

Performance Based Regulation of Philippines Electricity Distribution Companies

REGULATORY TRAINING COURSE

Cebu – November 5 & 6, 2007
Baguio – November 7 & 8, 2007

SESSION 2C – ODRC Standards for Valuing System Fixed Assets



Asset Valuation Policy & Standards

- An ODRC valuation depends on the existence of the following standards (approved by the ERC):
 - Standard Replacement Costs or MEAs
 - Standard Asset Lives
 - Optimisation Rules
- The ERC relies upon an expert to recommend the standards applicable to the Philippines DUs
- The expert undertakes studies and consultation with the DUs before making final recommendations to the ERC
- Compromises are necessary due to lack of information
- The standards are recorded as ERC Asset Valuation Guidelines

Standard RC Methods Allowed by RDWR

- Indexation
 - Little technological change
 - Valuation directly linked to historical valuation of assets
 - Suitable index can be devised
- Absolute Value by Replacement Cost Analysis
 - Little technological change
 - Suitable indexation cannot be devised
 - Valuation according to purchase prices in last 12 months or
 - Documented arms length prices for sale of such assets
 - Account for volume purchasing discounts
- Absolute Value using Modern Equivalent Asset Cost Analysis
 - Significant technological change
 - Asset no longer manufactured
 - Example - bulk oil circuit breakers replaced with SF6 or vacuum

Standard Replacement Costs

- The process used by the expert to determine Standard Replacement Costs is as follows:
 1. Start with RDWR Asset Categories
 2. Identify Asset Subcategories based on asset count / material value
 3. For each Asset Subcategory decide best replacement cost method
 4. Determine the Standard Replacement Costs
 5. Recommend to the ERC for approval

1. RDWR Asset Categories

- Power Conditioning Equipment
 - Capacitors
 - Voltage Regulators
 - Fault Limiting Reactors
- Services
 - Single Phase
 - Three Phase
- Meters and Metering Equipment
 - Single Phase
 - Three Phase
 - TOU meters
 - MW/MVAR meters
- Street Lighting
 - Standards
 - Lamps
 - Control Equipment

1. RDWR Asset Categories (2)

- Station Equipment
 - Power Transformers
 - Switchgear – (Circuit Breakers, Disconnectors, Earth Switches)
 - Protective Equipment – (PTs, CTs, Lightning Arresters, Relays, NER's, etc)
 - Metering and Control Equipment
 - Communications Equipment
 - Other Equipment (Gantries, Buswork, Battery Banks, LST)
- Poles, Towers and Fixtures
 - Concrete Poles
 - Steel Poles
 - GI Poles
 - Wood Poles

1. RDWR Asset Categories (3)

- Overhead Conductors and Devices
 - ACSR Conductor
 - Aluminium Conductor
 - Copper Conductor
- Underground Conductors and Devices
 - Aluminium Cable
 - Copper Cable
- Line Transformers
 - 19.92/34.5 kV
 - 7.62/13.2 kV
 - 3.6/6.24 kV
 - 2.4/4.16 kV
- Submarine Cables

2. Asset Subcategories

- Example of count & materiality for choosing Line Transformers subcategories
- 7 major subcategories of Line Transformer
- Remaining subcategories merged into nearest matching subcategory

Line Transformer	Count	% by Count	% by Value
DT, 100KVA, 13.8KV	4	4.44%	7.00%
DT, 100KVA, 34.5KV	1	7.04%	12.20%
DT, 150KVA, 13.8KV	38	0.46%	0.84%
DT, 15KVA, 13.8KV	125	0.14%	0.13%
DT, 15KVA, 34.5KV	198	1.96%	1.08%
DT, 167KVA, 13.8KV	13	4.73%	5.25%
DT, 167KVA, 34.5KV	4	2.70%	4.91%
DT, 25KVA, 13.8KV	55	7.47%	3.92%
DT, 25KVA, 34.5KV	133	14.47%	9.50%
DT, 37.5KVA, 34.5KV	76	0.04%	0.04%
DT, 50KVA, 13.8KV	210	12.83%	9.40%
DT, 50KVA, 34.5KV	407	43.55%	45.60%
DT, 50KVA, 2.4KV	1	0.14%	0.12%
DT, 75KVA, 34.5KV	361	0.04%	0.02%
Grand Total	1,225	100%	100%

2. Asset Subcategories – Concrete Poles

Asset Type Code	Asset Type Code Description	Material
POC0001	Concrete Pole – 15 ft	Concrete
POC0002	Concrete Pole – 20 ft	Concrete
POC0003	Concrete Pole – 25 ft	Concrete
POC0004	Concrete Pole – 30 ft	Concrete
POC0005	Concrete Pole – 35 ft	Concrete
POC0006	Concrete Pole – 40 ft	Concrete
POC0007	Concrete Pole – 45 ft	Concrete
POC0008	Concrete Pole – 50 ft	Concrete
POC0009	Concrete Pole – 55 ft	Concrete
POC0010	Concrete Pole – 60 ft	Concrete
POC0011	Concrete Pole – 65 ft	Concrete
POC0012	Concrete Pole – 70 ft	Concrete
POC0013	Concrete Pole – 85 ft	Concrete
POC0014	Concrete Pole – 90 ft	Concrete
POC0015	Concrete Pole – 105 ft	Concrete

