7.5 Recommendations

Recommendations of training for implementation of the distribution network are shown as follows.

7.5.1 Recommended Training Programs for the Distribution Network

Although introduction of new technology is also important for improvement of construction, maintenance, and operation for the distribution facilities, it is important to raise talented engineers and workers more than that. Here, the item considered to be required for the distribution facilities improvement is extracted based on the investigation conducted by present, and the training programs for the distribution network is summarized as one of the solution of those as follows. The study team proposes making this training programs for the distribution network reflect in existing training programs.

(1) Safety

Safety must precede everything. Therefore, the basic items that should be abided by workers in charge of the distribution systems to safeguard workers, third parties and distribution facilities are listed as follows.

(a) Prediction of danger

Workers should carry out a "Tool Box Meeting" (TBM) before work, then predict danger by finding points of danger involved in the work. After the work, a "Reflection Meeting " should be carried out, and workers should discuss dangerous points, excluding TBM. This should then be fed back at the next work.

(b) Human safety

(i) Work director

When two workers comprise one group for distribution work, the work director who controls, gives instructions for and directs the work should be appointed. The work director should take the prescribed training.

(ii) Elevated work

Work performed at heights above two meters is called "elevated work." In this case, workers should pay attention to the following points.

- Every worker must use an on-pole safety belt during elevated work.
- When a worker needs to move his safety rope, he must use an auxiliary rope while climbing up or down a pole or conducting on-pole work.
- A worker should climb up or down a pole under the supervision of a work director or a supervisor appointed by the work director who remains on the ground.
- Each worker should climb the poles with extreme caution, using his voltage detector to check whether the pole and its metallic attachments have any electrical leakage.

(c) Facility safety

To prevent existing distribution facilities near the work from being seriously damaged by dropped equipment, by touching construction machines, etc, they should be protected. In addition, to avoid the boom of a crane touching the overhead conductor, the overhead

conductor, which is placed near the work, should be covered by a protection pipe. A sign with small red flags should then be put on the protected conductor.

(d) Works for outages

Dead line work is conducted using the following process.

- ✓ When high voltage section switches must be manipulated to prepare for dead line work, each switch should be manipulated on a one-instruction, one-manipulation basis.
- ✓ Section switches that have been opened to prepare for dead line work, as well as high voltage section switches opened normally that are hooked up to the section whose service is interrupted, should be securely locked up. Signs reading "Switch Open for Dead Line Work" should be placed on each switch.
- ✓ Prevent distribution lines from receiving power surges from non-utility power-generating facilities via low voltage windings of a pole-mounted transformer. If dead line work has to be performed within a section that accommodates a customer with non-utility power generating facilities, the customer's section switch(es) or the primary switch(es) of the pole-mounted transformer(s) that power the customer's facilities should be opened.
- ✓ If work has to be done in the downstream reaches (load-side) of a pole-mounted transformer's primary switch, the transformer's secondary windings should be short-circuited by grounding.
- ✓ Open-circuited high voltage distribution lines or wires coming from the secondary windings of a pole-mounted transformer should be checked for the absence of electricity, phase by phase, with a voltage detector before starting dead line work.
- ✓ Grounding fittings should be mounted on the power-supply side of open-circuited high voltage lines near the work site. This measure is taken to prevent electrical shocks from occurring when power is supplied from the customer's power-generating facilities when power is inadvertently supplied during work or when any of the open-circuited high voltage line comes into contact with another live line, or when these lines develop voltage due to power surges from other lines.
- ✓ After completing dead line work, the work director responsible should personally run checks to make sure that the conductor connections have been correctly made, and that there are no missing connections and all grounding fittings have been removed. After this, the work director takes a roll call of his crew to make sure that everyone is now back on the ground, and that the section they have worked on is now ready to receive power. After everything is determined to be in order, the work director informs his headquarters that the dead line work has been completed.

(e) Work performed near live wires

(i) Forming a hot line proximity work team

As a rule, work performed near live wires should be conducted by groups of three or more workers. The work team should consist of a work director, a hot-line proximity worker(s), an on-pole worker(s), and an aboveground worker(s).

(ii) Arrangements made before working

Before starting work, the work director should ensure that the insulating protective gear (clothing), and guards to be used are in perfect order by checking them thoroughly. He should also explain to all of his crew their assigned work, the work methods to be employed, who does what, etc.

(iii) Work performed near high voltage live wires

When a worker has to work near high voltage live wires, the worker should be put on insulating protective gear (clothing) and install guards before starting work, in case of high voltage hot-line work.

(iv) Low voltage hot line work

If there is a possibility of electrical shocks occurring, all workers should wear safety headgear, low voltage insulating gloves, low voltage insulating clothing and insulating half boots. If the place where work is to be performed is wet, or if work must be performed on a highly conductive object, guards should be installed on the low voltage lines and grounding bodies.

(2) Plan of distribution lines

(a) Demand forecast

Before mapping out a distribution facilities expansion plan, it is necessary to forecast future increases in power demand (peak demand) so that facilities capable of supplying adequate power can be designed and installed. The demand forecasting techniques is as follows.

(i) Making forecasts based on external information

This technique is gathering and investigating information that suggest future increases in power demand, such as reports on housing complex construction projects, industrial estate construction projects, high-rise construction projects (quite often coupled with city planning) and big factory expansion plans.

(ii) Making forecasts based on past load grows curves

In areas where existing loads are concentrated with considerably high density, the loads already installed are expected to create considerable increases in the demand for power in addition to increased demand from newly installed loads.

(b) Substations for distribution

It will be necessary to install new distribution substations or expand existing distribution substations when capacity shortages begin to pose a problem, or the quality of electric power decreases to an unacceptable level due to increased power demand, or if there is a chronic substandard-quality problem.

(i) Substation capacity enlargement

A substation's utilization rate is obtained by dividing its maximum load by its rated capacity, and expressing the results of calculation as a percentage. A percentage calculated in this manner serves as one measure to determine when to install a new substation or expand an existing substation.

Basic load limits expressed in terms of substation utilization rates, as shown in the table below, are predetermined. A distribution substation reinforcement plan will be framed when these limits begin to be exceeded.

Table 7.7 Normal substation load limits

Items	Normal load limit (%)
Banks	90
Substation	90

(ii) Distribution line installation

The capacity of a single distribution circuit is limited by the allowable current of the cables or conductors used at the outlet of the substation concerned. The capacity of the

cables and conductors used along major main-line portions as well as the voltage drop along the way can also limit the capacity of the distribution circuit.

As demand grows and the predetermined allowable current and voltage drop limits are exceeded, it becomes necessary to unload some of the burden on existing distribution lines by installing new distribution line paths. In some cases, however, installing a new substation proves more advantageous.

These cases occur when distribution line-related measures cannot serve as viable solutions due to excessive voltage drops that develop along distribution lines.

Table 7.8 Bank capacities of a distribution substation

Item	Bank capacity
Large cities	15 or 8MVA
Mid-sized cities, environs of large and mid sized cities	8MVA
Small cities, sub-prefectural areas	8MVA

Table 7.9 High voltage distribution line voltage drop limits

Item	Voltage drop limits (The rate to the distribution voltage)
Low voltage	6.0%
11, 33 kV	9.0%
More than 110 kV	12.5%

Table 7.10 Feeder systems and capacities

Feeder category	Feeder size	Allowable current
Low voltage	34 sqmm	100 A
11, 33 kV	55 sqmm	140~160 A

(c) High voltage distribution lines

A distribution line path configuration is a network spread over an area, with feeders from substations connected to several points on this network.

This power-distribution network is basically made up of overhead distribution lines. Its major lines are called main lines while their offshoots are called branch lines. Feeders are lines that connect substations and distribution networks.

Generally, overhead distribution lines are standard, and not more than two high voltage circuits should be installed side by side.

(i) When to reinforce high voltage distribution lines

High voltage distribution lines need reinforcing in the following situations. The time to carry out reinforcement is determined after making a comprehensive study of following:

- The existing facilities are no longer capable of fully supplying demand; i.e., the normal service condition load limit of one circuit is exceeded due to increased load, or the loading current limit or voltage drop limit of a line is exceeded.
- Adequate reliability of power supply can no longer be obtained with the existing facilities.

(ii) How to implement a reinforcement plan

When devising a reinforcement plan of high voltage distribution lines, it is necessary to seek the highest possible investment returns by considering probable future line configurations, possible demand grows, predicted voltage drops, and other factors. The following basic points should be considered.

Table 7.11 Basic ideas of reinforcing power supply of high voltage systems

Classification	Expansion method	Description
Decreasing load current	Installing a new distribution substation	In this method, a new substation is added to an existing substation's service area to unload some of the burden on the area's existing distribution lines. This method makes it possible to produce several circuits' worth of additional power-supplying capacity at ones. Since costly power-transmission and -transformation facilities are involved, this method is used only when existing substations are running short in their capacities.
	Dividing a circuit	When the capacity of an existing distribution circuit has become insufficient, a new circuit is installed to share the burden. This method is used when an existing substation has sufficient reserve power-supplying capacity.
	Stepping up the supply voltage	This method of stepping up voltage is used when distribution power at the current supply voltage becomes uneconomical due to high growth in demand density and/ or very long downstream lines.
decreasing impedance	Re-stringing lines	In this method, existing lines are replaced with ones with greater cross sections, commensurate with load currents, to decrease the importance of those distribution lines and thereby increase their allowable current.
Installing equipment to improve voltage regulation	Installing automatic voltage regulating equipment	Equipment to improve voltage-regulation is installed somewhere midway along distribution lines to compensate for the lines' voltage drops caused by impedance. This strategy effectively compensates for voltage drops that develop along long-haul lines such as those cutting through sub-prefectural areas.
	Installing parallel capacitors	In this strategy, parallel capacitors are employed to largely improve voltage regulation by offsetting lagging current components contained in load currents by these capacitors' leading currents.

(d) Low voltage distribution lines

(i) Service reliability

It is important that a terminal voltage at the customers' service entrance should be maintained stably.

Table 7.12 Low voltage line voltage fluctuation range

Standard voltage	Terminal voltage range to be maintained
240 V	Max. 254 V Min. 226 V (±6%)

(ii) Low voltage line voltage drop limit

The low voltage line voltage drop limit is as follows.

Table 7.13 Low voltage line voltage drop limit

Item	Voltage drop limit
Low voltage line voltage drop	14 V

(iii) Flickering voltage drop limit

A recommendation of flickering voltage drop limit in a short period is as follows.

Table 7.14 Flickering voltage drop limit (Recommendation)

Frequency of flickers	Voltage drop limit
Approximately once a minute	16 V (7%)
Approximately three times or fewer per hour	24 V (10%)

(iv) Protective switch gears

To protect pole-mounted transformers, cutouts equipped with fuses that limit current are installed on their primary side.

These cutouts are used to prevent the transformer winding from melting down in the event of a short circuit in low voltage lines hooked up to these windings. Furthermore, there is distance limit on low voltage lines set according to their conductor sizes and the capacities of the pole-mounted transformers to which those low voltage lines are connected.

(3) Construction of distribution lines

(a) Design

(i) Major assignments of the design staff

- The design staffs conduct a site survey so that they can design facilities that satisfy the applicable laws, regulations, standards and specifications, and incorporate provisions for enhanced reliability, safety and ease of maintenance. Based on the results of the site survey, they decide on the best work method and give instructions to those responsible for implementing the planned installation.
- The design staffs prepare various reference materials, file applications, issues hot line/dead line work instructions, go through formalities, and conduct negotiations for site acquisition. At the same time, they calculate the required materials and components to avoid possible delays caused by unsuitable amounts of material.
- The staffs calculate the estimated cost for each project to draw up or supervise a budget. When an installation or expansion project must be mapped out, or when an existing facility must be moved to a new location, the staff calculate the estimated cost for each project to serve as a basis for determining how much the customer will pay. The amount to be paid out as compensation can also be decided here.

(ii) Representative design tasks

- Studying various reference materials and obtaining a clear picture of demand
- Conducting site surveys and studying/analyzing findings
- Establishing design policies
- Selecting areas through which distribution lines are to be installed
- Designing individual portions of distribution-line facilities

(b) Work plan

Based on the design document, a work-implementation plan is made that considers such factors as the amount of material and equipment, the scale of work, the type of work, the construction method, the formation of the work team, etc. In addition, the need for dead line work and weather conditions should be considered in the work implementation plan.

(c) Procurement of material

After the day that work begins has been determined, the required materials and components are arranged to be procured. It is a good idea to save spare parts to a certain extent if they are fixed from materials, but having an excessive amount of spare parts should be avoided. Therefore, it is important to know how many spare parts are in the warehouse by checking periodically.

In the case of large construction, the work implementation plan should match the material procurement plan.

(d) Construction supervision

Most important in construction control is "to finish construction on time." If construction cannot be finished on time even though it has been well done, the contractor must pay a penalty. To avoid this problem, the work supervisor should create a good relationship with the workers on the construction site, and should check work progress everyday. The work supervisor should also conduct periodic witnessed inspection, and check if there are defects or delays in construction, etc. If construction is delayed, it is important that the work supervisor and the work director discuss and find the best solution as soon as possible.

(e) Completion inspection

After completion, engineers such as A.E.s, etc, in the regional office should conduct completion inspections. The inspection items are as follows.

(i) Paper inspections

- Paper inspections are conducted for every work project to check:
- The piece-rate work concerned and the number of elemental jobs making up the contracted work are classified. In addition, construction costs are audited.
- Delivered/warehoused materials are measured against the design specification sheets and the design drawings; required payment adjustments are made.
- The number of days delayed while executing work and the number of days required for reworking, if any, are calculated.
- Other documents related to work completion to accurately enter the required information are prepared.

(ii) On-site inspections

Documents related to work completion that have undergone paper inspections are checked against completed on-site work based on such criteria as the installation method employed, the materials/components used, the classification of piece-rate work completed, the number of elemental jobs making up the contracted work and construction costs. In addition, the required measurements, such as the height of the completed facility above the ground and the distance between the facility and neighboring constructions, along with required tests, such as grounding resistance value measurements, are conducted.

Although all work is in principle subject to on-site inspection, sampling inspections are applied to those completed facilities that are unlikely to pose any serious problems in terms of safety and in relation with their surroundings.

(iii) Re-inspections

If completed facilities need additional work due to cost-cutting methods or poor workmanship, the work supervisor issues a re-work directive to the construction company concerned. After re-work is completed, another inspection is made of the facilities in the same way that completion inspections are usually conducted.

(4) Operating the distribution network

(a) Supply reliability

(i) Recording service interruptions

Service interruptions are distinguished as being caused by outside faults or work-related service interruptions. The problematic feeder should be located by recording the annual incidence and duration of service interruptions per feeder. It is important to understand the cause of service interruptions.

(ii) Measures to reduce fault-caused service interruptions

As an example of measures to reduce fault-caused service interruptions, applying an insulated conductor to the low voltage distribution lines is one solution.

(iii) Measures to reduce dead line work

As an example of measures to reduce dead line work, reducing the area subject to service interruption by applying temporary switches is one solution.

(b) Voltage control

Regarding distribution facilities, electricity travels through high voltage lines, pole-mounted transformers, low voltage lines, and service wires until it reaches customers. A voltage drop develops across each one of these components. The voltage drop varies with seasonal, daily and other load changes.

On the other hand, customer terminal voltages should be maintained within the ranges *shown in the following table.*

Voltage is controlled by adjusting the output voltage of each substation and changing the taps of the pole-mounted transformers while maintaining the voltage drops of high and low voltage lines within certain predetermined ranges.

Table 7.15 Allowable customer-terminal voltage ranges

Standard voltage	Allowable voltage range
240 V	240 ± 14 V

(i) Substation output voltage adjustment

Substation-output voltage is adjusted automatically with on-load tap changing transformers or induction regulators.

In addition, voltage adjustments are made manually in unusual cases, for example, at load-interchange times or during work related service interruption, or during fault-caused *service interruption. The recommendation of output-voltage adjustment range shown in the* following table is standard.

