technical losses
- Sales
- Cash collected

Losses Value chain

- Energy losses consists of
  - Technical losses
  - Non technical losses
- Technical losses is evident due to:
  - Network configuration and
  - Network loading
  - Consist of demand losses and energy losses
- Non technical losses is caused by:
  - Factors *outside the electrical* system,
  - This could include *inaccurate meters*,
  - *Inaccurate meter* readings,
  - Technical problems with meter installations,
  - *Billing errors* or errors in record keeping,
  - Consumption by *non metered installations* and
  - Energy theft
- Cash losses
  - Energy billed (sales) for which no payment has been received

Losses Value chain

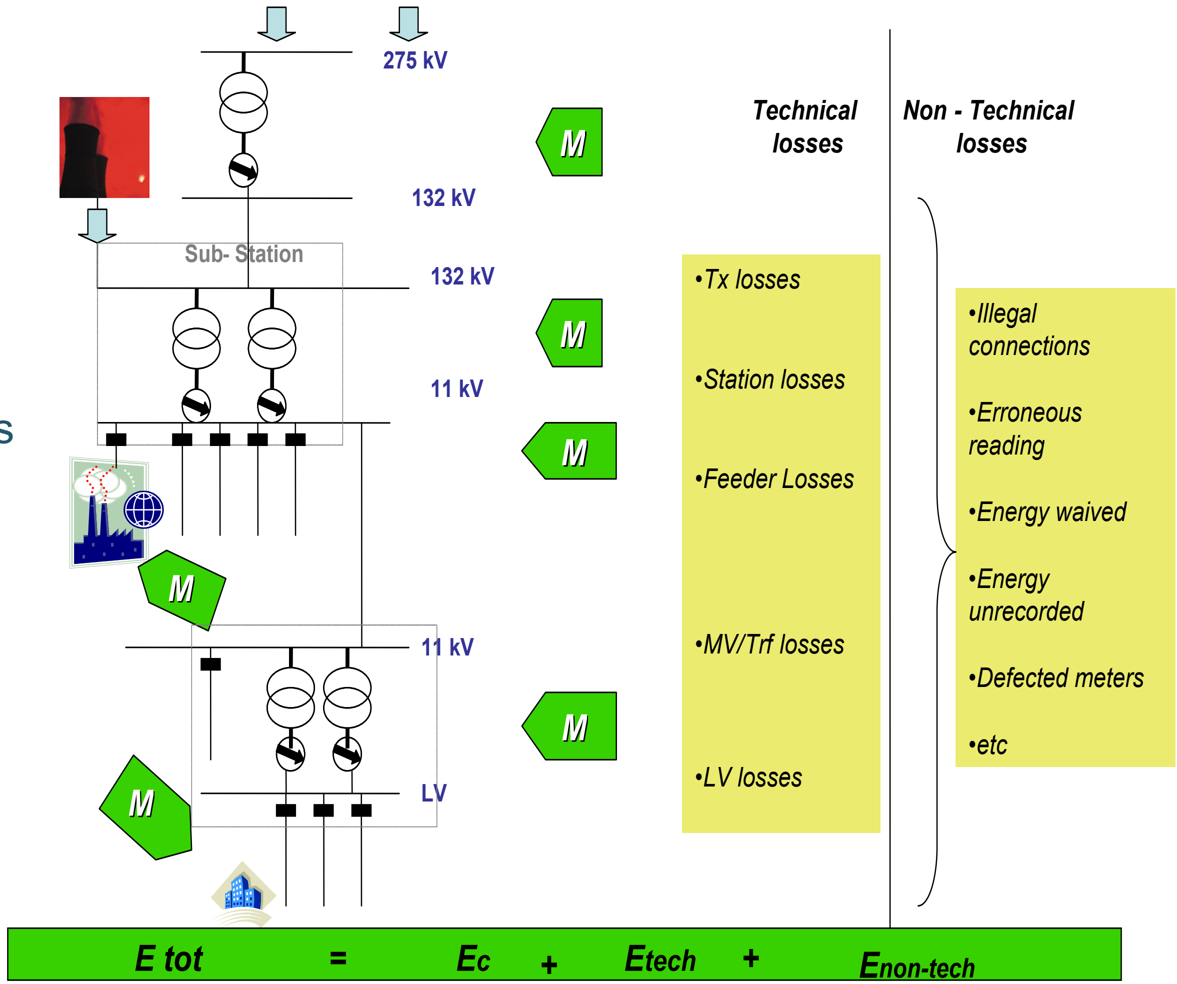


Losses Value chain

- Overall efficiency *benchmarks*
  - AT&C
  - CC/EI
- Aggregate *Technical and Commercial Losses* (AT&C)
  - Aggregate of technical and cash losses
  - Measured in %
  - AT&C = 1 - (1-Overall losses %) X Collection Efficiency%
- *Cash collected* per unit of energy in (CC/EI)
  - Is the ration between cash collected and energy in
  - Is given in c/kWh
  - This is normally compared with the average billing rate