2. Asset Subcategories – Line Transformers

Asset Type Code	Asset Type Code Description	HV (kV)	LV (V)	Rating (kVA)	Phases
LT0021	Distribution Transformer – 3.6/0.24 kV , 10 kVA	3.6	240	10	1
LT0022	Distribution Transformer – 3.6/0.24 kV , 15 kVA	3.6	240	15	1
LT0023	Distribution Transformer – 3.6/0.24 kV , 25 kVA	3.6	240	25	1
LT0024	Distribution Transformer – 3.6/0.24 kV , 37.5 kVA	3.6	240	37.5	1
LT0025	Distribution Transformer – 3.6/0.24 kV , 50 kVA	3.6	240	50	1
LT0026	Distribution Transformer – 3.6/0.24 kV , 75 kVA	3.6	240	75	1
LT0027	Distribution Transformer – 3.6/0.24 kV , 100 kVA	3.6	240	100	1
LT0028	Distribution Transformer – 3.6/0.24 kV , 167 kVA	3.6	240	167	1
LT0029	Distribution Transformer – 3.6/0.24 kV , 250 kVA	3.6	240	250	1
LT0030	Distribution Transformer – 3.6/0.24 kV , 333 kVA	3.6	240	333	1

2. Asset Subcategories – Station Disconnectors

Asset Type Code	Asset Type Code Description	kV	Thermal Rating (A)	Earth Switch	Pad Mounted
DIS0001	Disconnecter, 230 kV, 2000 A	230	2000	No	Yes
DIS0002	Disconnecter, 230 kV, 2000 A	230	2000	Yes	Yes
DIS0011	Disconnecter, 115 kV, 2000 A, Pad Mounted	115	2000	No	Yes
DIS0012	Disconnecter, 115 kV, 2000 A, Structure Mounted	115	2000	No	No
DIS0021	Disconnecter, 34.5 kV, 1200 A, Pad Mounted	34.5	1200	No	Yes
DIS0022	Disconnecter, 34.5 kV, 1200 A, Structure Mounted	34.5	1200	No	No
DIS0031	Disconnecter, 13.8 kV, 1200 A, Pad Mounted	13.8	1200	No	Yes
DIS0032	Disconnecter, 13.8 kV, 1200 A, Structure Mounted	13.8	1200	No	No

3. Best Replacement Cost Method

- Replacement Costs assigned if
 - Standard Asset in use (for at least 12 months)
 - Record of recent purchase prices
 - Volume discounts understood
 - Efficient building block cost lower than trended HC
- Indexed HCs used if
 - Convincing historical cost trending information available and HC lower cost than building block RC
- MEA assigned if
 - Asset no longer manufactured
 - Asset not a standard in Philippines (a standard elsewhere i.e. emerging technology) and clear economic benefits in Philippines environment or required to meet service standards

3. Best Replacement Cost Method

- Asset Categories & Subcategories assigned an RC

- | | |
|-----------------------|------------------------------------|
| – Power Transformers | – Poles |
| – Circuit Breakers | – Line Transformers |
| – Disconnectors | – Capacitors |
| – Potential and CT's | – Overhead and Underground Devices |
| – Relays | – Meters |
| – Lightning Arresters | |

- Asset Subcategories given an MEA
 - SF6 for Oil CBs

4. Standard Replacement Costs

Methodology for determining standard RCs

- Market Discovery
 - Cost of materials FOB inclusive of taxes based on PO's
- Local cost Structures
 - Direct local labour costs including contractor rates
 - Transport and plant costs for delivery and erection
 - Overhead costs
- Project Costings
 - Manhours based on efficient crew size for projects of significant size
 - Manhours based on benchmark comparison
- Computation of Efficient Replacement Cost
- Validation against Historical Trended Cost where available