Table 7.16 Substation output voltage adjustment range (Recommendation)

Output voltage adjustment range	Output voltage ± 4.5%

(ii) Voltage management (voltage control) of high voltage distribution line

The allowable voltage drop limit of high voltage distribution lines being used under

normal conditions varies with the type of service area to which they supply power. Allowable voltage drop limit rates of high voltage distribution lines by area type are as follows.

Table 7.17 Allowable voltage drop limit rates of high voltage distribution line by area type

Voltage level	Allowable voltage drop limit rate of high voltage line
11 kV	9.0%
33 kV	

(iii) Voltage management (voltage control) of low voltage distribution lines

The allowable voltage drop limit values for low voltage lines (including service wires) are prescribed as shown in the table below. Voltage controls are implemented to maintain customer terminal voltages within these prescribed tolerance ranges.

If the average voltage drop measured on the low voltage line during any 30 minute period is within the prescribed range (short voltage fluctuations such as flickers are not included), the line is judged satisfactory.

Table 7.18 Allowable voltage drop limit of low voltage distribution line

Allowable voltage drop limit of low voltage line	6%

(c) Load control

(i) Managing the loads of high voltage distribution lines

Managing the loads of high voltage distribution lines is conducted by checking the meter at the entrance of each substation.

(ii) Managing the loads of pole-mounted transformers

Managing the loads of low voltage distribution lines is conducted by checking the meter installed in the pole-mounted transformer.

Overload limits for the rated capacity of a pole-mounted transformer (Recommendation) are as follows.

Table 7.19 Overload limits with respect to the rated capacity of a pole-mounted transformer (*Recommendation*)

Transformer type	Bank under daytime peak load	Bank under nighttime peak load	
		Load factor during daytime hours	
		120% or lower	120% or higher
For powering lamp circuit	160%	170%	160%
For powering lamp and motor circuit	150%	170%	150%
For powering motor circuit	150%		

(d) Monitoring and control of substations for distribution

(i) Jobs involved in substations for distribution

The jobs involved in substations for distribution are as follows.

- Supervising the operating conditions of the substations and distribution lines under their charge and controlling these facilities.
- Supervising the operating conditions of each substation
- Controlling/manipulating distribution line equipment
- Recording the required information on substation equipment manipulations made under normal service conditions, as well as in the event of a fault
- Checking the extent of possible damage at the site in the event of a fault at a substation, and helping to take measurements required for recovering from a fault
- Getting in touch with those concerned in the event of a fault

(ii) Supervision and control

The general methods of supervision and control of substations for distribution are as follows.

Table 7.20 The methods of supervision and control of substations for distribution

Type	Definition
Continuous remote supervision and control	Technical staff stationed at a substation control center supervises the substation and manipulates its equipment.
Intermittent remote supervision and control	Technical staff goes to a substation control center a predetermined number of times a day and supervised and controls its equipment.
Intermittent supervision and control	Technical staff goes to a substation a predetermined number of times a day to supervise its operation, conduct patrol inspections and manipulate its equipment.
Simplified supervision	Technical staff goes to a substation as required. There, the staff supervises the substation's operation, conducts patrol inspections, and manipulates the equipment.

(5) Restoration of the distribution network

(a) Restoration of failure

(i) Establishing a recovery system

To recover from possible faults as soon as possible, a commander should be appointed beforehand. In addition, the study team recommends that the order in which to mobilize off-duty staff members, and the sequence in which individual high voltage section switches are to be manipulated in the event of a fault to pinpoint the faulty section and smoothly supply power to healthy sections should be established in tabular form.

Furthermore, in the event of a fault, to exchange information on the conditions of the fault and progress of the recovery efforts, radio equipment and an emergency telephone system should be installed. A recommendation of items decided beforehand in the event of a fault is as follows.

Table 7.21 Items decided beforehand in the event of a fault (Recommendation)

Work condition		Items decided beforehand	Remark
High voltage power failure	Within working hours	A contact manner for fault information A responsible staff of a fault recovery and a relief A commander of distribution system and relief A part of affairs Organizing of a fault investigation team, a fault recovery team and a switch-manipulating team A contact way in the case of requesting dispatch of construction dealers A contact way in the case of requesting support of other regional offices	A reporting system and measure in the regional office, between the regional office and headquarter, and Getting in touch with those concerned. A responsible staff integrating damage condition of the power failure and arranging for construction workers
	Without working hours (night time & holiday)	(Add above) A calling order and a contact way of a responsible staff of a fault recovery, a fault investigation, a fault recovery and a switch-manipulating team A contact way of construction dealer and supporting staff from other regional offices.	corresponding the staff on duty and Supporters
Low voltage power failure	Within working hours	a responsible staff from a fault recovery	Allocation by full-time or rotation
	Without working hours (night time & holiday)	a responsible staff from a fault recovery (staff on duty)	Corresponding the stuff on duty and a staff has been

(ii) Steps taken in the event of a fault

- A responsible staff member for fault recovery instigates fault investigation, fault recovery, and a switch-manipulating team, whose main objective is to supply power to

healthy sections from linkup distribution lines by manipulating switches under the instruction of the commander of the distribution system.

- After the faulty section has been located, the area whose service has been interrupted is further minimized by manipulating the section's switches. The faulty location is then pinpointed by patrolling the area and climbing the poles.
- Recovery is then conducted immediately (by provisionally fixing broken supports, joining broken wires together or replacing broken insulators with sound ones, etc). Upon completing recovery, the power supply is resumed to the fixed section.

(iii) Materials for urgent recovery

Examples of materials prepared for urgent recovery are conductors, connecting materials, insulators, support fittings, etc.

(6) Maintenance of the distribution network

To prevent a failure, the study team recommends that patrol, inspection and measurement should be executed.

(a) Patrol, inspection and measurement

(i) Periodic patrol

Periodic patrols are conducted to make sure that distribution lines are not being interfered with by neighboring objects, and maintain a safe distance from these objects. If an irregularity is observed during visual inspection from the ground, corrective measures should be taken immediately. The areas subject to patrol and the frequency of patrol are determined considering the condition of the facilities and the characteristics of the areas concerned.

A recommendation of the areas subject to periodic patrol and the frequency of patrol are as follows.

Table 7.22 The areas subject to Periodic patrol and the frequency of patrol (Recommendation)

Area type		Frequency
Special areas	Areas with many environmental changes	Every two months
	Areas in which a lot of environmental changes are expected	Every six months
	Areas where it is frequently necessary to cut trees	Once or twice a year
Ordinary areas	Areas other than those listed above	Every two years

(ii) Ad hoc patrols

Ad hoc patrols are carried out when it is necessary to supplement the periodic patrol or after an irregularity has been detected.

A recommendation of ad hoc patrols is as follows.

Table 7.23 Items of ad hoc patrol (Recommendation)

Inducements to ad hoc patrol	Frequency
Before and after the typhoon season and the thunderstorm season	Whenever needs occur
In the event of a fault ending with successful recluse, an ad hoc patrol is carried out to determine the cause.	Whenever needs occur
Others	Whenever needs occur

(iii) Inspections

Inspections are conducted to check that the functions and capabilities of electrical facilities and equipment are in order. If something is wrong, corrective measures should be taken immediately.

A recommendation of inspection items and inspection frequency is as follows.

Table 7.24 Inspection items and inspection frequencies (Recommendation)

Items		Inspection frequency	Inspection methods
Distribution lines		Once a year (The frequency should be increased appropriately in areas where damage caused by briny air and polluted gas.)	Electrical facilities are visually inspected and physically damage as well as for interference from other object in the vicinity.
Distribution equipment	Precision inspection	Switches; Whenever necessary Automatic voltage regulators; Oil is checked after 20,000 tap-changing cycles. They are replaced with new ones after 100,000 tap-changing cycles.	Visual inspection Visually checked through the inspection window and tap-changing counter
	Functional inspection	Automatic switches; Every three years Automatic voltage regulators; Every two years	The relay portion is checked on the pole to see whether it functions properly. The tap-changer and control circuit are checked on the pole to see whether they function properly.

(iv) Measurements

Measurements are conducted on lightning arresters, the secondary windings of transformers and so forth, to determine whether they have appropriate grounding resistance values. A recommendation of measurement items and measurement frequency is as follows.

Table 7.25 Measurement items and measurement frequency (Recommendation)

Classification of distribution facilities	Measurement frequency	Standard value
Lightning arrester	Every five years	30 ohm
The outer casings of high voltage distribution equipment		10 ohm
Transformer secondary windings		200 ohm

(b) Trimming trees near lines

To maintain the distance between the distribution lines and the trees, the trees near the lines should be trimmed.

(i) Plan

The results of the patrol indicate places where trees are situated near a distribution line or where there is a possibility of them approaching the line. The priority is decided considering the negotiation period of each distribution line. The tree-trimming area is then roughly planned.

(ii) Investigation

Measuring conductor height above the ground and tree height by the owner of each tree in the approximate area of tree trimming is conducted. Based on the obtained data, a drawing is executed to examine the distance between the distribution conductor and the tree; an accurate of tree-trimming area is then decided. In addition, the trees that have been cut

should be marked with paint.

(iii) Negotiation for tree trimming

After investigation, negotiation for tree trimming should be executed without delay.

(iv) Tree trimming work

When the tree is trimmed, workers should avoid the trimmed tree touching or approaching the distribution conductor. Workers should also consider their own safety.

(v) Management

After the tree-trimming work, the area of the tree trimming, the owner of the trimmed tree, and date of the tree trimming should be recorded clearly.

(c) Measures at the time of detection of defects

Measures at the time of detection of defects, which are found through patrol, investigation and measurement, are as follows.

- ✓ If the patrol crew that spotted the irregularity considers that they can amend the problem immediately using their own equipment, it should be adjusted and fixed by them immediately.
- ✓ If an irregularity cannot be remedied immediately, first aid should be executed temporarily, and replacement work should be conducted as soon as possible.
  In addition, replaced apparatus is adjusted and fixed if necessary as a result of applied and economical study.
- ✓ In the defect is in a safety hazard area, appropriate safety measures are taken;
  for example, "Danger" or "Keep out" signs are put up, and the "Keep out" area is marked off with a rope.

A recommendation of irregularities is classified into the following categories in order of repair priority.

Table 7.26 The categories of irregularities in order of repair priority (Recommendation)

Priority classification	Judgment criteria	Example cases
Top priority	Those irregularities highly likely to fatally electrocute of cause injuries from electric shocks. Also, fires or faults grave enough to cause a power interruption if left unfixed and is therefore in need of urgent repair.	A live conductor touching a building A damaged high voltage insulator or bushing A support in danger of falling to the ground because of a hole dug very nearby A dropping stay wire that has come off of its joint
High priority	Those irregularities caused by interference from foreign objects have somehow got into the facilities that need to be attended to within a month.	Distribution lines strung too close to a building Facilities whose grounding resistance is too high *Damaged low voltage*
Medium priority	High priority irregularities that have received first aid measures; irregularities inside electrical facilities or equipment in need of remedial attention within a year.	Wires on which protective ducts have been placed Wooden poles with attached reinforcing metal parts Equipment housings that are extremely rusty

7.5.2 Recommended Individual Training Program

In order to raise customer satisfaction as shown in Figure 7.6, improvement of distribution facilities (hardware) and personnel training (software) are required. The study team combines the proposal of the new training program in CTI and LSTC.

In order to satisfy customers as shown in Figure 7.7, a concept of new training program is effective, skill less (easy), and cost less.

(1) Suggestion regarding the CTI training program

CTI currently unifies and executes various training programs for engineers and officers who are considered "Non workers". However, training takes up the time of engineers and officers who belong to the regional offices and it is especially difficult for them to attend long-term training for more than one week.

Towards this end, the faculty should go out from CTI to regional offices and perform training for those Assistant Engineers who are especially busy at their office. This would reduce the time wasted traveling to attend the training and means that A.Es would not have to be absent from their office for a long time.

Training programs executed at the regional office should focus on accurate supervision of construction work and reduction of defective work. Thus, the study team suggests training programs as follows.

- Distribution-work safety training
- Distribution-work completion-statutory-inspection training

(a) Distribution-work safety training

Actual work for the distribution system is conducted by workers as distribution line workers and others. Engineers as A.Es and others conduct operation and maintenance of their distribution systems.

Work safety should be appreciated not only by workers but also engineers, because engineers supervise work and are responsible for safety management.

Thus, both engineers and distribution line workers undergo work-safety training in the field and the lecture room. The training program includes training engineers for distribution-work safety management.

(b) Distribution-work completion-statutory inspection training

Completion-statutory-inspection of the distribution line is necessary in order to improve the quality of its construction. Thus the study team recommends engineers as A.Es, etc in the regional office should conduct a completion-inspection. The training program trains engineers in inspection items and inspection standards.

(2) Suggestion regarding the LSTC training program

Currently, LSTC unifies and executes various training for workers as sub-engineers, distribution line workers, etc.

To enhance the reliability of the existing distribution system, the study team recommends executing the training programs as follows.

The study team suggests the maintenance training manner, which is executed at LSTC also adopts the manner as CTI. It would save their travel time to attend the training and it is not necessary for workers to be absent from their office for long. The training manner should be

divided into two steps. In the first step, the workers assemble and are trained at LSTC. In the second step, the training program is executed at each regional office through practical work.

Regarding the existing training program, the study team recommends separating training that can be executed at the regional office from training programs that are normally executed at LSTC, and then the faculty can go out from LSTC and provide workers with lectures at each regional office.

- Distribution-work safety training
- Patrol, Inspection and Measurement training
- Distribution line construction-standards training

(a) Distribution-work safety training

During 2003-2004, LSTC plans to execute a one-day "Workshop on safety measures in the field", consisting of 12 items.

It is important that distribution-work safety training is executed for workers who are directly in charge of the work. The training is conducted not only in the lecture room, but also in the field with simulations of practical work. Thus the training program includes the general safety education added the working plan, conducting a predicting of danger "Tool Box Meeting", setting "the keep-out area", setting the safety sign, conducting a voltage detection, setting and removing grounding fittings, etc.

(b) Patrol, inspection and measurement training

In order to reduce power failure caused by the distribution system, it is important that a periodic patrol, inspection and measurement should be conducted. The training program includes training workers in the manner of patrol, inspection and measurement for the distribution system.

(c) Distribution line construction-standards training

Almost 50% of the outage is caused by defective conductor connections. Thus, the reliability of the distribution line would be improved if the distribution line work is conducted accurately. The training program includes training workers in the manner of connecting conductors and fixing the conductor to the insulator using binding wire.

