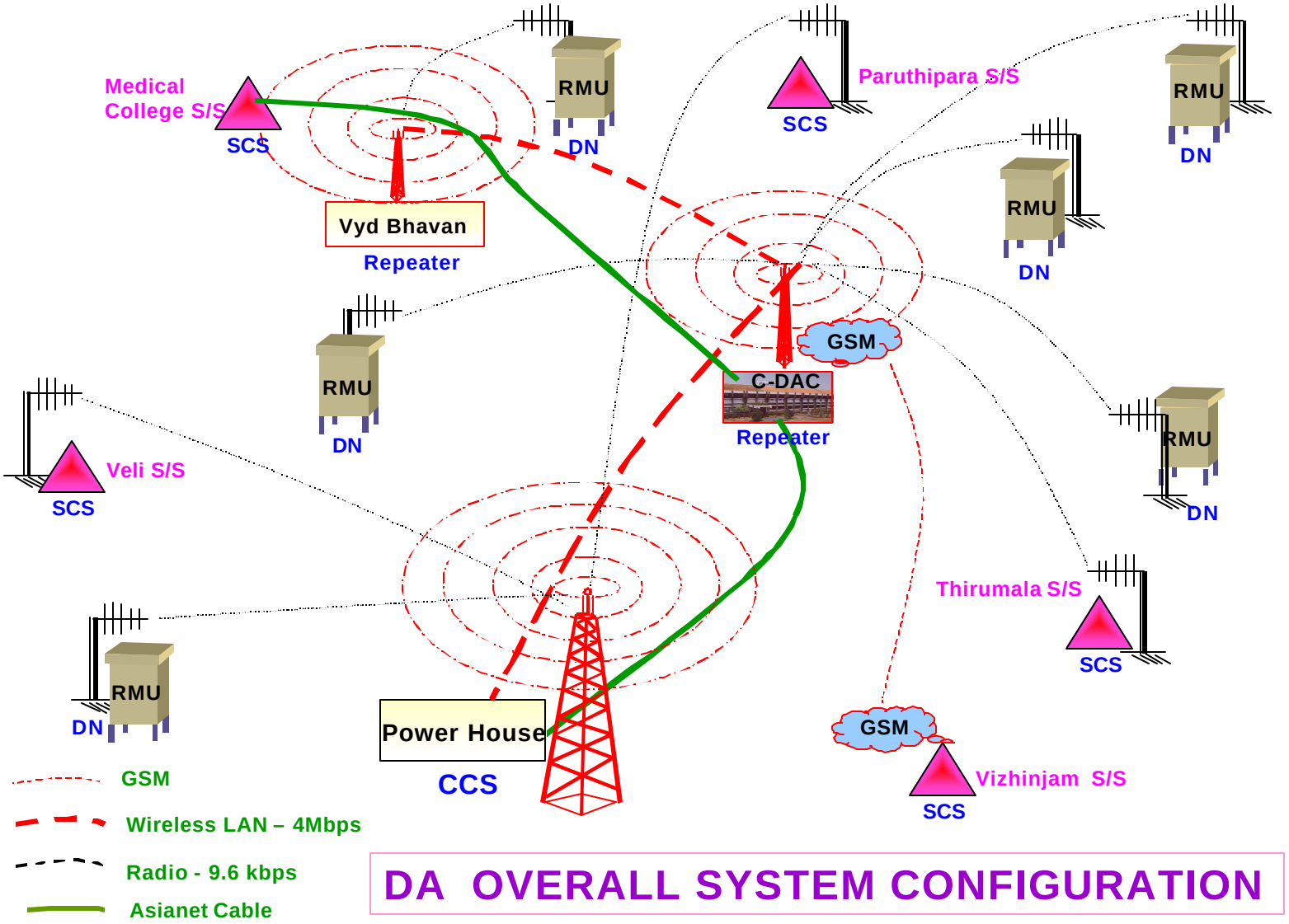
DISTRIBUTION AUTOMATION SYSTEM FOR THIRUVANANTHAPURAM CITY

Distribution Automation Project for Thiruvananthapuram city is a project taken up as part of the Retrofit Automation Projects of Department of Information Technology, Ministry of Communication and Information Technology (MCIT) under its Technology Mission Programme of using Information Technology in improving management of distribution of electricity in India. The project is being jointly implemented by Centre for Development of Advanced Computing(CDAC), Thiruvananthapuram and Kerala State Electricity Board (KSEB) and funded by DIT and KSEB. The project aims at the automation of the 11 KV distribution network of Thiruvananthapuram city. Main objective is to improve supply reliability by reducing the number and duration of outages, reduction of losses in the system, improved voltage profile, improved safety and personnel security.