Losses Quantification

- Needs to know the *components and quantum* of losses to decide on appropriate mitigation strategies
- Can easily determine overall energy losses
- Can calculate technical energy losses
- Derive non technical losses from the above
- For technical losses
  - Calculate demand losses
  - Calculate energy losses



Losses Quantification

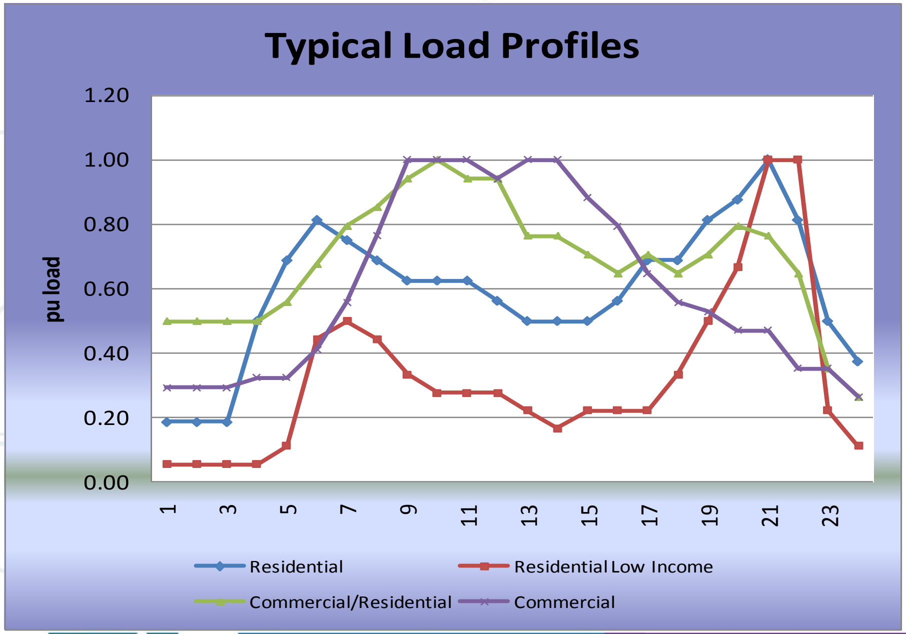
- Demand losses
  - Have to obtain this from load flow studies
  - Need to do it for all voltage levels
- Energy losses
  - Derived from demand losses and loss load factor (LLF)
  - Energy losses = MD loss in kW*LLF*hours in period
- **Determining the Loss Load factor**
  - From statistical metering
  - From the load factor (LF)
  - LF = Total Energy Available/(Maximum Demand in kW*hours in period)
  - The following formula shows how to derive the LLF from statistical metering

$$LLF = \sum_{n=1}^{35040} (\text{load}_n{}^2 / \text{peak load}^2) / 35{,}040$$

where:	35,040	= the number of 15 minute load recordings in one year
	load_n	= the 15 minute average load in the nth 15 minute period.
	peak load	= the highest 15 minute average load in the year

Losses Quantification

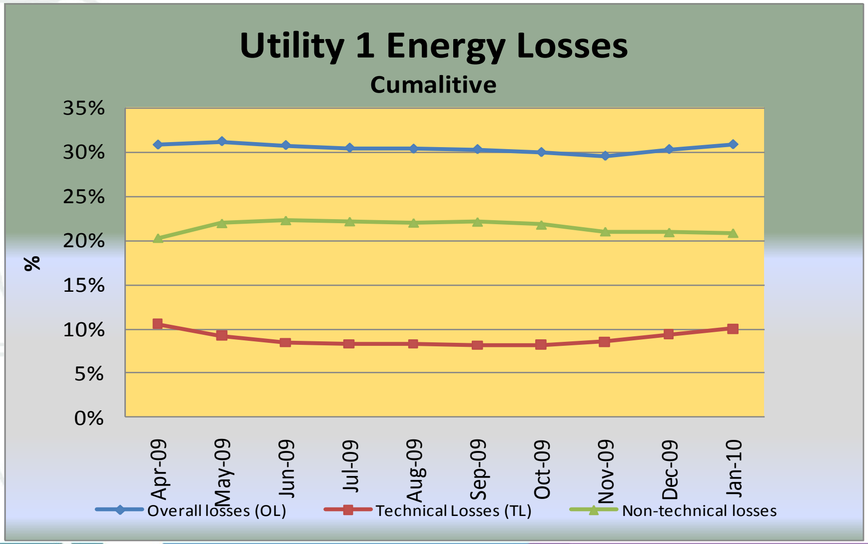
- Determining the Loss Load factor
  - From the load factor (LF)
  - LLF = k*LF+(1-k)*LF^2
  - The factor k depends on the load profile, if no data is available, normally assumed as .3
  - k = (LLF-LF^2)/(LF-LF^2)