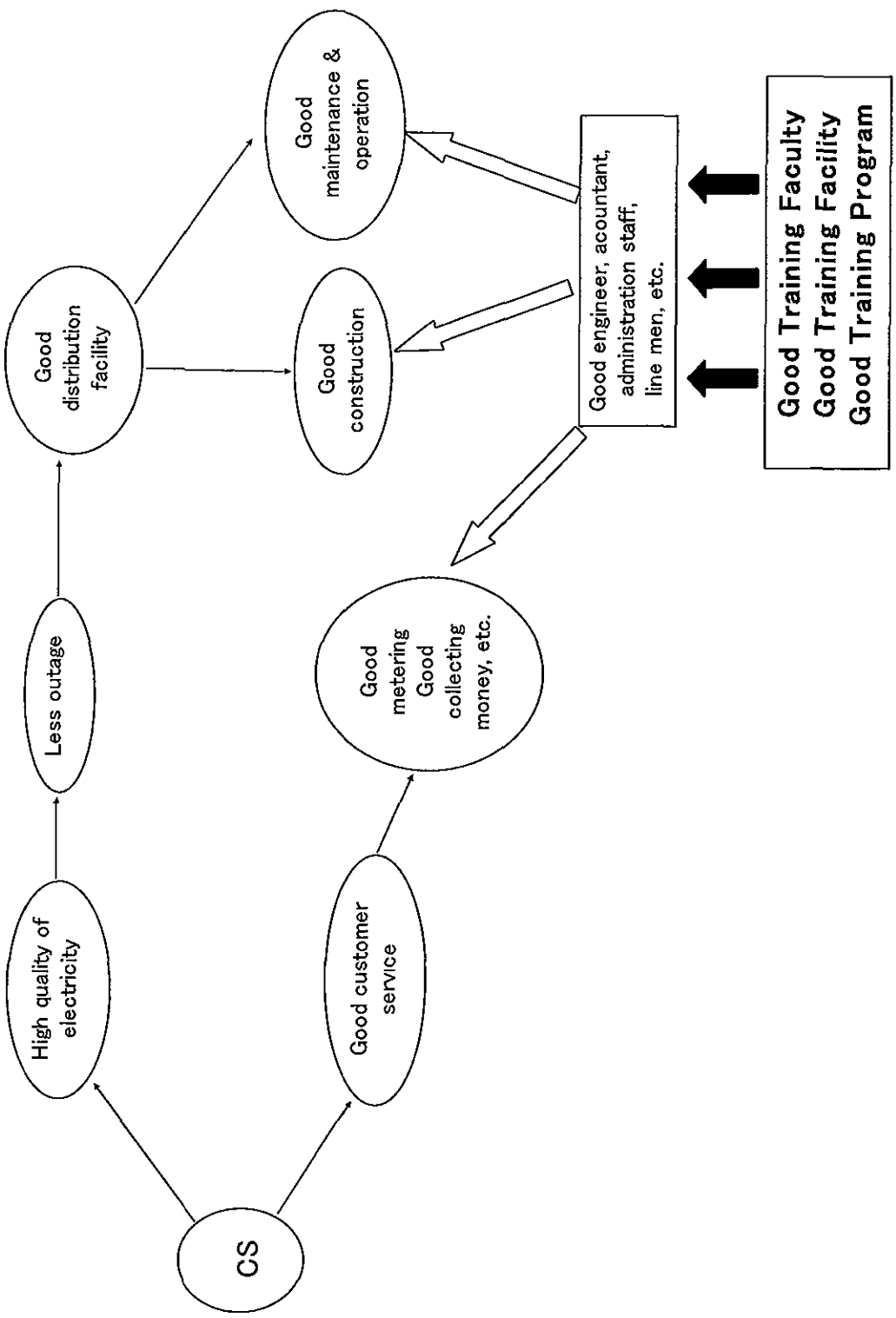


Figure 7.6 The purpose of conducting training

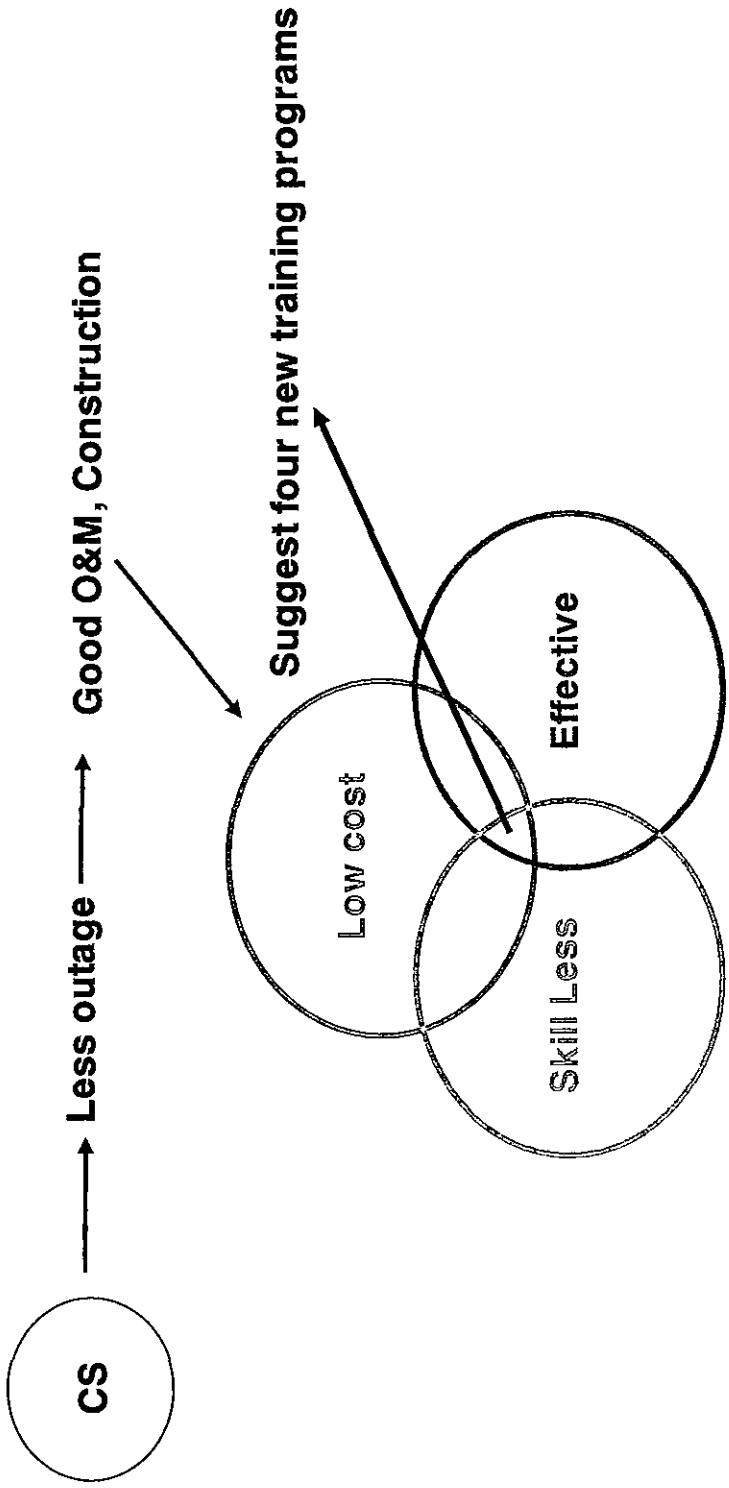


Figure 7.7 The concept of the new training programs

(3) Distribution-work safety training

(a) Training purpose

This training aims to teach workers distribution-work safety and teach accident prediction and avoidance skills.

(b) Training candidates

Training candidates include assistant engineers, additional assistant engineers, sub-engineers, distribution line workers, assistant distribution line workers, and junior distribution line workers.

(c) Training subject

Draft of the training subject and the manner of "Tool Box Meeting (TBM)" are as follows.

Table 7.27 Draft of the subject for the distribution-work safety training

The subject	Outline
General safety	● Organizing the working team ● Organizing the observation structure of work ● Duties of work supervisors and a work directors ● Attitude of workers ● Healthcare ● Prohibition of work in the case of bad weather ● Attention to night work ● Order for directions
Working plan	● Making a work plan ● Instructing a work plan ● Informing a work plan
Preparation of the work	● Advance meeting ● Confirmation before stating work ● Implementing "Tool Box Meeting (TBM)" and danger prediction ● Appropriate disposition of workers ● Setting working zone and safety sings ● Confirming and instructing preparation work
Implementation of the work	● Former inspection of the protectors for insulation ● Prohibition of parallel work ● Implementing voltage check and earth grounding ● Maintaining the working environment ● Measures in the case of work suspension or alteration ● Cleaning up the work site ● Confirming work termination
After the work	● Reflection after work

(d) Training faculty

The training faculty is elected from experienced engineers and officers in APTRANSCO, APCPDCL, etc.

(e) Training manner

When the annual training plan is framed, distribution-work safety training should be set for execution not only at CTI, LSTC but also at each regional office.

(f) Training record

The faculty records the result of the training and it is kept at CTI or LSTC.

Attached documents 7.1 Tool Box Meeting (TBM) - Prevision of Danger

In order to conduct distribution work safely, the study team proposes executing "distribution-work safety training". The outline of "Tool Box Meeting (TBM)- Prevision of Danger" which is one of the training subject is as follows.

TBM consists of four rounds (from first round to final round). TBM should be conducted every meeting before starting work. One of the workers should record the content of TBM.

(1) First Round; "What dangers lurk?"

Discuss the working situation, find factors behind lurking dangers and predict likely accidents. Identify as many danger factors as possible.

(2) Second Round; "What are the danger factors?"

Of the danger factors that are found in the first round, mark "○" in the column of a serious danger, and mark "@" in the column of a very serious danger. You should select two to three points.

(3) Third Round; "What action should we take?"

Discuss the dangers identified in the second round and identify measures to resolve them.

(4) Final Round; "Action we will take"

Mark "*" in the column of an important execution item, then set the concrete action that will be followed by the working team.

The reporting form of a TBM-Prevision of Danger is as follows.

Attached documents 7.2 Tool Box Meeting "TBM"- Prevision of Danger (Sample Form)

Date; DD/ MM/ YY
Place; **********

Name of team	Name of leader	Name of reporter	Other working team members

First Round; "What kind of danger lurks?" Discuss with all members and write down the lurking danger and expected accidents caused by those danger factors.

Second Round; "What are the danger factors?" Mark "○" next to a serious danger, and "@" next to a very serious danger. Select two to three points.

No.	Eva.	Expect the accident caused by lurking danger, then write "doing X results in Y."
1		
2		
3		
4		
5		
6		
7		

Third Round; "What action should we take?" Consider what measures should be taken to resolve serious dangers.

No. of @,○	Serious danger	Measure	Eva.
		1	
		2	
		3	
		4	
		1	
		2	
		3	
		4	
		1	
		2	
		3	
		4	

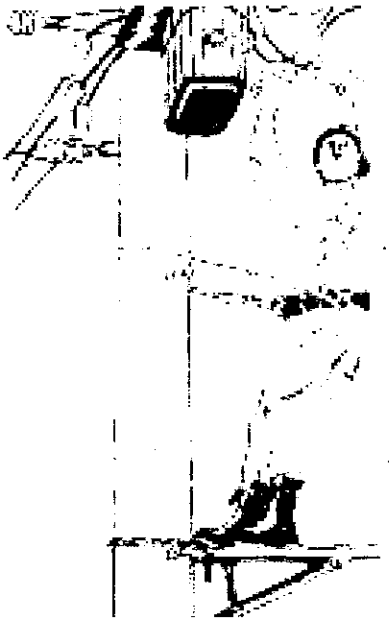
Final Round; "Action we will take" Mark "*" on the important execution item, then set the concrete action which will be followed by the working team.

The concrete action of the working team	

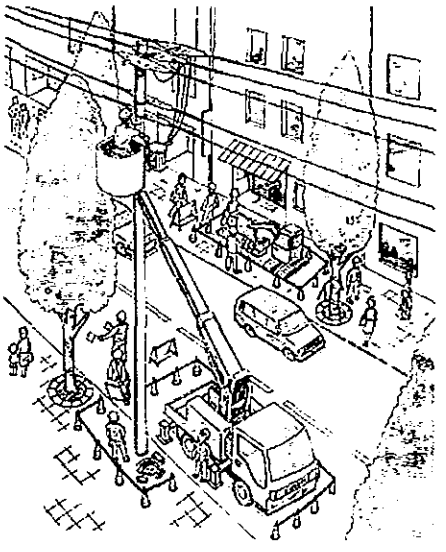
Attached documents 7.3 Tool Box Meeting "TBM"- Prevision of Danger Training (example)

Execute Tool Box Meeting "TBM"- Prevision of Danger about the work as follows.

(Example 1; Conductors connecting work on a pole)



(Example 2; Construction concerned with conductors using a lift truck.)



Attached documents 7.4 Tool Box Meeting "TBM"- Prevision of Danger Training Report; Conductors connecting work on a pole (entry example)

Date; DD/ MM/ YY
Place; **********

Name of team	Name of leader	Name of reporter	Other working team members
●●●●	○○	♠♠	♦♦, ▲▲

First Round; "What kind of danger lurks?" Discuss with all members and write down the lurking danger and expected accidents caused by those danger factors.

Second Round; "What are the danger factors?" Mark "○" next to important dangers, and "@" next to a danger considered very serious. Select two to three points.

No.	Eva.	Expect an accident caused by lurking danger, then write down "doing X results in Y."
1	○	A worker climbing a pole loses his footing.
2		A worker loses his footing on the pillar from the working base, and falls.
3	@	A worker touches a conductor on the hot-line side, and receives an electric shock.
4		A worker drops his tools, and another person is injured.
5		A worker loses his footing and falls onto the pillar because the working base is not appropriately secured.
6		A worker's eye's are injured when cutting wire.
7	○	A worker receives an electric shock when holding a conductor.
8		
9		

Third Round; "What action shall we take?" What measures are required to prevent serious dangers?

No. of @,○	Serious danger	Measure	Eva.
1	When a worker climbs up a pole, he misses his step and falls.	1. Wear a safety belt properly	
		2. Secure your climb up a pole from three points.	
		3. Use a safety rope properly.	
		4.	
3	A worker touches a live conductor, and receives an electric shock.	1. Wear protective clothes	
		2. Protect live areas with insulation.	*
		3. Check the voltage	*
7	When a worker holds a conductor, he receives an electric shock.	1. Check the voltage	
		2. Install an earth to ground the conductor	*
		3. Wear protective clothes	

Final Round; "Action we will take" Mark "*" on the important execution item, then set the concrete action which will be followed by the working team.

The concrete action of the working team	Voltage check and installation of earth grounding are performed securely. A worker watches out for the charging section during his work.

Attached documents 7.5 Tool Box Meeting "TBM"- Prevision of Danger Training Report; Construction work of conductors on using an elevated work vehicle (entry example)

Date; DD/ MM/ YY
Place; **********

Name of team	Name of leader	Name of reporter	Other working team members
●●●●	○○	▲▲	◆◆, ▲▲

First Round; "What kind of danger lurks?" Discuss with all members and write down the lurking danger and expected accidents caused by those danger factors.

Second Round; "What are the danger factors?" Mark "○" next to important dangers, and "@" next to a danger considered very serious. Select two to three points.

No.	Eva.	Expect the accident caused by lurking dangers, then write down "doing X results in Y."
1		A bucket that is used for lifting a worker is raised and hits against the pole accidentally, damaging the pole.
2	@	Operation of the bucket is incorrect and the worker touches a live line and receives an electric shock.
3	○	Fixation of the elevated work vehicle by the outrigger is inappropriate, and the elevated work vehicle overturns.
4		Operation of the bucker is incorrect, it hits against a transformer, and the transformer is damaged.
5	○	Tools or material is dropped from a bucket and a passerby is injured.
6		Tools or material is dropped from a bucket and a passing car is damaged.
7		
8		
9		

Third Round; "What action shall we take?" Consider the measure due to solving the serious danger.

No. of @,○	Serious danger	Measure	Eva.
2	Operation of the bucket is incorrect and the worker touches a live line and receives an electric shock.	1. Use a qualified person to control bucker operation.	*
		2. Station a watchperson on the ground.	
		3. Wear protective clothing.	
		4. Determine the power outage and charge in advance.	
3	Fixation of the elevated work vehicle by the outrigger is incorrect, and the elevated work vehicle overturns.	1. Park the elevated work vehicle horizontally.	
		2. Position outriggers horizontally and find a good position for the foundations.	
		3. Do not exceed the maximum limit for the bucket.	
		4.	
5	Tools or material is dropped from a bucket and a passerby is injured..	1. Attach a string to tools to prevent them falling down.	
		2. Carry materials in a tool bag.	*
		3. Prevent the public from entering construction sites.	
		4.	

Final Round; "Action we will take" Mark "*" next to the important execution item, then set the concrete action which will be followed by the working team.

The concrete action of the working team	*Use a qualified person to control bucker operation and be aware of passersby.*

(4) Distribution-work completion-statutory-inspection training

(a) Training purpose

This training aims to improve the construction reliability of distribution facilities by acquisition of inspection technology, maintenance, and improvement of the skills of those engaged in distribution work.

(b) Training candidates

Training candidate is taken as the person according to Assistant Engineer and it.

(c) Training subjects

Draft of the training subjects is as follows.

Table 7.28 Draft of the subjects for the distribution completion-inspection training

Subject	Outline
General items	● Duty of inspection ● Knowledge of inspection ● Kind of inspection
Inspection standard	● Independence inspection ● Completion inspection (documents inspection, on-site inspection) ● Re-examination
Timing of inspection	● Independence inspection ● Completion inspection (documents inspection, on-site inspection) ● Re-examination
The inspection method	● Independence inspection ● Completion inspection (documents inspection, on-site inspection)
Processing after inspection	● Processing at the time of acceptance ● Processing at the time of rejection
Management of an inspection result	● Grasp of an inspection result ● Analysis of the inspection results ● Storage of the inspection results

(d) Training faculty

The training faculty is elected from experienced engineers and officers in APTRANSCO, APCPDCL, etc.