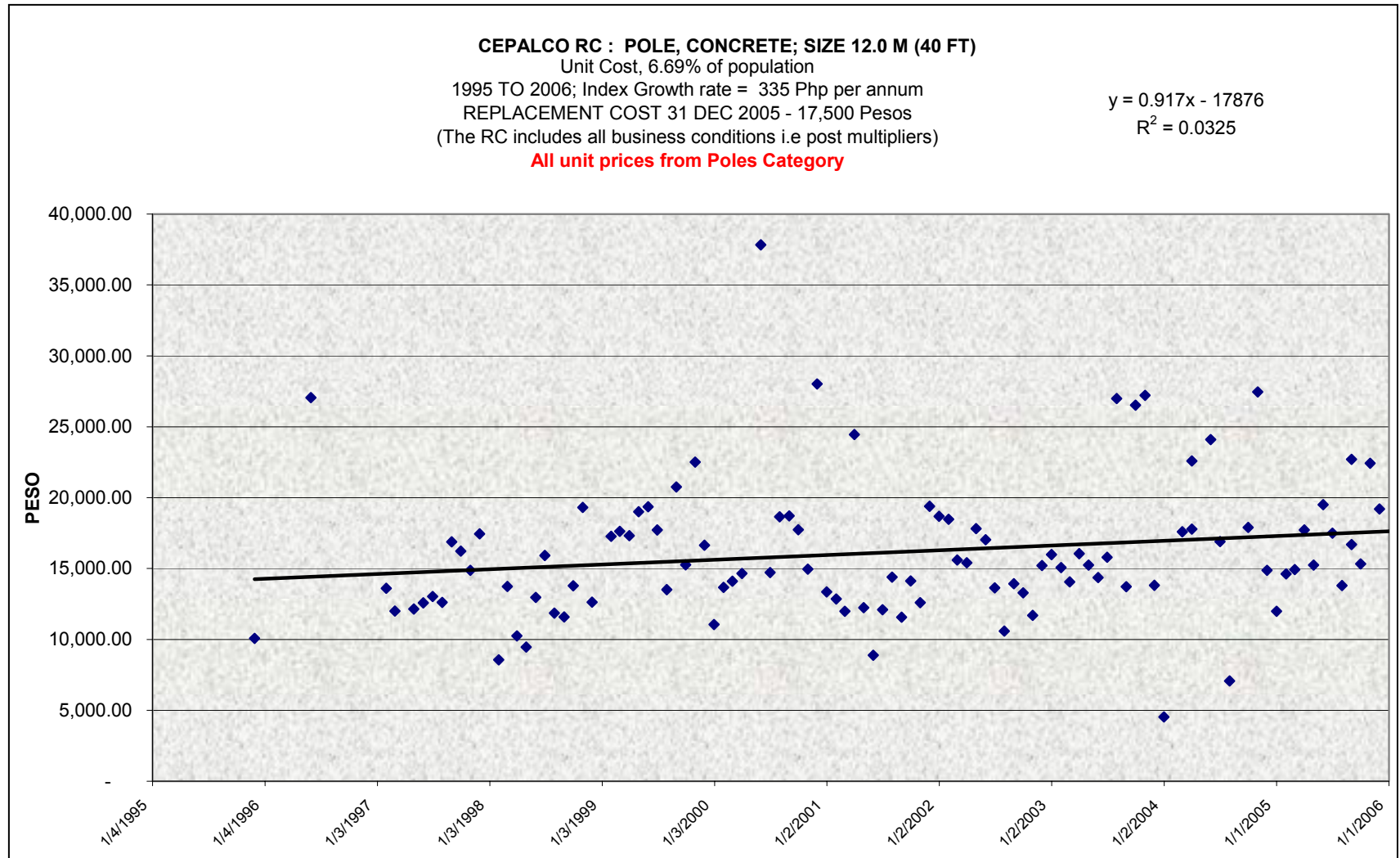
4. Standard Replacement Costs (2)

- Example Replacement Cost computation
 - Current RCs were determined for each DU
 - RCs based on functional equipment groups

	Trended Cost	Building Block Cost	
POLE, CONCRETE; 12.0 M (40 FT)	17,500	Raw Material	17,610
		Fixed installation	8,640
		TOTAL	26,250

4. Standard Replacement Costs (3)

Trended Historical Costs



Standard Asset Lives

The process used by the expert to determine Standard Asset Lives

- Information Sources
 - DU Asset Age Profiles (lack of failure data)
 - O&M policies and cycles (life extension, heavy loading, cycle times)
 - Standard asset lives in jurisdictions with similar environment including Transco
 - Manufacturers recommendations for Philippines environment
 - DU failure investigation reports
- Benchmark
 - Comparison of O&M policies and practices between DUs and international
 - Comparison of standard asset lives
- Consultation with DUs

Standard Asset Lives (2)