The scope of the project includes Central Control System (CCS), 8 Substation Control Systems(SCS), 120 Distributed Nodes(DN) and Repeater Stations for Radio communication between CCS, SCS and DN.



DA OVERALL SYSTEM CONFIGURATION

CENTRAL CONTROL SYSTEM (CCS)

The Central Control System is located in the Central Control Room in Power House, East Fort. It gathers on-line data from SCS and DNs over Radio and from Repeater Stations over high speed/ high bandwidth Wireless LAN

Central Control Room

Salient features

1. Dual Redundant Servers in hot standby configuration
2. Linux based Communication Server with priority based polling software for acquiring online data from Remote nodes
3. Client/Server Communication Software Modules
4. Power SCADA software (data over Radio /WLAN)
5. Man Machine Interface Modules
6. Data/Alarm Logging/display and Report Modules
7. 11 KV Distribution Network monitoring and Control (Remote Operation)
8. Feeder Reconfiguration by remote operation of RMU cable switches.
9. Geographical Information System (GIS) package
10. Load Flow Analysis (Voltage Profile, Loss etc)
11. Short Term Load Forecast
12. Web based report configuration/ generation of Substation feeder data
13. Fault/Switching Report Generation
14. Outage Management System(OMS)
15. Full Duplex Communication with Substations / Distributed nodes/ Repeater Stations(Radio/Cable/Wireless LAN)

SUBSTATION CONTROL SYSTEM

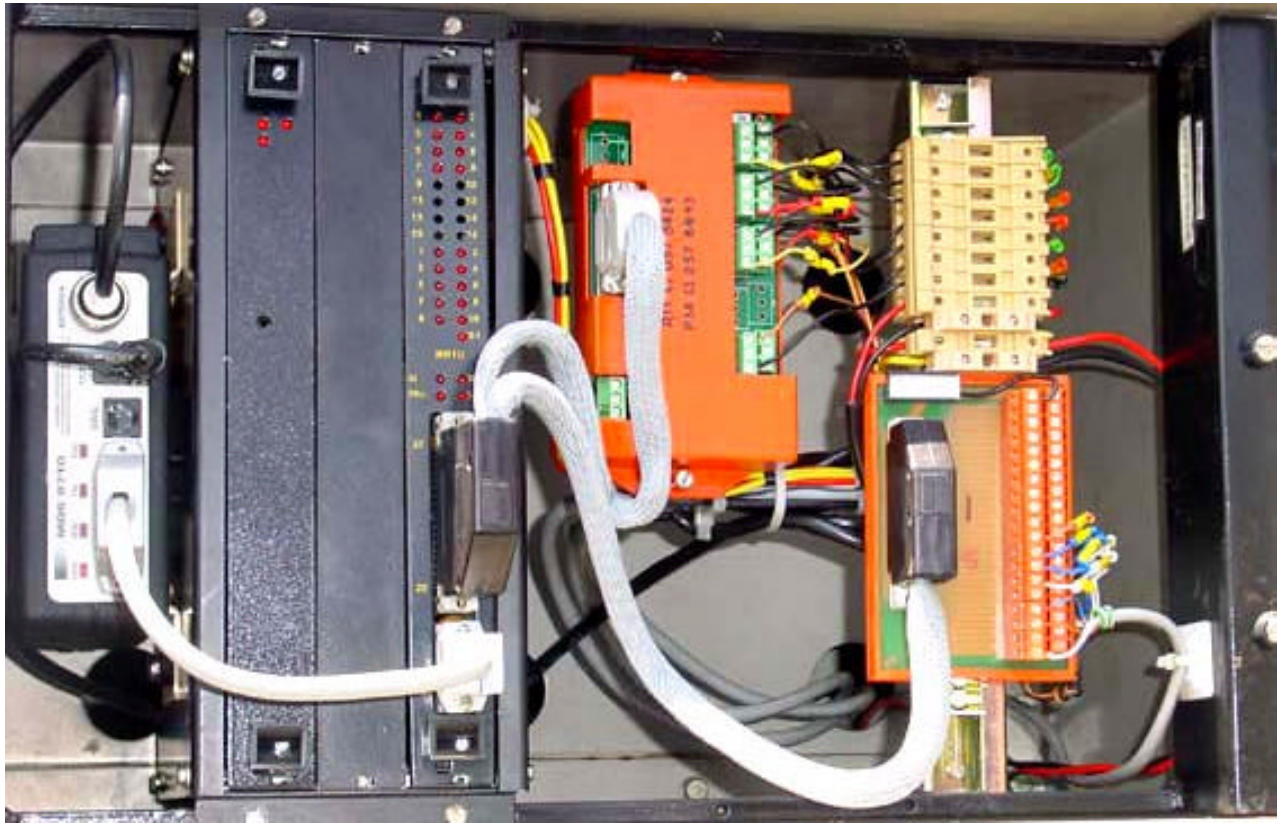
The Substation Control System consists of Operator Console, Substation RTU with Feeder Monitoring Units, Printer and Radio/GSM module/Cable modem for data communication with CCS/Repeater station.