(e) Training manner

When the annual training plan is framed, it should be taken into account that distribution completion-inspection training is executed not only at CTI but also at each regional office.

(f) Training record

The faculty records the result of the training and it is kept at CTI.

(5) Patrol, inspection and measurement training

(a) Training purpose

This training aims to prevent accidents at distribution facilities by acquisition of patrol, inspection and measurement technology and improvement of skills of those who are engaged in distribution maintenance.

(b) Training candidates

Training candidates include sub-engineers, distribution line workers, assistant distribution line workers, and junior line workers.

(c) Training Subject

Draft of the training subject is as follows.

Table 7.29 Draft of the subjects for patrol, inspection and measurement training

Subject	Outline
Patrol	● Classification and method of patrol ● Focus of patrol ● Disposal at the time of poor part discovery
Inspection	● Classification and method of inspection ● Focus of inspection ● Disposal at the time of poor part discovery
Measurement	● Grounding resistance measuring method ● Standard value of grounding resistance ● Disposal when grounding resistance is poor
Management	● Storage of patrol, inspection and measurement result

(d) Training faculty

The training faculty is elected from experienced engineers and officers in APTRANSCO, APCPDCL, etc.

(e) Training manner

When the annual training plan is framed, it should be taken into account that patrol, inspection and measurement training is executed not only at LSTC but also at each regional office.

(f) Training record

The faculty records the result of the training and it is kept at LSTC.

Attached documents 7.6 Check item table

	Points to observe	The checking method	Important matters
Poles	● Propriety of position ● Ground subsidence or collapse ● It inclines, bends and is unsupported or there is subsidence. ● Existence of externally caused injury by vehicle contact etc.	Viewing	● It belongs to an institution and is especially cautious of exposure of the root admission into a club by an earth-and-sand outflow, collapse, etc. in a ridge, sloping ground, riverbank, etc.
Concrete pole	● Surface cracks, chips, swelling or weathering ● Existence of bending ● A repair portion or existence of abnormalities around the circumference	Viewing	● Carefully check cracks that arise. ● The secular change situation of a repair part is checked.
Steel pole	● Existence of rusting, damage, and modification ● Existence of corrosion at ground level	Viewing	
Steel Arm	● Existence of a remarkable bending ● Existence of a main position gap ● Remarkable rusting, existence of corrosion ● Slack of a nut, and existence of omission	Viewing	● Is there any slack in the armband?
Wooden arm	● Existence of surface tracking phenomenon ● Existence of remarkable externally caused damage ● Existence of a remarkable bending ● Existence of a main position gap ● Existence of rot ● Slack of a nut, and existence of omission	1. Viewing 2. When judging the quality is difficult, a worker is lifted up and to check the pole.	● Watch out for the tracking phenomenon of what has large tension for a dead-end, and areas affected by salt contamination.
Insulator	● Existence of damage on a magnetic part, a crack, and corruption ● Bent pins, slack nuts, or omissions	1. Viewing 2. When quality judging is difficult, a worker is lifted up to check the pole.	● It is especially cautious of a strong thunder area and a salt contamination area.
Stay wire	● Propriety of a position ● Ground subsistence or collapse ● Existence of externally caused damage by vehicle contact etc.	Viewing	● Are there projections of the terminal parts and slack strands that could lead to a public incident?

	Points to observe	The checking method	Important matters
	● Propriety of terminal processing ● The strand piece of a stay wire, or existence of externally caused damage ● Existence of a crack in the ball insulator ● rusting of a stay wire, a corrosion situation ● Propriety of a distance with a charge part ● Existence of slack ● Existence of an anchor of the stay wire rising to the surface		
High and low voltage conductors	● Existence of partial bending of a conductor, a strand piece, and short circuit marks ● Existence of coming off and slack bind wire ● Propriety of the sag	1. Viewing 2. When quality judging is difficult, a worker is lifted up to check the pole.	
Ground wire	● Existence of partial bending of a conductor, a strand piece, and existence of a crack ● Existence of coming off and slack bind wire	1. Viewing 2. When quality judging is difficult, a worker is lifted up to check the pole.	
Apparatus	1. Main part ● Damage to an outside box, oil leakage, corrosion, existence of remarkable rust ● Existence of contamination of a porcelain part, a crack, and an arc trace (an air insulated switch and a surge arrester) 1. Bushing ● Existence of corruption, a crack, oil leakage, and an arc trace 2. Earth wire ● A earth wire piece, existence of damage 3. Others ● Existence of unusual noise	1. Viewing 2. When quality judging is difficult, a worker is lifted up to check the pole. 3. Hearing	● It is cautious of oil leakage from a welding part etc. ● Is there any damage that the earth wire exposes?
Lead-in conductor	● Existence of a strand piece ● Existence of contact in other things ● Propriety of the sag ● Existence of a rotted attachment part		● Is there anything left twisted around the thing and a pole hung down by an unnecessary lead-in line?

(6) Distribution line construction-standards training

(a) Training purpose

For those who are engaged in power distribution construction, by acquisition of distribution line construction technology, maintenance, and improvement, the reliability of distribution facilities are improved and it aims at decreasing the power outage resulting from poor construction.

(b) Training candidates

Training candidates include sub-engineers, distribution line workers, assistant distribution line workers, and junior distribution line workers.

(c) Training Subject

Draft of the training subject is as follows.

Table 7.30 Draft of the subjects for distribution line work training

Subjects	Outline
General things	● Importance of electric conductor support and connection ● Accidents that are caused by electric conductor support and poor connection
Construction of conductor support	● The kind and use classification of support material of a straight part ● The bind method of a straight part ● The kind and use classification of support material of a tension part ● The bind method of a tension part ● The method of keeping back by the keeping back grip ● The method of keeping back by the keeping back clamp
Construction of conductor connection	● The basic matter of connection construction ● Connection of the electric wire by B form sleeve ● Connection of the electric wire by the compressed type straight line sleeve ● Connection of the electric wire by the compressed type branch sleeve
Maintenance management of tools	● The maintenance management method of tools

(d) Training faculty

The training faculty is elected from experienced engineers and officers in APTRANSCO, APCPDCL, etc.

(e) Training manner

When the annual training plan is framed, it should be taken into account that distribution line work training is executed not only at LSTC but also at each regional office.

(f) Training record

The faculty records the result of the training and it is kept at LSTC.

Attached documents 7.7 Conductor connecting work procedure (1)

Name of work	Conductor connecting work (1)
The contents of work	Conductor connection by a straight sleeve
Working condition	Connection between twisted conductors, On the ground
Material	Twisted conductor, Straight sleeve
Protection implement	
A tool, apparatus	Wire brush, Compression tool

Procedure	The point of work	Explanation
1. Cleaning both conductors	Along with a twist, it polishes also with both conductors by the wire brush for 3 cm longer from a sleeve until it can take the tunic on the conductor.	
2. The size of a dice and a sleeve are checked.		
3. Conductor is inserted in a sleeve.	Conductors are inserted from both ends of the sleeve to the center plug of the sleeve.	Refer to Figure (c)
4. A sleeve is set to a compression tool.		Refer to Figure (b)
5. It compresses.	(1) The regular number of times of compression, the compression direction, and order are observed. (2) The tool compresses until it carries out sound. (3) *It compresses rotating the* sleeve 180 degrees every 2 or 3 times, in order to prevent the sleeve bending.	Refer to Figure (a)
6. The compression tool is removed.		

(Procedure)

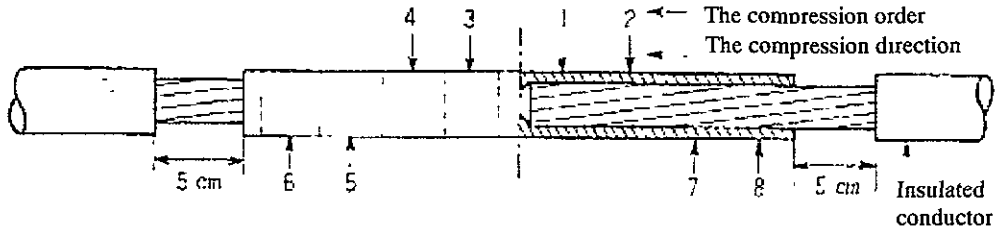
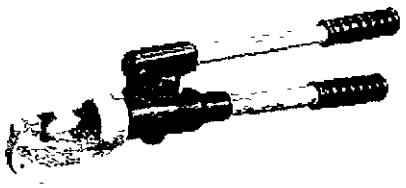


Figure (a) Compression direction and compression order of a straight sleeve (in the case of an aluminum conductor)



Compression power	83kN
The length	589mm
The weight	4.5kg

Figure (b) Sleeve compression tool (example)

Figure (c) Straight sleeve (example)

Attached documents 7.8 Conductor connecting work procedure (2)

Name of work	Conductor connecting work (2)
The contents of work	Conductor connection by a compression branch sleeve
Working condition	Connection between twisted conductors, Dead-line work on a pole
Material	Twisted conductor, Compression branch sleeve (C shape connector)
Protection implement	Safety belt
A tool, apparatus	Wire brush, Compression tool, A working stage on a pole

Procedure	The point of work	Explanation
1. Insulation of a conductor is stripped.		
2. Cleaning both conductors	Along with a twist, it polishes also with both conductors by the wire brush for 3 cm longer from the sleeve until it can take the tunic on the conductor.	
3. The size of the dice and the sleeve are checked.	Are the size of the dice and the sleeve suitable?	Foreign matter on the sleeve will cause poor contact . Refer Figure (c)
4. The sleeve is set to a compression tool.	(1) The slot on the sleeve is turned outside. (2) The sleeve center is lightly pressed down with a compression tool.	It presses down by the grade to which conductors do not fall from the sleeve.
5. Conductor is set to the sleeve.	(1) The end of conductors is taken out from the sleeve 2 cm. (2) An assistant holds the conductor.	Refer Figure (b)
6. It compresses.	(1) The tool compresses until it carries out sound. (2) Three places of the sleeve are compressed.	Refer Figure (a)
7. The compression tool is removed.		

(Procedure)

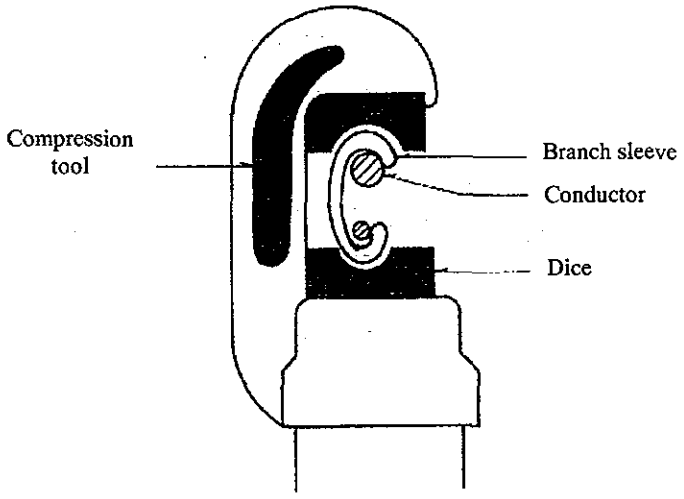
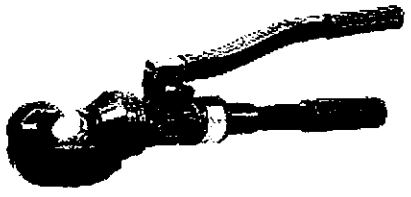


Figure (a) Compressing method of a compression branch sleeve



Compression power	59 kN
The length	460 mm
The weight	2.9 kg

Figure (b) Sleeve compression tool for a compression brunch sleeve (C shape connector) (example)

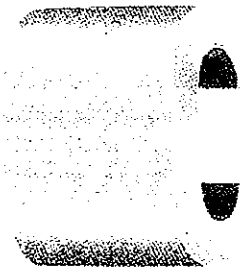


Figure (c) Compression brunch sleeve (C shape connector) (example)

Attached documents 7.9 Electric conductor fixed work procedure to a high voltage pin insulator

Name of work	An electric conductor fixing work
The contents of work	A bind wire is used and an electric conductor is fixed to a high voltage pin insulator.
Working condition	Dead-line work on a pole
Material	A high voltage pin insulator, electric conductor **mm2, vinyl bind wire 2.0 mm
Protection implement	Safety belt
A tool, apparatus	A working stage on a pole, pliers

Procedure	The point of work	Explanation
1. Make the volume start of bind.	(1) Put a conductor on the side part of an insulator, and coil it twice. (2) 0.5 times of the beginning is a hand, and while pliers fasten, twist 0.5 next times firmly. (3) And the ring of the bind line is piled up.	Refer to Figure a (1) Fix both outside lines to the side of the insulator by the side of a pole. (2) Fix a middle line to the insulator side by the side of opposite of a pole. However, in the case of a bend track, it fixes so that an insulator may become inside the track.
2. Apply a bind wire to both sashes.	(1) Arrange two bind lines (2) And twist firmly.	Refer to Figure b (1) Do not use pliers because they damage electric wires..
3. Twist around the opposite side of beginning which coils a bind wire.	(1) With two bind lines arranged (2) Twist 3 times with a bundle firmly.	Refer to Figure b (1) Do not use pliers because they damage electric wires..
4. Twist for beginning to coil a bind wire	(1) It is hard and twists the longer one twice.	Refer to Figure b (1) Do not use pliers because they damage electric wires..
5. The both ends of a bind wire are twisted.	(1) It is the opposite side of a conductor (2) And on pliers, it is hard and twists a bind wire twice.	Refer to Figure c
6. Cut the both ends of a bind wire	(1) The waste of a bind wire receives by hand (2) And suppresses an end on pliers into a slot.	