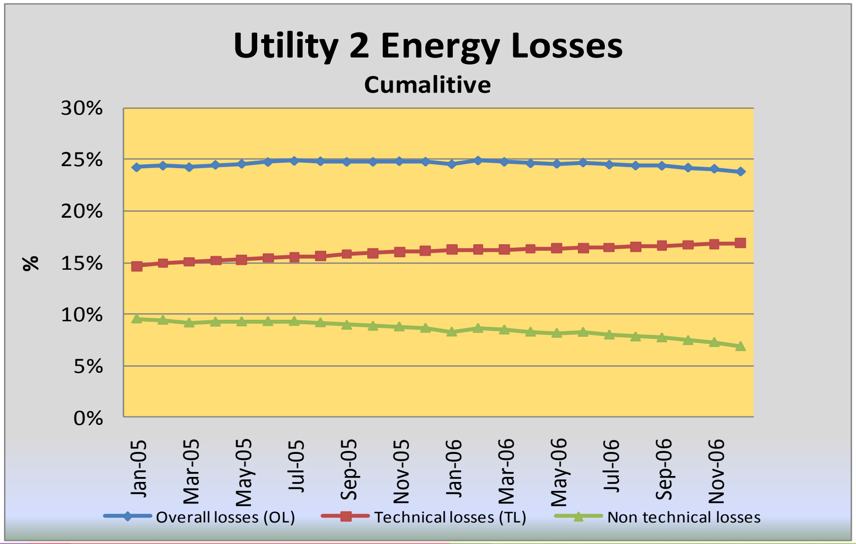


	Residential	Residential Low Income	Commercial/ Residential	Commercial
LF	0.59	0.32	0.69	0.61
LLF	0.40	0.17	0.50	0.44
k	0.18	0.30	0.16	0.32

Typical Results

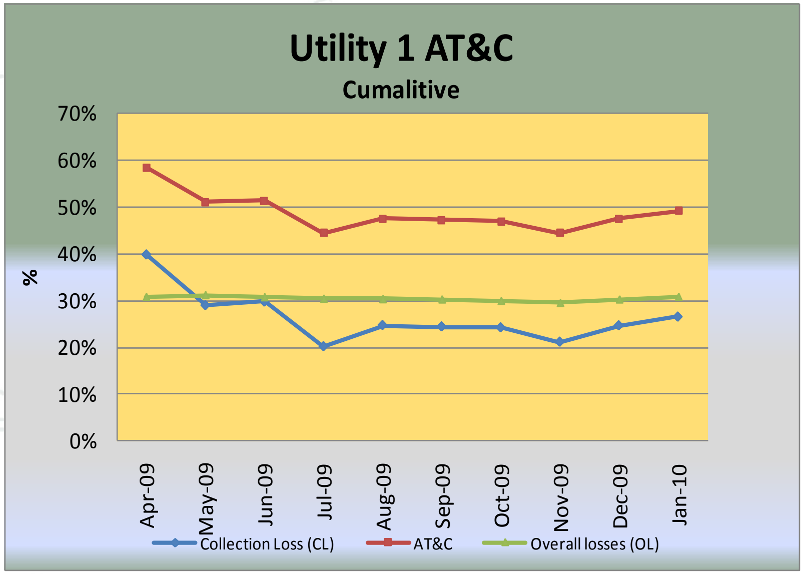
- Energy losses
  - Energy losses *follow* demand profile
  - Energy losses *increase* exponentially as load increases, therefore nullifies the improvement in non technical losses
  - Energy losses are still high, and the technical losses depends a lot on the *network configuration*
  - Utility 1 a urban network, lots of cable, where as utility 2 includes a lot of rural networks