Salient Features

1. Non Intrusive type power interface
2. Transducerless Substation RTU which monitors electrical parameters, trip relay status,CB status etc.
3. Redundant Communication Strategy(Radio / Telephone line/GSM/Cable)
4. Power SCADA
5. MMI modules
6. Data/Alarm Logging/Display and Report Modules
7. Online display of mimic, bar, trend, Engg. Value etc.
8. Historical display (Trend, Alarm)
9. Communication Software Module(Radio/Telephone line/ GSM/ Cable)
10. Report Generation

DISTRIBUTED NODES

The Distributed Node consists of Ring Main Units(RMUs), Micro Remote Terminal Units(MRTUs) and Remote Radios and installed in transformer locations in the distribution network. The MRTU enables easy and reliable remote operation from Control Room



MRTU Rack Assembly

Salient Features

1. Micro RTU with AI/DI/DO interface
2. RMU interface
    a. Senses SC/EF, Gas Pressure, CB status
    b. operates RMU Switches
3. Data Acquisition / Diagnostics
4. Radio Communication
5. Remote operation of RMU switches from Control Room

REPEATER STATIONS

Repeater Stations are used to collect data from RMUs/Substations which have poor Line-Of-Sight (LOS) with Power House and send to CCS at Power House. Repeater Stations are installed at VydyuthiBhavanam and CDAC, Thiruvananthapuram which communicate with CCS over high speed, high bandwidth wireless LAN and with RMUs/Substations over Radio/ GSM/ Cable.

Trouble Call Management System(TCMS)

The Trouble Call Management System caters to 21 Electrical Sections in Thiruvananthapuram city and is commissioned in the KSEB's Call Centre at Power House. The GUI enables manual complaint registration/despatch, pending complaints monitoring, report generation etc. Automatic complaint registration is effected via the Integrated Voice Response System(IVRS).

Salient features

1. Integrated Voice Response System (IVRS)
2. SCADA interface for online information
3. Complaint Registration via SMS
4. Complaint Despatch / Alert Messaging using SMS
5. Report generation

Benefits to KSEB by DA Project

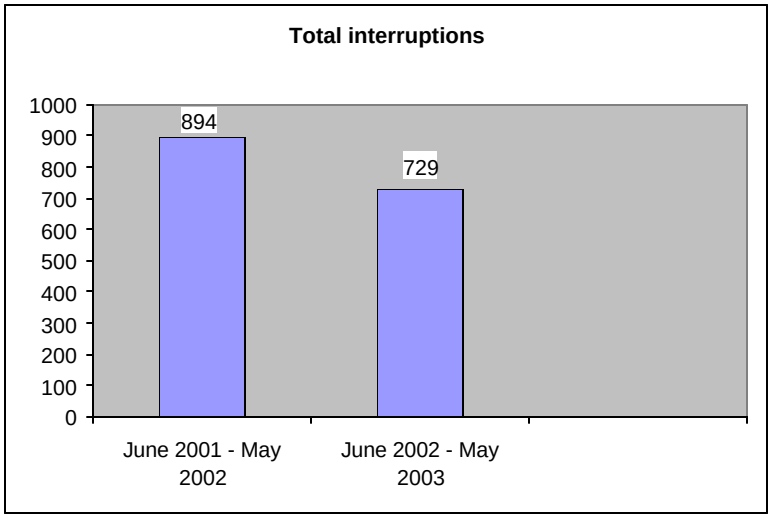
The overall benefits to KSEB by implementation of the project can be summarized as follows:

1. Presentation of total distribution network information to Control Room Engineer.
2. Faster fault location on the distribution network, their isolation and service restoration
3. From the total feeder loading status available to the Control Room operator, proper load transfer can be made to reduce peak load. This results in reduction of power losses and improved voltage profile.
4. Automated fault location and faster service restoration reduces the duration of interruptions, outage time and improves the supply reliability and quality of service. This increases customer satisfaction.
5. Reduction in operating expenses, manpower saving in operation and maintenance.
6. Improvement of safety of men and material
7. Improvement of equipment availability
8. Better tools for accurate short term and long term distribution planning.