(Procedure)

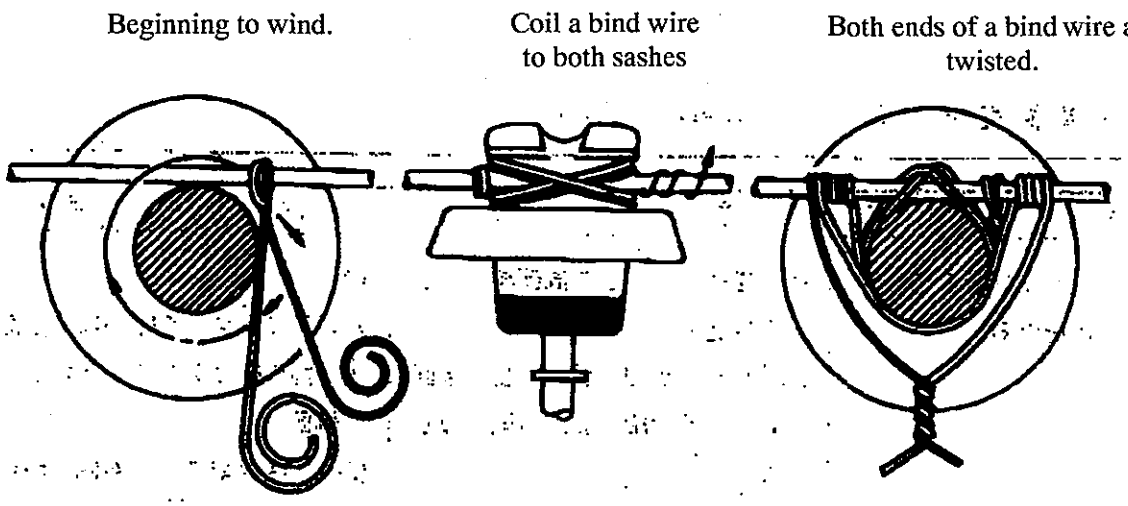


Figure (a) Electric conductor fixed work procedure to a high voltage pin insulator

Attached documents 7.10 Electric conductor fixed work procedure to a low voltage tension insulator

Name of work	An electric conductor fixing work
The contents of work	An aluminum bind wire is used and an electric conductor is fixed to a low voltage tension insulator.
Working condition	Dead-line work on a pole
Material	A low voltage tension insulator, electric conductor **mm2, aluminum bind wire 4.0mm
Protection implement	Safety belt
A tool, apparatus	The tool that stretches a conductor, A working stage on a pole, a visiting rope, a tool bag, a wire cutter, a measure

Procedure	The point of work	Explanation
1. Stretch an electric conductor	(1) The sag of an electric conductor is considered.	(1) Refer to Figure a
2. The electric conductor passes to an insulator.		
3. Coil a bind wire	(1) Make a shape (the conductor is met like). (2) Turn up, and roll the end of 5 times bind 5 times continuously.	
4. Remove the tool which stretches the conductor.	(1) Loosen gradually, checking that there is no slide of the conductor. (2) Check the sag	
5. Binding	(1) About 25 times. Pliers are not used.	Refer to Figure b
6. The terminal of the conductor is processed.	(1) Cut from the end of a bind volume in a 25 cm place. (2) Make a terminal there be along the conductor and stop it by the bind wire.	Refer to Figure c

(Procedure)

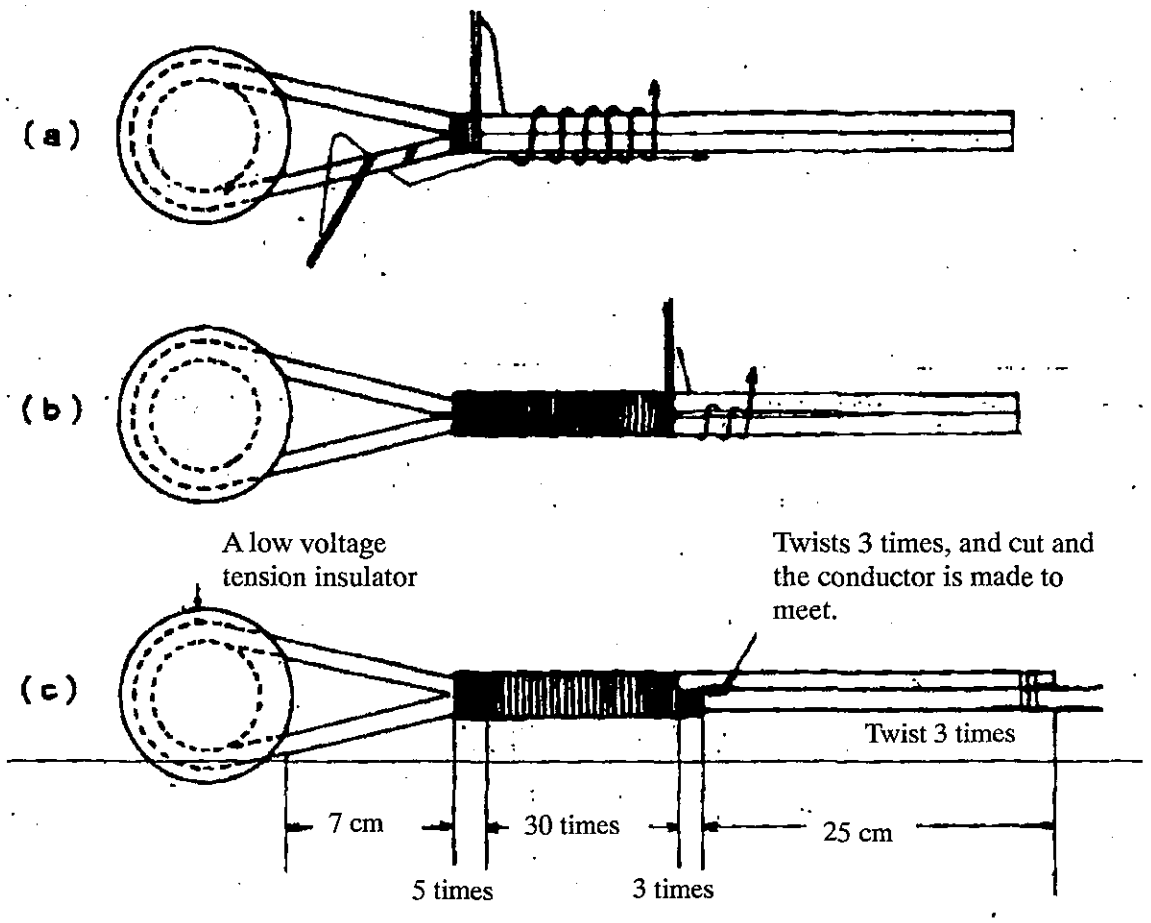


Figure (a) Electric conductor fixed work procedure to a low voltage tension insulator

7.5.3 Recommendation on Training Facilities

The investigation team proposes an expansion plan for training facilities of LSTC in order that APCPDCL executes the individual training program to upgrade maintenance and operation ability of site engineers and site workers in power distribution plants.

LSTC expansion plan consists of three major items.

- Construction of indoor training facilities (Computer laboratory)
- Reconstruction of outdoor training facilities (Facilities for practical skills training in power distribution plants)
- Preparation of materials and equipments for practical training in distribution network

The contents of each item are as follows.

(1) Construction of indoor training facilities (Computer laboratory)

Currently, LSTC does not provide any computer-applied training course. However, introduction of computers to power distribution plants is indispensable for plant management on site and customer service. Electronic data processing on maintenance/operation management and customer service will be advanced rapidly.

CTI has already started to provide the practical skills training course in personnel computers usage for advanced engineers. Also at LSTC, construction of computer laboratory should be recommended in order to provide field engineers and field workers with the computer-applied training program.

The outline of computer laboratory is as follows.

Table 7.31 Outline of new computer laboratory at LSTC (draft)

Items	Specifications	Quantity
Building		
Computer laboratory	20m x 20m, including air conditioner	400m^2
Computer console		
Computer	CPU ; Pentium 4 2.4GHz, Memory ; 256MB HDD ; 40GB ; CD-RW, 15-inch Color display	20
Operation software	Windows XP Professional	20
Application software	MS Office Professional	20
Color printer	Laser printer (A-3 compatible)	5
Overhead projector		1
LDC projector		1
Capture		1
UPS	3kVA	5
Fixture		
	Desk, Chair, Whiteboard, etc.	1 suite

The existing sanitary accommodations including a lavatory and others should be used. And such facilities should not be equipped in the laboratory.

(2) Reconstruction of outdoor training facilities (Facilities for practical training in distribution network)

Although LSTC has outdoor facilities for practical training in distribution network, the existing facilities are not sufficient because of the inadequate contents. They have some poles for climbing training and simulated line of 11 kV distribution line. Therefore, it has been proposed to replace the existing outdoor facilities with new one taking the following into considerations.

- To install high voltage simulated line of 33kV and 11kV (including straight and bending portion of 30° and 90°)
- To install low voltage distribution simulated line (including vertical intersection)
- To install board wall with integrating wattmeter and simulated service wire for service wire installing training
- To install transformers for three phase 315kVA, 250kVA, 160kVA, 100kVA, 63kVA, 25kVA, 3x15kVA and single phase 15kVA, which APCDDCL uses now, on the route of simulated line of high voltage distribution lines for practical maintenance training in transformer.
- To build three power poles for cable laying training of high voltage cable
- To build warehouse for storage of training materials and equipments

The outline of outdoor training facilities is as follows.

Table 7.32 Outline of outdoor training facilities (draft)

Items	Specifications	Quantity
33kV simulated distribution line	ACSR 55mm^2	50m
11kV simulated distribution line	ACSR 34mm^2	50m
Low voltage simulated distribution line	Three phase, four wire, 34mm^2	50m
Pole		
For high voltage	Height ; 9m	20
For low voltage	Height ; 8m	10
Wattmeter		
	For single phase (5-20A)	3
	For three phase (5-20A)	3
	For three phase (10-40A)	3
Pole-mounted transformer		
	Three phase, 315kVA	1
	Three phase, 250kVA	1
	Three phase, 160kVA	1
	Three phase, 100kVA	1
	Three phase, 63kVA	1
	Three phase, 25kVA	1
	3 x 15kVA	1
	Single phase, 15kVA	1
Warehouse for materials and equipments	15m x 10m	150m^2

Figure 7.8 shows the layout of new LSTC outdoor training facilities (draft).

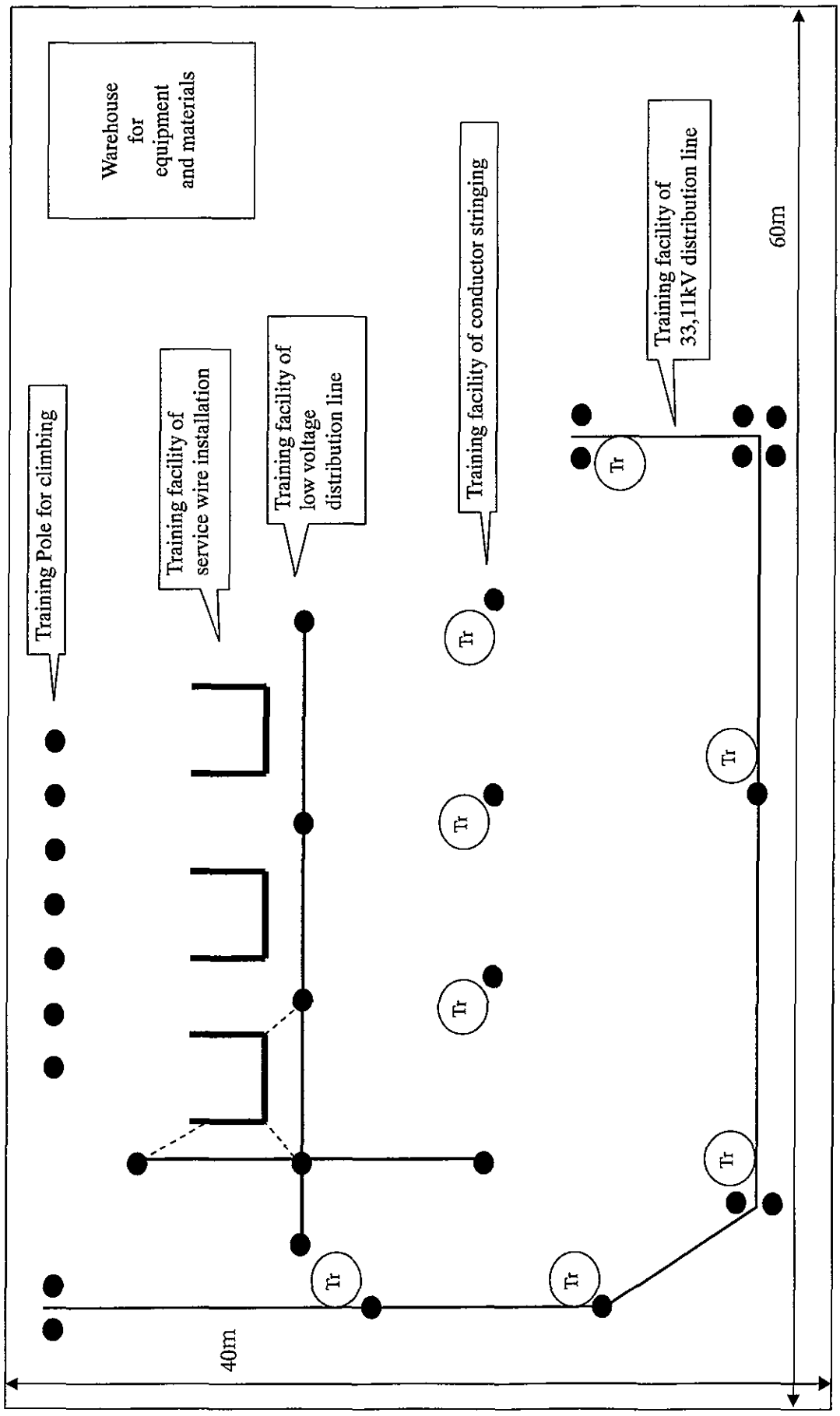


Figure 7.3 Layout of LSTC Outdoor practical training facilities of distribution network (draft plan)

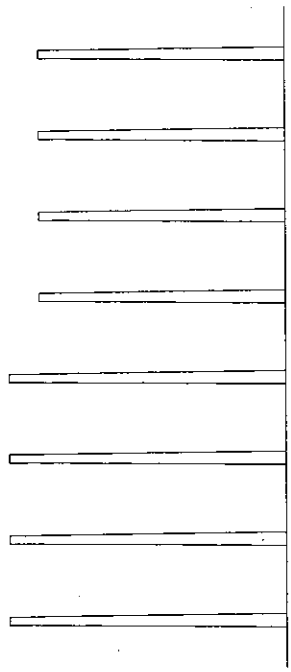
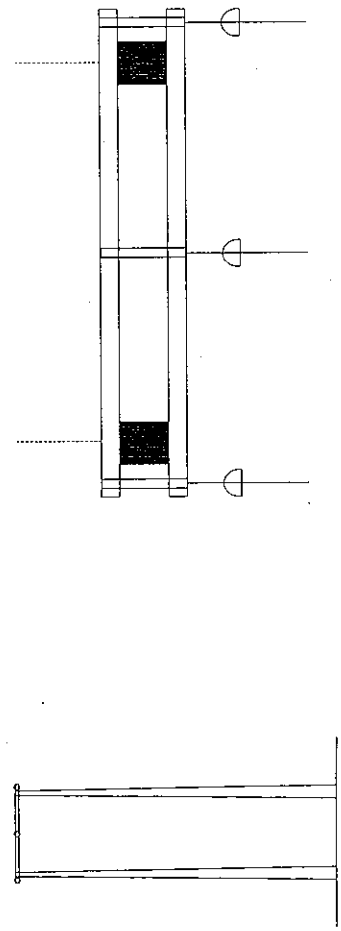


Figure7.9 Training Pole for climbing (7.5m and 6.5m)



Plane figure

Side figure

Figure7.10 11kVpole for dead end

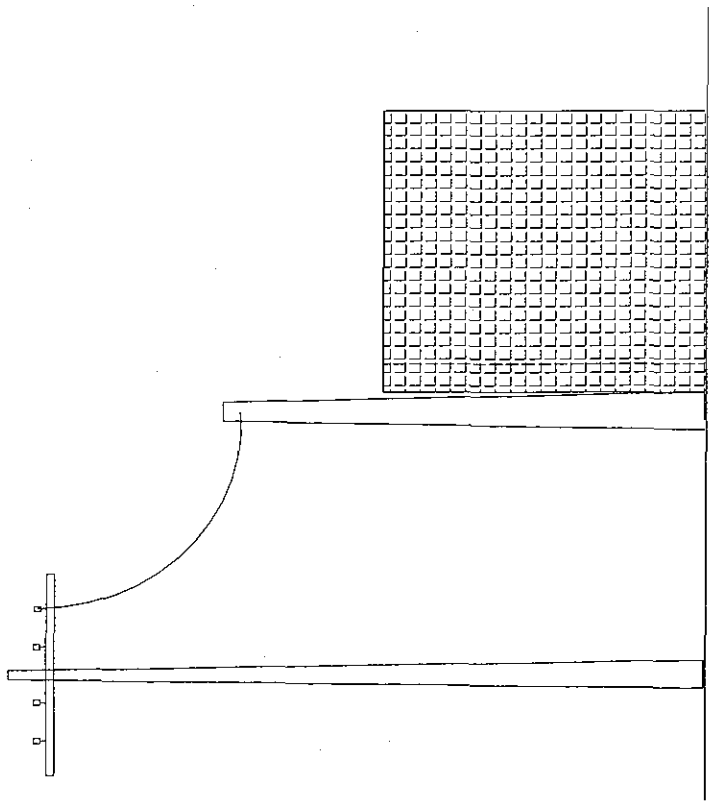


Figure7.11 Training facility of service wire installation

(3) Preparation of materials and equipments for practical training in distribution network

The required materials and equipments mentioned at 7.5.2 are shown in Table 7.33.