Age Profiles

Figure D-8: Age Profile of Cepalco Distribution Transformers

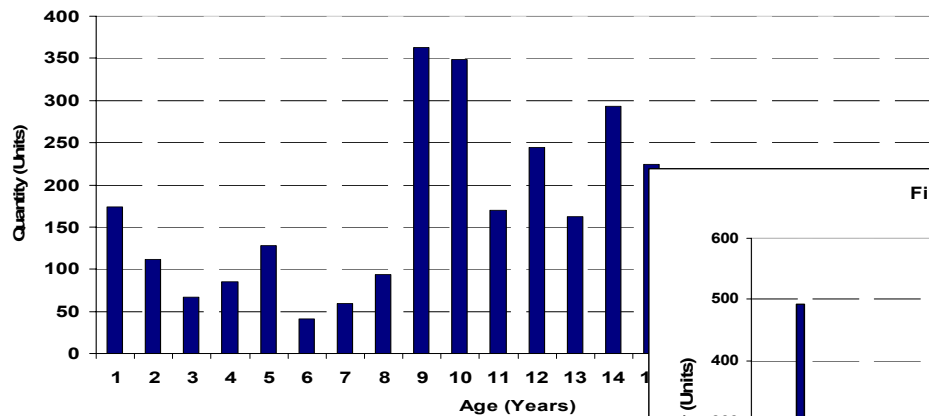


Figure E-10: Age Profile of Decorp Line Transformers

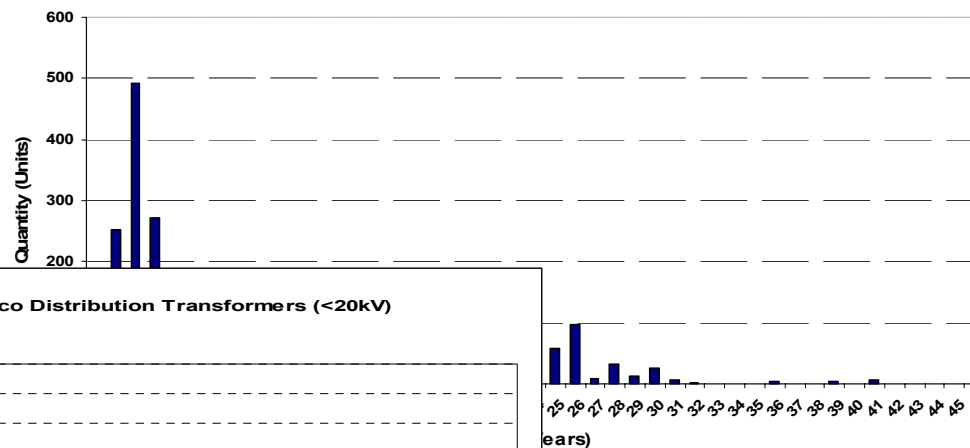
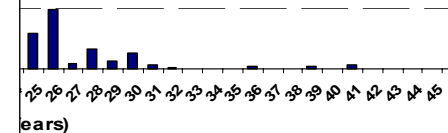
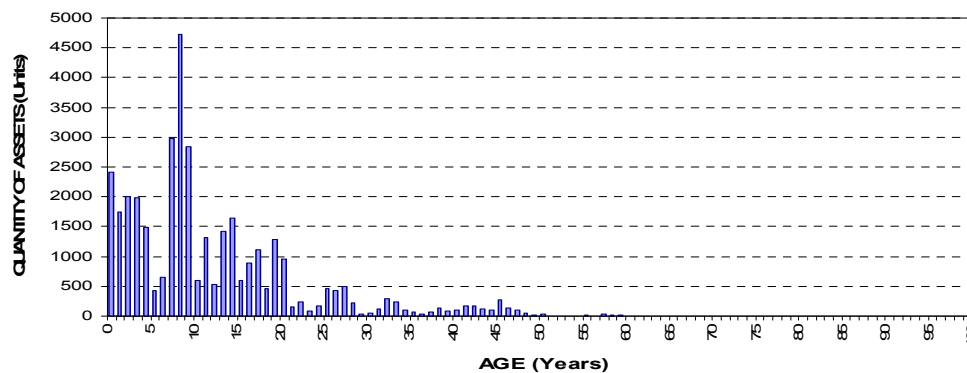


Figure C-9: Age Profile of Meralco Distribution Transformers (<20kV)



Standard Asset Lives (3)

Regulatory Jurisdiction	Philippines				South Africa	New Zealand	Australia			UK	CIGRE
Koppen Climate Classification	Af: Tropical Rainforest				Cfa: Humid Sub-tropics	Cfc: Marine West Coast Cool	Cfa: Humid Sub-tropics	Aw: Tropics Wet Dry	Bwh: Dry / Arid Hot	Cfc: Marine West Coast Cool	Varied
Region or Utility	Transco 2005	Cepalco 2004	Decorp 2004	Meralco 2004	All	All	All NSW	All Queens-land	North WA	All	Refer Error! Reference source not found.
Effective Date of Determination	Aug 2005	2004	2004	May 2005	2004	Aug 2004	May 2003	Nov 2004	July 2004	2004	Nov 2000
	Asset Life in Years										
HV Transformers	45	25	25	30	50	55	45 ²	50	50	55+/-11	42 +/-8
HV Overhead Lines											
- Steel Towers	50	N/A	30	30	50	45	60	60	60	46+/-8	46+/-15
- Steel Poles	50	30	30	30			N/A	N/A		(Towers)	63+/-21
- Concrete Poles	50	30	30	30			55	55		55+/-8	N/A
- Wood Poles	25	10	10	10			45/55	45/55		(Poles)	44+/-4
HV Cables	50	N/A	N/A	30	50 PILC 45 XLPE	45 XLPE 70 PILC	45	45	55	61+/-9	51 +/-20
HV Substation Equipment	40	20	20	30	50	45	45 ²	45	50	50+/-7	40+/-6
MV Line Transformers and Pad Mount-Transformers	N/A	15	15	30	45	45	40	35/45	35	50+/-10	N/A
MV Cables	N/A	N/A	N/A	30	45	45 XLPE 70 PILC	60	60	60	85+/-12	N/A
MV Lines	N/A	30 (Steel/ Concrete) 10 (Wood)	30 (Steel/ Concrete) 10 (Wood)	30	50	60 (Concrete) 45 (Wood)	45/55 ¹	45/55 (Wood) 55 (Concrete)	41 Wood 50 Steel	45+/-11	N/A
MV Substation Equipment	N/A	20	20	30	45	40 - 45	35/45 ¹	35 - 50	35	46+/-8	N/A
LV Network	N/A	20	20	30	50	45	45/55 ¹	45/55	-	56+/-11	N/A
Network Management (SCADA)	15	10	10	20	20	15	10	-	-	-	N/A
Meters	15	10 (Digital) 15 (Electromechanical)	10 (Digital) 15 (Electromechanical)	25	15 Prepaid 30 Credit	-	25	-	25	-	N/A
Communications & Telemetry	15	6	6	20	20	15	10	10	-	-	N/A