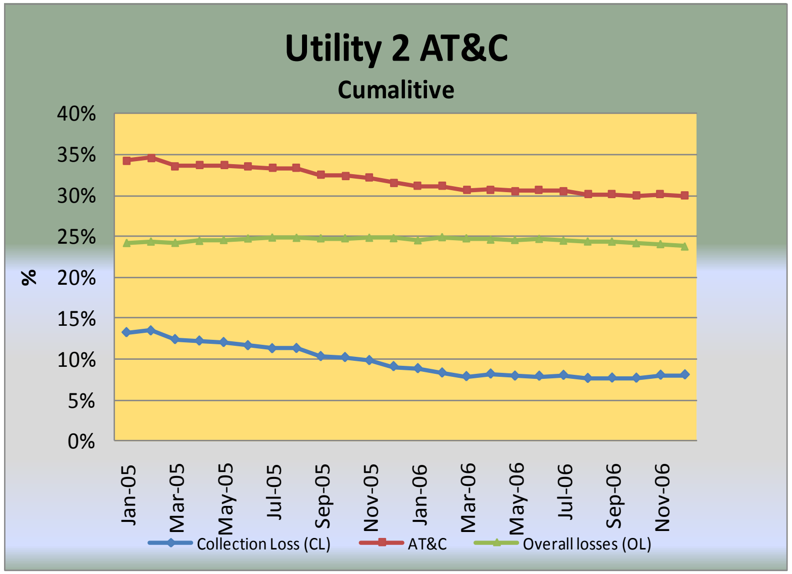




Typical Results

- AT&C
  - Shows the combine effect of technical and cash losses
  - For Utility 2 one can see that mitigation strategies had a positive effect on cash losses helping AT&C to improve.
  - For Utility 1 no mitigation strategies have been implemented yet





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Typical results – Mitigation strategies

- Technical losses
  - Network Optimisation – open points
  - Reduce overloading, especially transformers
  - Balancing of load
  - Ensure optimal voltage levels

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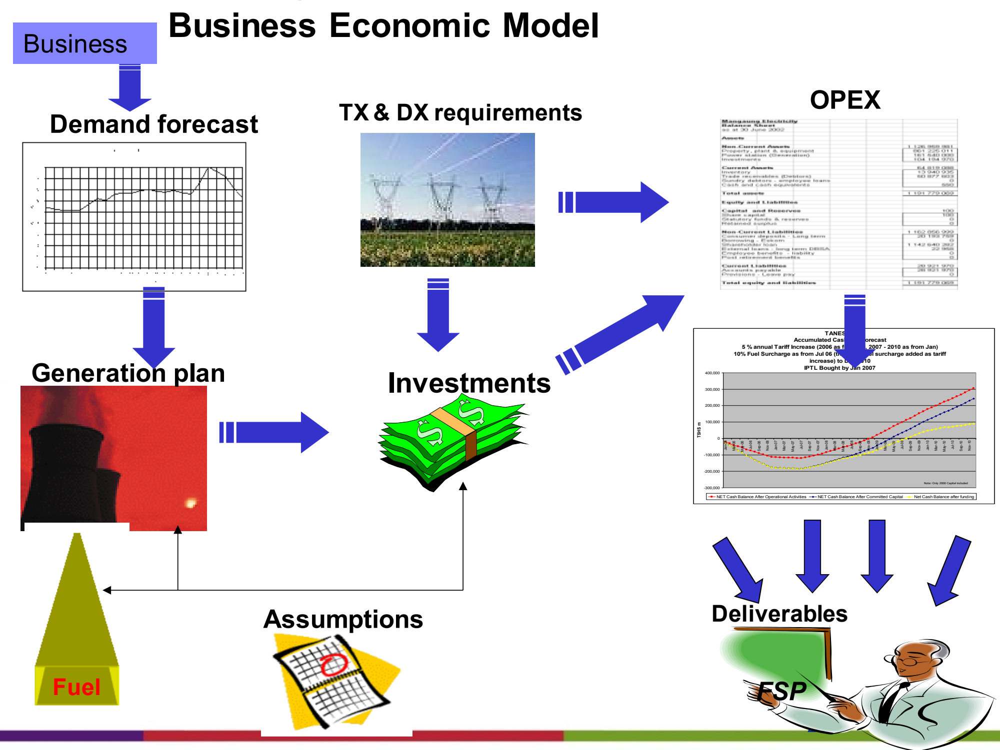
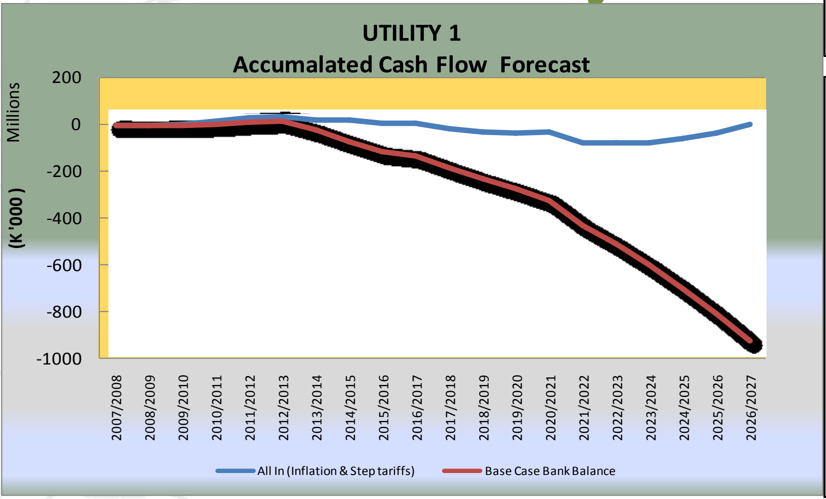
- Non technical losses
  - Appropriate systems
  - Improved meter reading strategies
  - Meter installation audits
  - Appropriate disconnection and re-connection strategies
  - Organisational change to enhance revenue protection