Table 7.33 Materials and equipments for outdoor practical skills training

Items	Contents	Quantity	Remark
Equipments			
Hand-operated crimping tool		30	
Hand-operated cable cutter		30	
Tool box	Tools, helmet, safety shoes, groves	30 sets	
High voltage insulation tester		10	
Low voltage electroscope		10	
Handy high voltage electroscope		10	
High voltage phase checker		10	
Battery-type insulation tester		10	
Telestereoscope		10	
Safety belt		30	
Materials			
C cramp	For branching conductor		
	For 34mm^2	6,000	5pieces / person x 20person / time x 12times / year x 5years
	For 55mm^2	6,000	ditto
	For 100mm^2	6,000	ditto
Straight sleeve	For connecting conductor		
	For 34mm^2	6,000	5pieces / person x 20person / time x 12times / year x 5years
	For 55mm^2	6,000	ditto
	For 100mm^2	6,000	ditto
Conductor			
	For 34mm^2	12,000m	10m / person x 20person / time x 12times / year x 5years
	For 55mm^2	12,000m	ditto
	For 100mm^2	12,000m	ditto

Materials just required for the distribution line construction-standard training are listed. The quantity is determined on 20 person / time, based on 12 times / year and for 5 years.

(4) Approximate cost of LSTC expansion plan

LSTC expansion plan has been explained in 7.5.3(1)-(3). The approximate cost for the plan is calculated in this section.

The results of the calculation are shown in Table 7.34.

Table 7.34 Approximate cost for LSTC expansion plan

Items	Specifications	Cost (thousand yen)
Indoor training facilities		18,500
Building	Including air conditioner	10,000
Computer apparatus		8,000
Fixture		500
Outdoor training facilities		5,000
Outdoor practical training facilities		3,000
Warehouse for materials and equipments		2,000
Training materials and equipments for outdoor training		64,000
Equipments		14,000
Materials		50,000
Total		87,500

Table 7.34 shows the approximate cost for the training facilities, materials and equipments for LSTC expansion plan. It excludes such operating expenses as instructor fee or travel and hotel charges of participants.

7.5.4 Suggestion Regarding the Training Implementation Method

The on-site survey shows that field engineers and workers are busy with their daily works, it is difficult in Hyderabad to go out in order to take a lecture in CTI or LSTC, which means that they receive insufficient training. On the other hand, since the reliability of distribution facilities must be improved in order to raise customer satisfaction, cutting edge engineers and workers who are responsible for maintenance, operation of these facilities and directly facing customers should be given sufficient training.

The following three steps are proposed as a method of providing training.

Upon this, two suggestions are presented as a way to train equally and periodically all of the employees of APCPDCL down to the field workers, as described below:

(1) Career Development Program

An investigation made of the attendance of site engineers and workers to training programs shows that only a small number of employees have undergone a training program organized in LSTC and that a further smaller number of employees have attended to more than one training program. As an example, a worker has attended to only one training program during his 20 years career.

The training programs offered in LSTC are modified every year in reply to the needs on site. A particular program is offered to a limited number of trainees selected according to their occupational positions.

However, as described above, the training programs offered in LSTC are not always so organized, in reality, as to continuously develop the abilities of individual workers.

The study team proposes a career development program aimed at improving the abilities of individual workers and developing their careers.

(a) Purpose

The purpose of the career development program is to offer to an individual worker a training program corresponding to the length of his career and his occupational position and at a time as required by his actual conditions.

(b) Implementation of the program

- ✓ Classify the existing training program into basic, intermediate and advanced courses.
- ✓ Impose a certain limit on the period during which employees can attend to a training course according to their length of career. For example, offer the basic course to employees whose career are for 5 years or less including newly recruited. The intermediate course is provided for employees whose career is for 6 to 10 years and the advanced course are provided for employees whose career is more than 10 years.
- ✓ Impose such a restriction that no trainee who does not finish a lower class course can attend to a higher class course.
- ✓ In principle, offer a training course to an employee so that he may undergo it in the first year of the period allocated to him. For example, the intermediate course should be provided for 6^{th} year employees.
- ✓ Offer a higher course to an employee who is promoted to a higher status, regardless of their length of career.

(c) Positive effects

The stipulation of trainees and training periods allows engineers and workers actually

occupied by their daily tasks on site to have an equal opportunity to attend to a training program.

The classification of training programs and the need to attend to a specified training program for the promotion in status are effective in heightening trainees' will to learn.

(2) Training implementation method

At present, the field engineers and workers belonging to APCPDCL are intensively trained only in LSTC. However, as described above, the field engineers and workers are occupied by their daily tasks have difficulties in going to Hyderabad to attend to the training courses. Therefore, they have no opportunity to attend the training.

In order to make employees receive the training effectively and in equally, the study team suggests dividing the training implementation method into three stages as described below:

(a) Step 1

The new training program shown in 7.5.1 and 7.5.2 is carried out at CTI and LSTC.

(b) Step 2

In order that cutting edge engineers may shorten the period in which they are out of the office and attend training conveniently, engineers and workers are brought together in each divisional headquarters and training is provided by dispatch from CTI and LSTC.

(c) Step 3

Basic practical training facility for the distribution line is newly established in each divisional headquarters, and the faculty is dispatched from LSTC so that engineers and workers of the area concerned are able to attend lectures on practical training conveniently.

Table 7.2 Annual Training Plan for the year 2003-2004 –APTRANSCO (1/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog.	Prog. days	Faculty Name Sarva Sri	Man days	Tentative month
1	Technical	MRT	Protection & transformers	SE, DE, ADE, AE, AAE	2	6	12	1. M.V.S. Birinchi, Director (Retd.) 2. Surya Prakash Rao, SE (Retd.) 3. Dakshina Murthy, DE 4. J. Bala Krishna Rao, CE (Retd.)	360	June, Sept'03
2	Technical	MRT	Recent trends in power system protection and control	DE, ADE, AE	1	5	5	ESCI	20	As per external schedule
3	Technical	Transmission Lines	Transmission line construction	SE, DE, ADE, AE, AAE, O & M Staff	4	5	20	1.Purusothama, CE (Retd.) 2. P.V.Subba Rao, CE (Retd.) 3. K.S.N.Murthy, ADE/ TL & SS/ Hyd	600	July, Sept, Nov'03, Jan'04
4	Technical	Transmission lines/ sub stations	Environmental issues in transmission lines and Substations	DE, ADE, AE	1	4	4	ESCI	80	As per external schedule
5	Technical	Tariff filing	Tariff structure and analysis	CE, SE, DE, FA & CCA, Dy.CCA, SAO	1	5	5	ESCI	100	As per external schedule
6	Technical	Substations	Workshop on controlling and operating systems in Substations	DE, ADE, AE, Sub -Eng, O & M Staff	4	5	20	1. Dakshina Murthy, DE 2. Surya Prakash Rao, SE (Retd.) 3. J.Balakrishna Rao, CE (Retd.) 4. Giri, DE 5. Ganesh Babu	600	June, Oct'03, Feb, Mar'04
7	Technical	Substations	Emerging systems in power System Switch gear	DE, ADE, AE	1	5	5	ESCI	20	As per external schedule
8	Technical	Substations	Workshop on transformer oil related aspects	DE, ADE, AE	1	2	2	ESCI	8	As per external schedule

Table 7.2 Annual Training Plan for the year 2003-2004 –APTRANSCO (2/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog.	Prog. days	Faculty Name Sarva Sri	Man days	Tentative month
9	Technical	Load dispatch & grid management	SCADA, ULDC	CE, SE, DE, ADE, AE	4	2	8	1. Prasad Rao, ADE 2. Meda Ram Mohan, DE 3. Ganesh Babu, DE	240	Apr, Sept'03, Jan, Mar'04
10	Technical	Telecommunication	Power line carrier communication	CE (Tel), SE (Tel) DE (Tel), ADE (Tel), AE (Tel)	2	3	6	1. Murthy, ADE/ TL & SS/ Hyd 2. Sundaraiah, CE/ Telecom 3. Durga Prasad, ADE/ Telecom	180	Sep'03, Feb'04
11	Technical	Telecommunication	Optical fiber and satellite communication	CE,SE, DE, AE	1	5	5	Power systems training institute (PSTI)	100	As per external schedule
12	Technical	Energy Audit	Energy accounting	SE, DE, ADE, AE	3	2	6	1. Durga Prasad, JMD (vigilance) 2. Vinay Kumar, SO/ APGENCO 3. V.Padmaiah, DE (Retd.) 4. T.V.Mohan Rao, CE (Trg. & Plg.) 5. K.S.N. Murthy, ADE/ TL & SS	180	Apr'03 to Mar'04
13	Technical	Energy audit	Power system Energy losses and modern techniques of improvement	SE, DE, ADE, AE	1	7	7	Gridco	28	As per external schedule
14	Technical	Purchase Management and stores	Value based management strategic cost reduction, resource management and inventory control	CE, SE, DE, ADE, AE, SAO, AO, AAO, JAO	3	3	9	SE/DE (Purchases) SAO/AO (CTI)	270	May, Nov'03 Mar'04
15	Technical	Civil	Construction details	CE, SE, DE, ADE, AE	2	2	4	1. Kutumba Rao 2. Jan Prakash, CE/ Civil	120	May, Dec'03

Table 7.2 Annual Training Plan for the year 2003-2004 –APTRANSCO (3/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog.	Prog. days	Faculty Name Sarva Sri	Man days	Tentative month
16	Technical	Quality	Trg. on understanding and applications of quality control principles and procedures	DE, ADE, AE	1	2	2	1. Durga Prasad, DE/ M & P/ Guntur 2. M. Gopal Rao, CE/ TL & SS/ VJW 3. Surya Prakash, DE/ TL & SS, Guntur	60	Dec'03
17	Technical	Planning	Corporate planning techniques	SE, DE, ADE, AE	1	2	2	CE/SE/ Plg	60	June'03
18	Technical	General Programs	Introduction to Technical and Non-Technical (Including Finance and HR) functions of the organization	AE	2	30	60	1.Gandhi, Director/ Comm. & CC 2. Keshava Rao, Director/ Trans. 3. Dugra Prasad, JMD (Veg.) 4. Dinesh Kumar, JMD (HRD) 5. Rachel Chatterjee, CMD 6. Director (Finance) 7. CGM (HRD)/ NPDCL 8. List of Faculty enclosed	1,800	May, June'03
19	Technical	General Programs	Refresher course on technical and non technical (including Finance and HR) functions of the organization	AAE	1	12	12	List of faculty enclosed	360	Sept'03
20	Technical	General Programs	Refresher Course on Substation Operating Manuals	DE, ADE, AE, Sub -Eng, O&M Staff	10	1	10	1. Dakshina Murthy, DE 2. Surya Prakash Rao, SE (Retd.) 3. J.Balakrishna Rao, CE (Retd.) 4. Giri, DE 5. Ganesh Babu	300	May, June, Aug, Sept, Oct, Nov, Dec'03, Jan, Feb, Mar'04

Table 7.2 Annual Training Plan for the year 2003-2004 –APTRANSCO (4/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog.	Prog. days	Faculty Name Sarva Sri	Man days	Tentative month
21	Commercial/ Accounts	Stores Accounting	Stores Accounting procedures	SAO, AO, AAO, JAO,	1	2	2	1. SAO/ Stores 2. AO/ Stores	60	May'03
22	Commercial/ Accounts	Tariff related accounts	Cost accounting in relation to tariff fixation	SAO, AO, AAO, DE, ADE, AE	1	2	2	1. A. Srinivas, Company Secretary 2. Satya Murthy, AO/ Dir (Finance)/ PESHI 3. D.Srinivas Rao, CE (Retd.) 4. K. Hari Prasad, AAO	60	July'03
23	Commercial/ Accounts	Budget & Resources	Preparation of resource projection and annual financial statements	SAO, AO, AAO, JAO, UDC	2	2	4	SAO/ AO (B & R)/ Vidyut Soudha SAO/ AO/ Budget/ Vidyut Soudha	120	Aug'03, Jan'04
24	Commercial/ Accounts	Budget & Resources	Profit and responsibility center operations in the new paradigm of Power Sector	CE, SE, DE, FA&CCA, Dy CCA, SAO	1	5	5	ESCI	20	As per external schedule
25	Commercial/ Accounts	General Programs	Finance for non finance officers	DE, ADE, AE	1	2	2	SAO/ AO/ Balance sheet/ VS AO/ Director finance/ PESHI	60	June'03

Table 7.2 Annual Training Plan for the year 2003-2004 –APTRANSCO (5/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog.	Prog. days	Faculty Name Sarva Sri	Man days	Tentative month
26	Commercial/ Accounts	General Programs	Refresher course for JAOs	JAO	2	15	30	1. CE (Trg. & Plg.) 2. SAO/ CTI 3. AO/ CTI 4. M. Hanumantha Rao, DS, 5. Keshava rao, DS 6.Vinay Kumar, SO/ APCPDCL 7. D.Srinivas Rao, CE (Retd.) 8. M.Visvanadham, DE/ Disciplinary 9. DE/ DPE/ CPDCL 10. A. Naga Bose, 12. Sreedhar Gupta, SE (Retd.) 13. N.P.Rao	900	Apr, June'03
27	Commercial/ Accounts	General Programs	Refresher course for UDCs	UDC	2	15	30	1. CE (Trg. & Plg.) 2. SAO/ CTI 3. AO/ CTI 4. M. Hanumantha Rao, DS 5. Keshava rao, DS 6.Vinay Kumar, SO/ APCPDCL 7. D.Srinivas Rao, CE (Retd.) 8. M.Visvanadham, DE/Disciplinary 9. DE/ DPE/ CPDCL 10. A. Naga Bose, 12. Sreedhar Gupta, SE (Retd.) 13. N.P.Rao	900	May, July'03

Table 7.2 Annual Training Plan for the year 2003-2004 –APTRANSCO (6/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog.	Prog. days	Faculty Name Sarva Sri	Man days	Tentative month
28	Commercial/ Accounts	General Programs	Higher accounting to unqualified UDCs	UDC	1	6	6	1. A. Srinivas, Company Secretary 2. Satya Murthy, AO/ Dir (Finance) 3. I. Laxman Rao, AO/ Genco 4. Vijay Kumar, AAO/ Genco 5. Harinadha Babu, AO/ Genco 6. Ashok, AAO/ Director (Fin) Peshi 7. K. Hari Prasad, AAO/ REC 8. K. Purushotham, AO/ Rev	180	Apr'03
29	Commercial/ Accounts	General Programs	Financial Management for non finance executives in power utilities	SE, DE, ADE, AE	1	5	5	ESCI	20	As per external schedule
30	Personnel	HR System	Knowledge of labor laws, including ID Act	CE, SE, DE, GM, DS, AS, FA&CCA, DYCCA, SAO	1	2	2	Company Secretary/ APTRANSCO GM (IR) / GM (HR), Outside consultants	60	Aug'03
31	Personnel	HR System	Advanced personnel management	CE, SE, DE, GM, DS, AS, FA & CCA, Dy.CCA, SAO	1	2	2	JMD (HRD)/ APTRANSCO CGMs of Discoms, Outside consultants	60	May'03,
32	Personnel	HR System	Industrial Management Relations	DE, ADE, AE, DS, AS, PO, SAO, AO AAO	1	2	2	GM (IR)/ GM (HR)/ APTRANSCO	60	July'03
33	Personnel	HR System	Development of leadership and interpersonal skills, group dynamics and team building	CE, SE, DE, FA&CCA, Dy.CCA, SAO, DS, AS	2	2	4	Outside consultants	120	July, Dec'03