Standard Asset Lives (3)

Extract

Account Name	Estimated Service Life (Years)
TRANSMISSION PLANT	
Structures and Improvements	35
Station Equipment	30
Towers and Fixtures	30
Poles and Fixtures	30
Overhead Conductors and Devices	30
Underground Conductors and Devices	30
Underground Cables and Devices	30
DISTRIBUTION PLANT	
Structures and Improvements	30
Station Equipment	30
Customer's Substation	30
Poles, Towers and Fixtures	30
Overhead Conductors and Devices	30
Underground Conduits	30
Underground Conduits and Devices	30
Line Transformers	30

Optimization

- Basic rules:
 - Provide a quality of supply similar to that which currently exists, except where this exceeds the approved standard quality of supply criteria
 - Provide a capacity similar to that of the existing network, except where this exceeds allowed future load growth over the forecast periods allowed
- Practical Outcomes
 - In areas with double-digit load growth, spare capacity will be used up quickly and optimization is less likely
 - Clear Planning Policy guidelines, utilization statistics and load forecasting techniques are advantageous to the DU in establishing the prudence of past investment decisions

Optimization Must Observe Quality Levels

Quality Category	Network Components	Quality Level
Degree of network security	<ul style="list-style-type: none"> • Points of connection to transmission network • Sub-transmission network • Substations • Primary switching stations • Primary distribution feeders 	n-1
	<ul style="list-style-type: none"> • Secondary distribution feeders • Low voltage network 	n-0
Power Factor	All	> 0.85 lagging
Voltage Variations	All	> 90% nominal voltage < 110 % nominal voltage
Signal Distortion	All	< 5%
Technical System Losses	All	<=6.5%

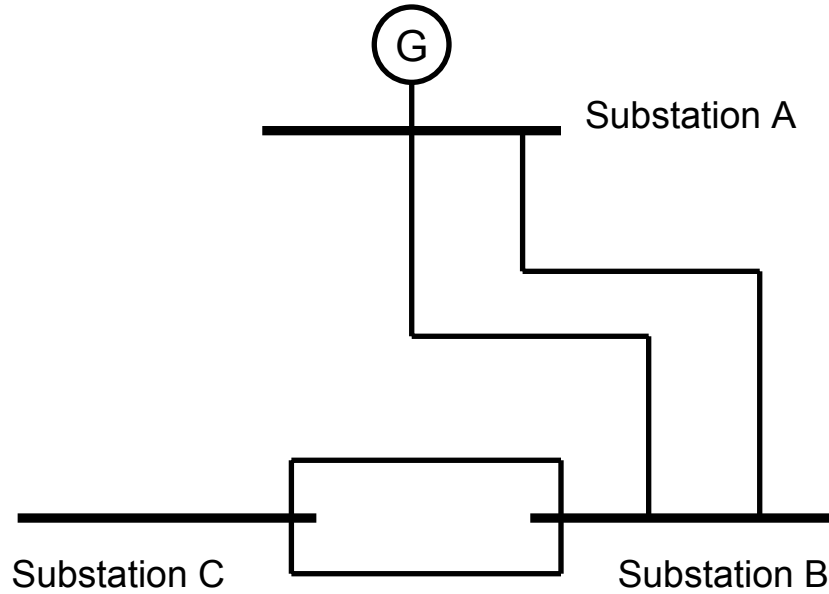
Optimization Must Observe Planning Horizons

Network Component	Planning Horizon
Sub-transmission lines Substations (excluding transformers) Primary distribution circuits Points of connection to transmission networks	15 years
Substation Transformers	10 years
Distribution transformers	5 years
Low voltage network Other distribution assets	5 years