Holistic approach to financial sustainability

- Identify all activities affecting cash flow
- Understand and model the relationships accordingly (business economic model)
- Obtain relevant inputs from other modeling, like:
  - Loss quantification
  - Electrical Master plan
  - Business plan
  - Etc
- Scenario Planning
  - Mitigation Strategies
- Monitoring and Reporting framework
  - KPI’s
  - Dashboard

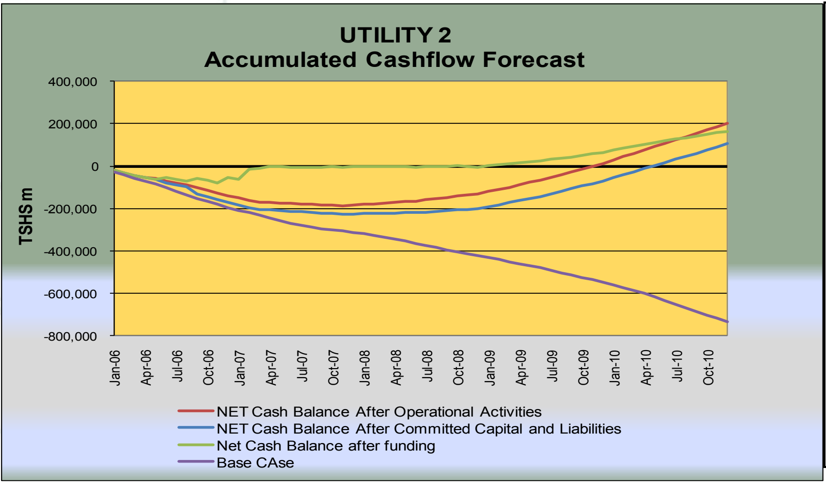


Holistic approach to financial sustainability



Mitigation Strategies

- Reduce technical losses from 16 to 14 % and non technical losses from 5.5% to 2.5% ,
- Increase the collection efficiency from 93% to 97.5%,
- Collection of old debtors over a 3 year period,
- Increase in operational efficiency with 40% (measured in kWh per employee or number of customers per employee).
- Additional step tariffs above inflationary tariffs
- Monitoring and reporting through appropriate KPI's



- Technical Loss reduction from 20% to 17%, non technical losses from 6% to 3%,
- Maintain collection efficiency,
- Convert expensive generation, and optimise generation mix,
- Restructuring of debt,
- Increase the quality of supply and reducing outages,
- Increase sales through electrification and large mining loads,
- Additional step tariffs in short term and
- Overdraft to support short term cash deficit

Benefits from managing losses

- Technical loss reduction
  - Reduce the *cost of supply*, as this will reduce the cost of generation and imports
  - Will save on the *most expensive generation* in a least cost generation strategy
  - *Network optimisation* (optimal switching arrangements, balanced loading, optimal voltage levels) will not need capital investment (except if new switchgear is required to implement the optimal open points)
  - *Network strengthening* will require investment

- Non Technical loss reduction
  - Will either be converted into *additional sales*, or reduction in generation cost (same as for technical losses), or both
  - Will *not need* huge *investments*, might increase short term operational expenses to implement the necessary strategies
  - Will also encourage *efficient usage of electricity* as customers will pay for what they consume and tend to force average consumption down

Conclusion

- Revenue protection is part of a *holistic approach*
- Losses can be reduced through *tailored mitigation strategies*
- Management can get the utilities back to financial sustainability by implementing the *right strategies*
  - Monitoring and reporting
  - Loss quantification
  - Business economic modeling
  - Integrated planning
- Charge *market related tariffs* by cutting out losses and inefficiencies

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END

To measure is to know…