Table 7.2 Annual Training Plan for the year 2003-2004 –APTRANSCO (7/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog.	Prog. days	Faculty Name Sarva Sri	Man days	Tentative month
34	Personnel	HR System	Principles and practices of Change Management	CE, SE, DE, FA&CCA, Dy.CCA, SAO, DS, AS, PO	1	2	2	Outside Consultants	60	Oct'03
35	Personnel	Disciplinary *proceedings*	Handling of disciplinary *proceedings*	DE, ADE, AE, DS, AS, PO, SAO, AO, AAO	1	2	2	JMD (Vigilance)/ APTRANSCO JMD (HRD)/ APTRANSCO *DE (Disciplinary Proceedings)* Outside consultant	60	Aug'03
36	Personnel	Service regulations	Procedure and rules for recruitment, promotion & appraisal	GM, DS, AS, PO, JPO, SAO, AO, AAO, JAO, DE, ADE, AE	2	2	4	GM Personnel's office	120	Oct'03
37	Personnel	Service regulations	Overview to service rules and regulations	GM, DS, AS, PO, JPO, SAO, AO, AAO, JAO, DE, ADE, AE	3	2	6	GM Personnel's office	180	Sept'03
38	Personnel	General Programs	Train the trainers	Dy.CCA, SAO,AO, SE, DE, ADE, AE, AS, PO, JPO	2	2	4	Director Finance / APTRANSCO SAO/AO/CTI, CE/ TRANSMISSION CE/ TL & SS/ Hyd, CE (RAC) CE/SE (Commercial), CGMs of DISCOMS, Vinay Kumar, SO/ APGENCO, Outside Consultants	120	Sept'03, Feb'04, Dec'03, Jan'04
39	Regulatory affairs	Interfacing functions	Corporate governance	CE, SE, FA&CCA, Dy.CCA, SAO, GM, DS, AS	1	2	2	Outside Consultants	60	June'03
40	Regulatory affairs	Interfacing functions	Over view of regulatory and legal framework	CE, SE, FA&CCA, Dy.CCA	2	2	4	SLAs/ Commercial, Services & Finance CE (Commercial) CE (RAC) DS (Legal)	120	Sep'03, Jan'04

Table 7.2 Annual Training Plan for the year 2003-2004 –APTRANSCO (8/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog.	Prog. days	Faculty Name Sarva Sri	Man days	Tentative month
41	Regulatory affairs	IPP	Preparation and handling of power purchase agreements (PPAs) Analysis on load forecasting	CE, SE, DE, ADE, FA&CCA, Dy. CCA, SAO	2	2	4	CE/SE/DE/IPC SAO/ Accounts/VS	120	May, Sept'03
42	Regulatory affairs	ARR	Understanding principles and procedures of aggregate revenue requirement (ARR)	CE, SE, DE, ADE, AE, FA&CCA, Dy.CCA, SAO, AO	1	2	2	CE/SE/DE (Plg.) AAO/RAC, AO/ Budget, AO/ Director Finance (PESHI)	60	Aug'03
43	Regulatory affairs	Tariff filing	Tariff analysis	CE, SE, DE, ADE, AE, FA&CCA, Dy.CCA, SAO, AO	1	2	2	DE/ AO/ RAC CE/SE/DE/ Commercial/ VS	60	Oct, Nov'03
44	Information Technology	MIS	Preparation of management information system	CE, SE, DE, FA&CCA, Dy.CCA, SAO, GM, DS	1	2	2	Vishnuvardhan Reddy, ADE/ LSTC	60	June'03
45	Information Technology	Computer Applications	MS - Office	SAO, AO, AAO, JAO, UDC, LDC, TYPIST, DE, ADE, AE, Sub-Eng, AS, PO, JPO, Asst.	6	6	36	ADE/ AE/ CTC/ CTI Outside Consultants	1,080	Apr(1), May(1), June(2), July(2), Aug(1), Sept(1), Oct(1), Dec(1), Jan(1), Feb(2), Mar(1)
46	Information Technology	Computer Applications	MS-Project	DE, ADE, AE, AS, PO, JPO, ASST, TYPIST, SAO, AO, AAO	2	5	10	ADE/ AE/ CTC/ CTI Outside Consultants	300	May, June, Aug, Sept, Dec'03, Mar'04
47	Information Technology	Data Base applications	Oracle	ADE, AE/AAE, AAO, JAO, UDC, PO, JPO, Asst.	1	6	6	ADE/ AE/ CTC/ CTI Outside Consultants	180	Sept(1)

Table 7.2 Annual Training Plan for the year 2003-2004 –APTRANSCO (9/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog.	Prog. days	Faculty Name Sarva Sri	Man days	Tentative month
48	Information Technology	Data Base applications	MS Access	ADE, AE /AAE, AAO, JAO, UDC, PO, JPO, Asst.	1	6	6	ADE/ AE/ CTC/ CTI Outside Consultants	180	May'03
49	Information Technology	Internet Applications	Internet Basic	DE, ADE, AE, SAO, AO, AAO, JPO, AS, PO, JPO	2	1	2	ADE/AE/CTC/CTI	60	Apr,Sept'03
					92		394		10,926	

Table 7.3 Annual Training Plan for the year 2003-2004 –Discoms (1/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog	Prog days	Faculty Name Sarva Sri	Man days	Tentative month
1	Technical	MRT	Protection & transformers	SE, DE, ADE, AE/AAE	4	6	24	1. M.V.S. Birinchi, Director (Retd.) 2. Surya Prakash Rao, SE (Retd.) 3. Dakshina Murthy, DE 4. J. Bala Krishna Rao, CE (Retd.)	720	Oct, Nov, Dec'03, Feb, Mar'04
2	Technical	MRT	Recent trends in power system protection and control	DE, ADE, AE	1	5	5	ESCI	150	As per external schedule
3	Technical	Distribution	Preventive Maintenance of distribution transformers	ADE, AE(Ops)	6	2	12	1. K.V.Surya Prakash Rao, SE (Retd.) 2. V.Padmaiah, DE (Retd.) 3. Hanumantha Rao, CE (Retd.) 4. J.Balakrishna Rao, CE (Retd.)	360	Apr'03 to Mar'04
4	Technical	Distribution	Distribution transformers repairs and maintenance	ADE, AE(Ops and SPM)	6	2	12	1. K.V.Surya Prakash Rao, SE (Retd.) 2. Valiluddin 3. Hanumantha Rao, CE (Redt.) 4. Gopala Krishna	360	Apr'03 to Mar'04
5	Technical	Distribution	Revenue recovery act and spot billing	DE, ADE, AE, SAO, AO, AAO	4	2	8	1. Geetha, Thasildar/ APTRANSCO 2.T.V.Mohan Rao, CE (Trg. & Plg.) 3. Rajeswari, ADE	240	May, July, Sept, Nov'03, Jan, Mar'04
6	Technical	Distribution	HVDS single phase transformers	ADE, AE, (OPN, SPM)	8	1	8	1. Pullaiah, ADE 2. Vishnuvardhan Reddy, ADE/ LSTC 3. K.S.N.Murthy, SE/ CPDCL	240	Apr'03 to Mar'04

Table 7.3 Annual Training Plan for the year 2003-2004 –Discoms (2/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog	Prog days	Faculty Name Sarva Sri	Man days	Tentative month
7	Technical	Distribution	HT& LT billing and Collection	SAO, AO, AAO, JAO	6	1	6	1. Laxmi Narasaiah, SAO/ CTI 2. Nagabose, FA & CCA (Retd.) 3.Krishnamurthy, Dy.CCA/ APGENCO	180	Apr'03 to Mar'04
8	Technical	Distribution	Workshop for LT/HT industrial consumers on maintenance	DE, ADE, AE, CONSUMERS	4	1	4	1. V. Padmaiah DE (Retd.) 2. Purushothama CE (Retd.)	120	Apr'03 to Mar'04
9	Technical	Distribution	Consumer service, communication and safety	AE, ADE, JAO, AAO, AO, LM, ALM, Sub-Eng	20	2	40	1.DineshKumar,JMD (HRD, Plg.&RA) 2. T.V.Mohan Rao, CE (Trg. & Plg.) 3. Meda Rammohan, DE/ SCADA 4. Vishnuvardhan Reddy, ADE/ LSTC	1,200	5 Programs at 5 LSTCs during May, July, Oct'-03, Jan'04
10	Technical	Distribution	Consumer relations and quality service	DE, ADE, AE,SAO, AO, AAO, JAO, UDC	1	2	2	BSES	40	As per external schedule
11	Technical	Distribution	Commercial aspects of power distribution system	CE, SE, FA & CCA, Dy.CCA, SAO	1	1	1	BSES	20	As per external schedule
12	Technical	Distribution	Energy efficiency program	CE, SE, DE	1	5	5	BSES	100	As per external schedule
13	Technical	Distribution	Distribution automation and load management	SE, DE, ADE, AE	1	5	5	ESCI	100	As per external schedule
14	Technical	Distribution	Latest developments in electricity metering, billing and collections	SE,DE, ADE, AE, SAO, AO, AAO, JAO	1	5	5	ESCI	100	As per external schedule

Table 7.3 Annual Training Plan for the year 2003-2004 –Discoms (3/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog	Prog days	Faculty Name Sarva Sri	Man days	Tentative month
15	Technical	Distribution	Demand side management and end-use efficiency	SE, DE, ADE, AE	1	4	4	ESCI	80	As per external schedule
16	Technical	Distribution	Power systems - SCADA	DE, ADE, AE	1	5	5	Power systems training institute (PSTI)	100	As per external schedule
17	Technical	Substations	Emerging systems in power system Switch gear	DE, ADE, AE	1	5	5	ESCI	100	As per external schedule
18	Technical	Substations	Workshop on transformer oil related aspects	DE, ADE, AE	1	2	2	ESCI	40	As per external schedule
19	Technical	Energy Audit	Energy accounting	SE, DE, ADE, AE	9	2	18	1. Durga Prasad, JMD (vigilance) 2. Vinay Kumar, SO/ APGENCO 2. V.Padmaiah, DE (Retd.) 3. T.V.Mohan Rao, CE (Trg. & Plg.) 4. K.S.N. Murthy, ADE/ TL & SS	540	Apr'03 to Mar'04
20	Technical	Energy Audit	Power system Energy losses and modern techniques of improvement	SE, DE, ADE, AE	1	7	7	GRIDCO	140	As per external schedule
21	Technical	Purchase Management and stores	Value based management strategic cost reduction, resource management and inventory control	CE, SE, DE, ADE, AE SAO, AO, AAO, JAO	3	3	9	SE/ DE (Purchases) SAO/ AO/ CTI	270	July, Sep'03, Mar'04
22	Technical	Civil	Construction details	CE, SE, DE, ADE, AE	2	2	4	1. Kutumba Rao 2. Jan Prakash, CE/ Civil	120	Oct'03

Table 7.3 Annual Training Plan for the year 2003-2004 –Discoms (4/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog	Prog days	Faculty Name Sarva Sri	Man days	Tentative month
23	Technical	Quality	Trg. on understanding and applications of quality control principles and procedures	DE, ADE, AE	3	2	6	1. Durga Prasad, DE/ M & P/ Guntur 2. M. Gopal Rao, CE/ TL & SS/ VJW 3. Surya Prakash, DE/ Tl & SS, Guntur	180	June'03, Feb, Mar'04
24	Technical	Planning	Corporate planning techniques	SE, DE, ADE, AE	3	2	6	Out side consultant from ASCI (Dr. Kinnera Murthy)	180	Aug, Nov'03, Feb'04
25	Technical	General Programs	Induction Training Program	AE	8	30	240	1.Gandhi, Director/ Comm. & CC 2. Keshava Rao, Director/ Trans. 3. Dugra Prasad, JMD (Veg.) 4. Dinesh Kumar, JMD (HRD) 5. Rachel Chatterjee, CMD 6. Director (Finance) 7. CGM (HRD)/ NPDCL 8. List of Faculty enclosed	7,200	July, Aug, Oct, Nov, Dec'03, Jan, Feb, Mar'04
26	Technical	General Programs	Refresher course on technical and non technical (including Finance and HR) functions of the organization	AAE	3	12	36	List of faculty enclosed	1,080	Apr'03 Jan, Mar'04
27	Commercial/ Accounts	Stores Accounting	Stores Accounting Procedures	JAO/ AAO, AO/ SAO	4	2	8	1. SAO/ Stores 2. AO/ Stores	240	Apr, July, Sept, Oct, Dec'03

Table 7.3 Annual Training Plan for the year 2003-2004 –Discoms (5/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog	Prog days	Faculty Name Sarva Sri	Man days	Tentative month
28	Commercial/ Accounts	Tariff related accounts	Cost accounting in relation to tariff fixation	AAO/ AO/ SAO, ADE/ AE/ DE	2	2	4	1. A. Srinivas, Company Secretary 2. Satya Murthy, AO/ Dir (Finance)/ PESHI 3. D.Srinivas Rao, CE (Retd.) 4. K. Hari Prasad, AAO	120	Sept, Dec'03
29	Commercial/ Accounts	Budget & Resources	Profit & Responsibility center operations in the new paradigm of power sector	CE, SE, DE, FA&CCA, Dy.CCA, SAO	1	5	5	ESCI	100	As per external schedule
30	Commercial/ Accounts	General Programs	Refresher course for JAOs	JAO	6	15	90	1. CE (Trg. & Plg.) 2. SAO/ CTI 3. AO/ CTI 4. M. Hanumantha Rao, DS 5. Keshava rao, DS 6.Vinay Kumar, SO/ APCPDCL 7. D.Srinivas Rao, CE (Retd.) 8. M. Visvanadham, DE/ Disciplinary 9. DE/ DPE/ CPDCL 10. A. Naga Bose 12. Sreedhar Gupta, SE (Retd.) 13. N.P. Rao	2,700	Aug'03 and 1 batch in Sept'03 and Feb'04
31	Commercial/ Accounts	General Programs	Refresher course for UDCs	UDC	6	15	90	To be identified	2,700	Dec'03 and 1 batch in Oct, Nov'03

Table 7.3 Annual Training Plan for the year 2003-2004 –Discoms (6/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog	Prog days	Faculty Name Sarva Sri	Man days	Tentative month
32	Commercial/ Accounts	General Programs	Higher accounting to unqualified UDCs	UDC	3	6	18	1. A. Srinivas, Company Secretary 2. Satya Murthy, AO/ Dir (Finance) 3. I. Laxman Rao, AO/ Genco 4. Vijay Kumar, AAO/ Genco 5. Harinadha Babu, AO/ Genco 6. Ashok AAO/ Director (Fin) Peshi 7. K. Hari Prasad, AAO/ REC 8. K. Purushotham, AO/ Rev	540	July, Oct, Nov'03
33	Commercial/ Accounts	General Programs	Finance for non finance officers	AE, ADE, DE	3	2	6	SAO/ AO/ Balance Sheet/ VS AO/ Director finance/ PESHI	180	Aug'03, Jan, Mar'04
34	Commercial/ Accounts	General Programs	Financial Management for non finance executives in power utilities	SE, DE, ADE, AE	1	5	5	ESCI	100	As per external schedule
35	Commercial/ Accounts	General Programs	Legal aspects on commercial matters & Consumer disputes	DE, ADE, AE, SAO, AO, AAO	2	2	4	Out side consultant, SLA – APTRANSCO/ Discoms	120	
36	Personnel	HR System	Knowledge of relevant labor laws, including ID Act	CE, SE, DE, GM, DS, AS,PO, FA&CCA, Dy.CCA, SAO	2	3	6	CGM (HRD) of Discoms IR Specialist	180	Aug'03
37	Personnel	HR System	Advanced personnel management	CE, SE, DE, GM, DS, AS, FA&CCA, Dy. CCA, SAO	4	2	8	JMD (HRD)/ APTRANSCO CGMs of Discoms, Out side consultant (ASCI/ IPE)	240	May'03,

Table 7.3 Annual Training Plan for the year 2003-2004 –Discoms (7/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog	Prog days	Faculty Name Sarva Sri	Man days	Tentative month
38	Personnel	HR System	Development of leadership and interpersonal skills, group dynamics and team building	CE, SE, DE, FA&CCA, Dy.CCA, SAO, DS, AS	4	2	8	CGM (HRD) of Discoms, Outside consultant	240	Sept'03
39	Personnel	HR System	Implementing organizational change & Development	CE, SE, DE, FA&CCA, Dy.CCA, SAO, DS, AS	2	2	4	CE (RAC) Outside Consultants	120	Nov'03
40	Personnel	HR System	Motivation and work orientation	ADE, AE, Staff, AO, AAO, JAO, PO, JPO	4	2	8	T.V.Mohan Rao / CE (Trg. & Plg.) out side consultant	240	Dec'03
41	Personnel	HR System	Time Management	DE, ADE, AE, SAO, AO, AAO, DS, AS, PO	1	2	2	Out side consultant	60	
42	Personnel	HR System	Presentation Skills	DE, ADE, AE, SAO, AO, AAO, DS, AS, PO	1	2	2	CGM (HRD) of Discoms, Outside consultant	60	
43	Personnel	Disciplinary proceedings & service regulations	Overview of disciplinary proceedings & Service rules and regulations	DS, AS, PO, JPO, CE, SE, DE, Dy.CCA, SAO, AO, AAO, JAO, UDC, LDC	4	2	8	Expert in Disciplinary proceedings Mr. Venkat Rao CGM / HRD of Discoms	240	June, Aug, Oct, Nov'03, Feb, Mar'04
44	Personnel	Security and vigilance	Technical awareness program for vigilance wing	SP, CI, SI, Constables	4	2	8	JMD (V&S) / APTRANSCO V.Padmaiah, DE (Retd.) T. Mohan Rao, CE (Retd.)	240	May, July, Sept, Dec'03
45	Personnel	Service regulations	Procedure and rules for recruitment promotion & appraisal	AS, PO, JPO, SAO, AO, AAO, JAO, DE, ADE, AE	4	3	12	DS of Discoms	360	June, Sept., Dec'03 and Feb'04