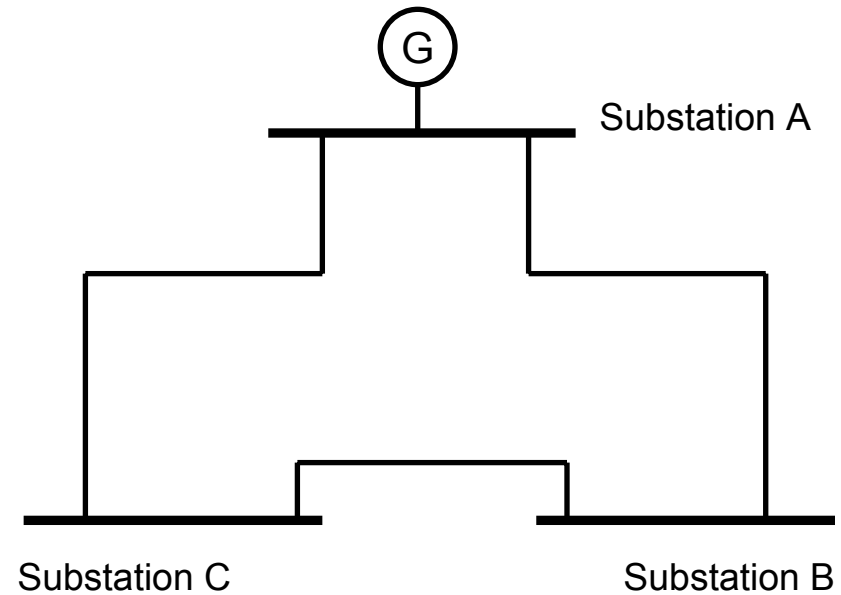
Optimization Process

- The process used by the expert to determine the amount of optimization consists of five stages:
 1. Excluding stranded assets
 2. Optimizing the configuration of the network
 3. Optimizing the capacity of elements in the network
 4. Optimizing network engineering
 5. Optimizing stores and spares
- 1. Excluding Stranded Assets
 - Assets anticipated to no longer earn revenue during the appropriate forecast period
 - In practice stranding low due to relocation of DTs and high growth
 - Example DTs – 1% stranded asset

2. Optimizing the Configuration of the Network



Pre Optimization



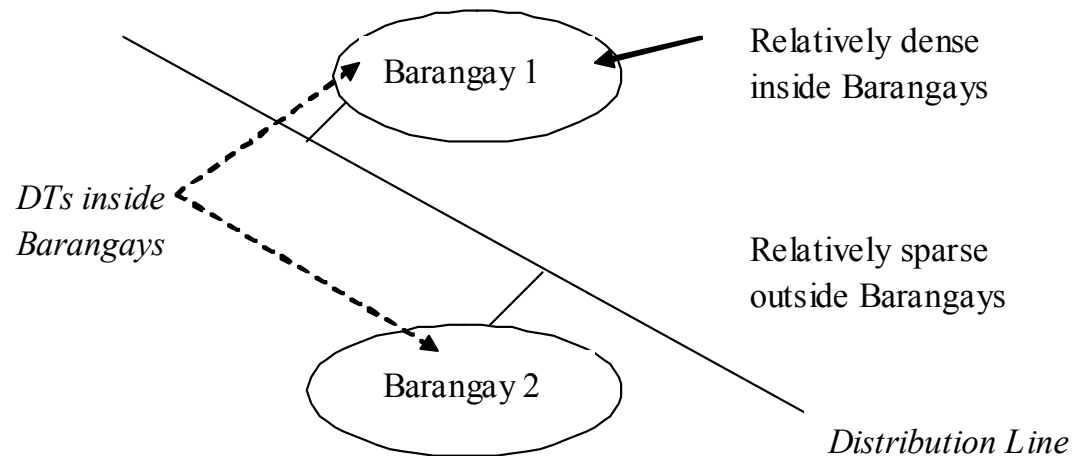
Post Optimization

3. Optimizing the Capacity of Network Elements

- Capacity must be optimised when the asset is anticipated to have excess capacity at the end of the planning period compared to the expected maximum demand
- Examples
 - A major substation has two 50 MVA transformers. At the end of the planning period of 10 years the maximum demand at the substation is estimated to be 40 MVA. Therefore the 50 MVA transformers would be optimised to 40 MVA units and given a replacement cost equivalent to the smaller units
 - A substation is supplied by three transmission lines. Each line is capable of supplying 30 MVA. The maximum demand at the substation at the end of the planning period of 15 years is 60 MVA. Therefore the transmission line capacities can be optimised down to 20 MVA

3. Optimizing the Capacity of Network Elements

- DT Utilisation
 - High for DTs in Barangays
 - Densely populated towns
 - DTs placed in load centres
 - Customers per DT ~ 50 in urban and rural locations
 - Utilisation high