Table 7.3 Annual Training Plan for the year 2003-2004 –Discoms (8/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog	Prog days	Faculty Name Sarva Sri	Man days	Tentative month
46	Personnel	General Programs	Train the trainers	Dy.CCA, SAO, AO, DS, AS, PO, SE, DE, ADE	3	2	6	Outside consultants CGM / HRD of DISCOMS	180	July, Sept, Dec '03, Jan'04
47	Regulatory affairs	Interfacing functions	Corporate governance	CE, SE, DE, FA&CCA, Dy.CCA, SAO, GM, DS, AS	4	2	8	Outside consultants	240	May, July, Aug'03 Jan'04
48	Regulatory affairs	ARR	Understanding principles and procedures of aggregate revenue requirement (ARR)	CE, SE, DE,ADE,AE, FA&CCA, Dy.CCA, SAO,AO	4	2	8	Director (Tech/ Com) of Discoms, APERC CE (RAC)	240	Sep'03, Jan, Mar'04
49	Regulatory affairs	Tariff filing	Tariff analysis	CE, SE, DE, ADE, AE, FA&CCA, Dy.CCA, SAO, AO	1	2	2	DE/ AO/ RAC CE/SE/DE/ Commercial/ VS APERC	60	Oct, Nov'03
50	Regulatory affairs	General Programs	Business Planning & Effective Execution	CE, SE, DE, ADE, AE, FA&CCA, Dy.CCA, SAO, AO, AAO, DS, AS, PO	1	2	2	CMD, JMD (HRD) of APTRANSCO CGMs of Discoms	60	
51	Information Technology	MIS	Preparation of management information system	CE, SE, DE, FA&CCA, Dy. CCA, SAO, GM, DS	3	2	6	AGM (IT) / GM (IT) of Discoms	180	Aug, Sept'03, Feb'04
52	Information Technology	Computer Applications	Computers- Concepts & Applications & Internet Basics	DE, ADE, AE, Sub-Eng, SAO, AO, AAO, JAO, DC, LDC, AS, PO, JPO, ASST, TYPIST	24	6	144	ADE/ AE/ CTC/ CTI Outside Consultants	4,320	April(1), May(1), June (1), July(1), Sept(1), Oct(1), Nov(3), Dec(1), Jan(1), Feb(2), March(1)

Table 7.3 Annual Training Plan for the year 2003-2004 –Discoms (9/9)

No.	Functional Area	Sub Area	Trg. Program	Target Cadre(s)	No. of Prog.	Days per prog	Prog days	Faculty Name Sarva Sri	Man days	Tentative month
53	Information Technology	Computer Applications	MS-Project	DE, ADE, AE, AS, PO, JPO, Asst., TYPIST, SAO, AO, AAO	8	5	40	ADE/ AE/ CTC/ CTI Outside Consultants	1,200	Oct(1), Nov(1), '03, Jan(1), Feb(2) '04
54	Information Technology	Database applications	Oracle & M.S. ACCESS	ADE, AE, AAE, AAO, JAO, UDC, PO, JPO, Asst.	2	9	18	ADE/ AE/ CTC/ CTI Outside Consultants	540	Oct
55	Information Technology	Database applications	Computerization and Consumer care	ADE, AE, Sub-Eng, AO, AAO, JAO	1	1	1	BSES	20	As per external schedule
					208		1,009		29,760	

Table 7.4 External Training Programs

No.	Program name	Area	Target cadre	No of days	Batch -size	Man days	Institute
1	Consumer relations and quality of service	Distribution	DE, ADE, AE, SAO, AO, AAO, JAO, UDC	2	20	40	BSES
2	Commercial aspects of power distribution system	Distribution	CE, SE, FA&CCA, Dy.CCA, SAO	1	20	20	BSES
3	Energy efficiency program	Distribution	CE, SE, DE	5	20	100	BSES
4	Computerization and consumer care	Database applications	ADE, AE, Sub-Eng, AO, AAO, JAO	1	20	20	BSES
5	Power system Energy losses and modern techniques of improvement	Energy audit	SE, DE, ADE, AE	7	20	140	Gridco
6	Emerging systems in power System Switch gear	Substations	DE, ADE, AE	5	20	100	ESCI
7	Workshop on transformer oil related aspects	Substations	DE, ADE, AE	2	20	40	ESCI
8	Financial Management for non finance executives in power utilities	General (Accounts)	SE, DE, ADE, AE	5	20	100	ESCI
9	Environmental issues in transmission lines and Substations	Transmission lines/ Substations	DE, ADE, AE	4	20	80	ESCI
10	Tariff structure and analysis	Tariff filing	CE, SE, DE, FA&CCA, Dy.CCA, SAO	5	20	100	ESCI
11	Recent trends in power system protection and control	MRT	DE, ADE, AE	5	20	100	ESCI
12	Distribution automation and load management	Distribution	SE, DE, ADE, AE	5	20	100	ESCI
13	Latest developments in electricity metering, billing and collections	Distribution	SE, DE, ADE, AE, SAO, AO, AAO, JAO	5	20	100	ESCI
14	Demand side management and end-use efficiency	Distribution	SE, DE, ADE, AE	4	20	80	ESCI
15	Profit and responsibility center operations in the new paradigm of Power Sector	Budget and resources	CE, SE, DE, FA&CCA, Dy.CCA, SAO	5	20	100	ESCI
16	Power systems - SCADA	Distribution	DE, ADE, AE	5	20	100	Power systems training institute (PSTI)
17	Optical fiber and satellite communication	telecommunicat-i ons	CE, SE, DE, AE	5	20	100	Power systems training institute (PSTI)
					340	1,420	

Table 7.5 Overall training man-days

	Man-days			% Time allocated		
	Transco	Discoms	Total	Transco	Discoms	Total
Technical	5,190	13,440	18,630	41%	50%	47%
Commercial/accounts	2,280	6,480	8,760	18%	24%	22%
Personnel	840	2,220	3,060	7%	8%	8%
Regulatory affairs	420	540	960	3%	2%	2%
Information Technology	3,840	4,260	8,100	31%	16%	21%
Total	12,570	26,940	39,510	100%	100%	100%

Table 7.6 Annual Training Calendar for the year 2003 – 04 at LSTC/ CPDCL/ Hyderabad

No.	Name of Programs	No. of Programs	Duration
1	Training Program for Junior Line Men Working in O & M cadre	6 Programs	15 days
2	Training Program for Asst. Line Men & Line Men	6 Programs	15 days
3	Training Program for Sub-Engineers	6 Programs	15 days
4	Training Program for LDC/ Steno/ Typist/ Revenue Cashiers	7 Programs	15days
5	Training Program for 33/11kV Substation	12 Programs	2 days
6	Awareness Program for House Wives	6 Programs	One day
7	Awareness Program for Farmers on use of energy efficient pumps	12 Programs	One day
8	Workshop on Safety Measures in field	12 Programs	One day
9	Spot Billing (For Meter Readers)	6 Programs	One day
10	Customer Service & Communication Skills	12 Programs	One day
11	Stress Management	6 Programs	2 days
12	Energy Audit	6 Programs	2 days
13	Preventive Maintenance of Transformer	4 Programs	2 days
14	HT/ LT Metering	4 Programs	2 days
15	Performance Evaluation	12 Programs	2 days
16	Higher Accountancy	3 Programs	5 days
17	Tech. Exposure to Non Tech	6 Programs	One day
18	Revenue Recovery Act	6 Programs	2 days
19	Transformer Repairs/ SPM	6 Programs	2 days
20	Miscellaneous	10 Programs	2 days

Table 7.7 Calendar of Training Programs April 2003 - March 2004 - ESCI (Power & Energy Division) (1/2)

No.	Title of Program	Dates	Duration
1	Application of CIS and CPS in Power Utilities	08-09 May 2003	2 Days
2	Modern Techniques and Practices for Assessment and Reduction of T&D Losses	13-17 May 2003	5 Days
3	*Application and Commercial Accounting Systems before and after Reforms*	19-23 May 2003	5 Days
4	Failure of Power and Distribution Transformers	16-20 Jun 2003	5 Days
5	Latest Trends in Power System Switch-gear	24-28 Jun 2003	5 Days
6	Power Cables and Accessories	24-26 Jun 2003	3 Days
7	Design a Construction of Hydro Power Stations	07-11 Jul 2003	5 Days
8	Tariff Structure and Analysis	14-18 Jul 2003	5 Days
9	Renovation and Modernization of Hydro Power Stations	21-25 Jul 2003	5 Days
10	Reactive Power Management	29 Jul to 2 Aug 2003	5 Days
11	Transformer Oil - Related Aspects	12-13 Aug2003	2 Days
12	SCADA and its Applications in Power Utilities	18-20 Aug 2003	3 Days
13	Latest Developments in Electricity Metering, Billing and Collection	25-29 Aug 2003	5 Days
14	*Trends & Developments in Transmission Line Technology Including Quality in Construction*	10-15 Sep 2003	5 Days
15	Condition Monitoring of Industrial and Power Plant Equipment	16-19 Sep 2003	4 Days
16	Recent Trends in Power System Protection and Control	22-26 Sep 2003	5 Days
17	Energy Audit - An Effective Tool for Energy Management for Thermal Power Plants	06-08 Oct 2003	3 Days
18	Energy Audit - An Effective Tool For Energy Management for Transmission and Distribution Systems	09-11 Oct 2003	3 Days
19	Maintenance of EHV Substation Equipment	14-18 Oct 2003	5 Days
20	Pilferage of Electricity - Issues & Challenges	03-07 Nov 2003	5 Days

Table 7.7 Calendar of Training Programs April 2003 - March 2004 - ESCI (Power & Energy Division) (2/2)

No.	Title of Program	Dates	Duration
21	*Power Sector Reforms in Distribution - Issues & Challenges*	11-15 Nov 2003	5 Days
22	Optimization of Thermal Power Stations	18-22 Nov 2003	5 Days
23	Modern Developments in Transmission Systems	01-03 Dec 2003	3 Days
24	Governing and Protection of Steam Turbines	09-11 Dec 2003	3 Days
25	Customer Information Systems in Power Distribution	16-18 Dec 2003	3 Days
26	Control & Instrumentation in Thermal Power Plants	05-08 Jan 2004	4 Days
27	Distribution Automation and Load Management	19-23 Jan 2004	5 Days
28	Water Chemistry in Power Plants	27-29 Jan 2004	3 Days
29	Coal Handling and Ash Handling in Thermal Power Plants	02-04 Feb 2004	3 Days
30	Renovation and Modernization of Distribution Systems	03-07 Feb 2004	5 Days
31	Successful Practices for Assessment and Reduction of T&D Losses	10-13 Feb 2004	5 Days
32	Profit and Responsibility Center Operations in the New Paradigm of Power Sector	16-20 Feb 2004	5 Days

Table 7.8 Calendar of Training Programs 2003 - 2004 – CIRE (1/2)

No.	Name of the Program	Focus on	Dates	Duration (Days)
1	Power Distribution Management and Technologies	Design and planning of Sub-Transmission and distribution systems. Latest developments, SCADA/ DA/ DSM/ Load Management/ Energy audit, Power sector reforms. Computerized billing.	28 April - 9 May 2003	12
2	Customer Information Systems for Power Utilities	Consumer management & service, Consumer Act, Trouble call management, Computerized billing, Complaint handling, Obligations of consumer, Automated System.	25 - 28 Aug 2003	4
3	Pilferage of Electricity - Technical and Legal Remedies	Methods and mal-practices adopted, Deletion and preventive measures, Vigilance operations, IE Rules and IE Act, Case studies.	25 - 28 Aug 2003	4
4	Cyber Laws (in association with National Academy of Legal Studies and Research-NALSAR)	Cyber revolution, Impact on society and legal systems, Jurisdiction in cyber space, Cyber contracts, Intellectual property rights in cyber space, Cyber crimes, Consumer protection in internet.	16 - 19 Sept 2003	4
5	Up-gradation of Power Distribution Technologies and System Improvement	Innovative and cost effective technologies such as SCADA, DA, Load management, DSM, HVDS, Energy audit etc. Evaluation of alternatives for improvement of distribution, Reduction of losses and improvement of power quality, CAD.	16 - 19 Sept 2003	4
6	Power Sector Reforms	Status of power reforms, Electricity Bill 2003, MOUs, Private participation Licensing, Important regulations and orders, Privatization of distribution, APDRP.	14 - 17 Oct 2003	4
7	Safety and Conservation	Issues related to safety in electrical installations, Guidelines, IE Rules, Energy conservation act, International standards on safety and environment, Conservation of energy.	14 - 17 Oct 2003	4
8	Power Purchase Agreement	Undertaking & obligations of Developer and Power Utility, Acceptance test procedure, O&M of generating stations, Sale & purchase of energy, Tariffs, Force measure, Buy-out, Arbitration & Conciliation Act 1 996, Regulatory Commissions, Electricity Bill 2003.	17 - 20 Nov 2003	4
9	Internet Applications for Power Utilities	Computer networking concepts, Web Technologies e-business, IT Act, Uses of internet for business operations, Complaints handling, Consumer service.	17 - 20 Nov 2003	4
10	Power Transformers - Ensuring Optimum Performance	Design and operation of power transformers, Selection of ratings, Specifications, Tap changers, IR values, Earthing. Installation, Commissioning and testing, Maintenance and trouble shooting.	16 - 19 Dec 2003	4

Table 7.8 Calendar of Training Programs 2003 - 2004 – CIRE (2/2)

No.	Name of the Program	Focus on	Dates	Duration (Days)
11	Power Sector Accounting with reference to ESAAR & GAAP	Existing legal framework for accounting and financial reporting, ESAAR 1985 & GAAP, Issues in application of accounting standards, Accounting for fixed assets, Lease accounting etc.	16 - 19 Dec 2003	4
12	Information Technology for Executives	IT Trends & Developments, Data & Computer network management, Server management, Security Issues, IT infrastructure development, e-governance, e-service.	06 - 09 Jan 2004	4
13	Reliable and Energy Efficient Distribution Transformers for Power Utilities	Adoption of new technologies such as CSP/ Fail safe/ CRD/ AMDT/ Single phase transformers, Low loss and energy efficient transformers, Failure analysis & measures to reduce failure of DTs.	06 - 09 Jan 2004	4
14	Trends & Developments in Electricity Metering and Billing.	New developments in metering technologies, Tamper proof meters, Electronic metering, AMR, Meter Reading Instruments, Computerized billing and Revenue Collection.	03 - 06 Feb 2004	4
15	Understanding Electricity Regulation in India	Principles of utility regulations, Regulatory authorities in USA & UK, Need for independent regulator, Electricity Regulatory Commission, Relationship between Regulator, Licensee, and Government.	03 - 05 Feb 2004	3

OTHER PROGRAMMES

1. CIRE also organizes Seminars and Workshops in collaboration with other organizations on topical themes.
2. Tailor-made programs on specialized subjects can be conducted at a place of choice of the sponsoring organization.
3. Sponsored programs can also be organized at CIRE campus on payment of a lump sum course fee for 20-25 participants.

Reference Data

1. Analyzed Results of Operating (Outages) Data of Distribution Line
2. Manual for Improvement of Distribution Network
3. Basic Manual for ArcMap