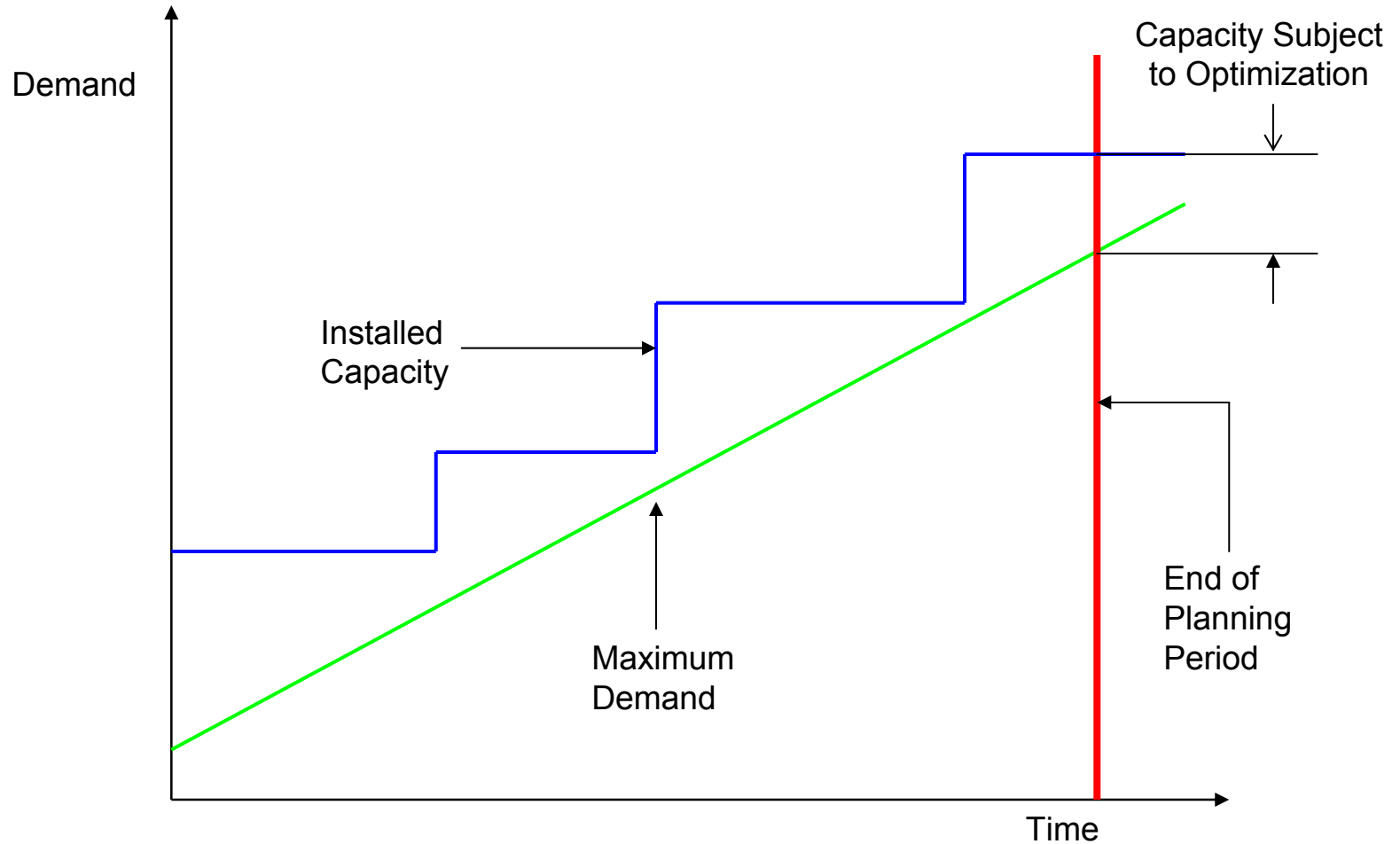
3. Optimizing the Capacity of Network Elements

- DT Utilisation Targets
 - 50% for small size; 70% for large size

Existing DT Capacity	Class Assumption	Utilization at 5 yr planning horizon	Actual kVA loading	Optimise to RC of DT with capacity of
25kVA	Residential	< 50%	<12.5kVA	15kVA
50kVA	Residential	<50%	<16kVA	25kVA
75kVA	Commercial	<70%	<52.5kVA	50kVA
100kVA	Commercial	<70%	<70kVA	75kVA

3. Optimizing the Capacity of Network Elements

- Load Utilization & Planning Horizon



4. Optimizing Network Engineering

- Optimizing Network Engineering
 - This ensures that no excess engineering has been undertaken on the network
- Examples
 - A distribution feeder has duplicated protection relays
 - A substation was built to an indoor design when it should have been open terminal design (outdoor)
 - Meters with excess functionality used in place of lower meter

4. Optimizing Network Engineering (2)

- Meters Example

$$Opt(\%) = \frac{Qty_{opt}}{Qty_{org}} \left[\frac{(RC_{org} - RC_{opt})}{RC_{org}} \right]$$

- Where
 - Opt(%) is the percentage that the RC is to be reduced by
 - Qtyopt is the total number of items to be optimised
 - Qtyorg is the total number of items in the asset category
 - RCorg is the replacement cost of the asset to be optimised
 - RCopt is the replacement cost of the new asset category.
- When an item is to be optimised out RCopt is set to zero, therefore the equation reduces to:

$$Opt(\%) = \frac{Qty_{opt}}{Qty_{org}}$$

5. Optimizing Network Spares

- Optimizing Network Spares
 - The amount of spares held must not be excessive
- Examples
 - 1000 distribution transformers are installed on the network and 500 are held as spares. This would be considered excessive. In discussion with the DU a suitable number of spares would optimised out
 - Equipment older than the standard life should not be included in the spares list unless refurbished

5. Optimizing Network Spares (2)

- ABC Ltd has approximately 1,330,000 meters of 15kV overhead conductor in use (excluding). The stockholding amounts to approximately 36% of conductor in use.
 - 1) Network replaced at 5% per annum – 66,500 meters per annum. Network growth ~ 20% of stock based on 1st half 2006 additions – 95,000 meters per annum. i.e. total usage of 161,500 meters per annum
 - 2) $475,000 - 161,500 = 313,500$ meters excess to requirements
 - 3) 313,500 meters of conductor with make up as follows - Bare ACSR 336.4MCM @ 40%, Bare No 4/0 AWG @ 40% and Bare No 2/0 AWG @20%
- Total optimisation is approximately Php 22.6m

Depreciation

- There are two main ways in which assets can be depreciated
 - Straight-line basis
 - Diminishing balance method
- For historical valuation, depreciation is usually over a fixed period, in equal nominal amounts i.e. on a straight-line basis
- In current cost depreciation, the current/inflation-indexed value is depreciated over the remaining useful life of the asset after taking into account condition

Depreciation (2)

- In the ODRC valuation methodology, depreciation is calculated on a straight-line basis
- The value that is depreciated is the newly determined Replacement Cost (RC). The Remaining Life (RL) is divided by the Total Life (TL) of the asset and this factor is multiplied by the RC to give the depreciation
- Under PBR a residual value of 5% of ORC is applicable – this discourages replacement prior to end of useful service (technical life)
- The depreciation calculation is built into the ODRC register provided to the DU by the ERC

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SESSION 2D – Valuing System Fixed Assets



How Is An ODRC Valuation Conducted?

The ODRC Valuer

1. Prepares of a detailed asset register that complies with the requirements of the methodology
2. Verifies the physical existence of the assets and the installed dates through asset inspection
3. Calculates the Replacement Cost (RC) using the RCs and Modern Equivalent Asset Values (MEAs)
4. Optimizes the system
5. Calculates the depreciation based on the age of the asset
6. Reconciles the ODRC values with previous valuations

1. Create the ODRC Register

- The DU conducts an audit of the Fixed Asset Register (for tax purposes)
- The Valuer reviews the FAR and recommends an asset subcategorisation to the ERC (as close as possible to other DU scheme)
- The DU allocates assets into the standard asset subcategories approved by the ERC
- The DU to prepare the register in the standard format provided by the ERC including installed dates
- The Valuer provides expert assistance thru' this process
- The DU submits the ODRC Register to the Valuer in first instance

2. Verify the RC Register

- The Valuer undertakes Substation Inspections to 100% confidence
- The Valuer undertakes Distribution Network Fixed Assets Inspections on Sampling Basis
 - Major categories to 99% confidence level (250 inspections)
 - Minor categories to 95% confidence level (100 inspections)
- For verification
 - Fundamental requirement #1 is physical location
 - Work around is to match GIS asset counts to FAR counts
 - Check processes for entering assets into the FAR from as-built drawings
 - Use drawings for site inspection verifications
 - Fundamental requirement #2 is installed date
 - Work around is to correlate age observed from site inspections against age profiles in the FAR & recorded on drawings

3. Calculate Replacement Costs

- The DU provides the Valuer with information pertaining to replacement costs as requested by the Valuer, purchase records, standard job costings, etc
- The Valuer determines and recommend standard replacement costs to the ERC
- The Valuer consults with the DU
- The DU enters the ERC approved replacement costs into the ODRC register
- The DU provides the Valuer with a copy of the newly formed ODRC register

4. Optimise the RC Register

- The Valuer works with the DU to identify any assets to be optimised
- The DU provides the Valuer with System Planning Policy, Design Standards, O&M Policy, Load Forecasting techniques
- The Valuer recommends the amount of optimisation to the ERC
- The Valuer consults with the DU
- The Valuer adjusts the ODRC register according to the outcomes of the consultation process and table the basis for adjustments with the ERC

5. Calculate Depreciation & Finalise ODRC Register

- The Valuer verifies the calculation of depreciation and the ODRC register as a whole
- The Valuer provides the DU with a copy of the final ODRC register and a draft valuation report to the DU and ERC
- Following consultation the Valuer tables the exchange of views and reasons for any adjustments to the valuation

6. Reconcile the Valuation

- The Valuer reconciles the ODRC valuation against previous valuations
- The Valuer consults with the DU in relation to any material differences
- The Valuer submits a valuation report to the ERC
- The DU submits their valuation proposal
- The ERC undertakes final consultation with the DU
- The ERC makes a determination of the final values

Thank You

Proceed to next session