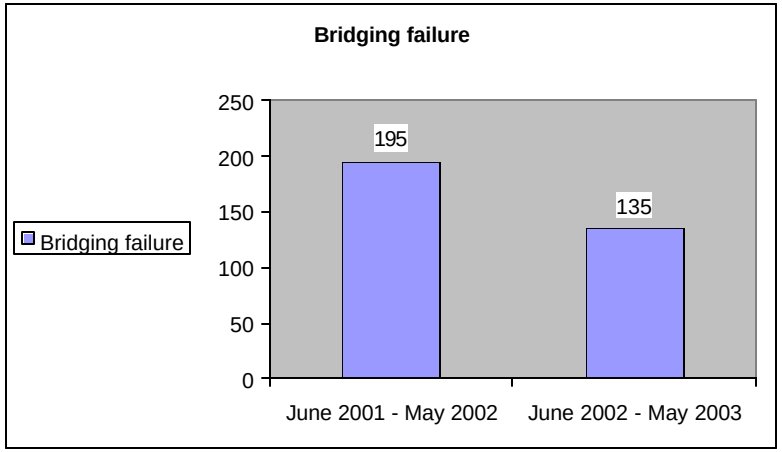
Benefits

(i) Centralised monitoring of all 11KV parameters

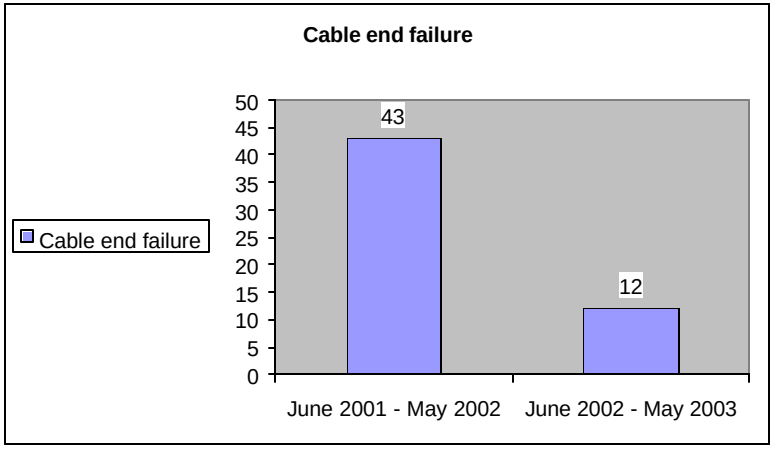
(ii) Even balancing of feeder loads resulting in reduced outage due to overloading



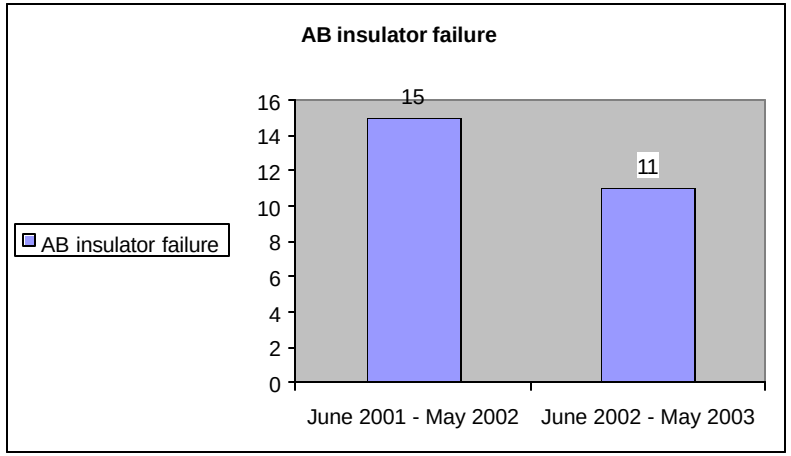
Reduction in Total interruptions - 18.45 %



Reduction in interruption due to *Bridging failure* - 30.77 %

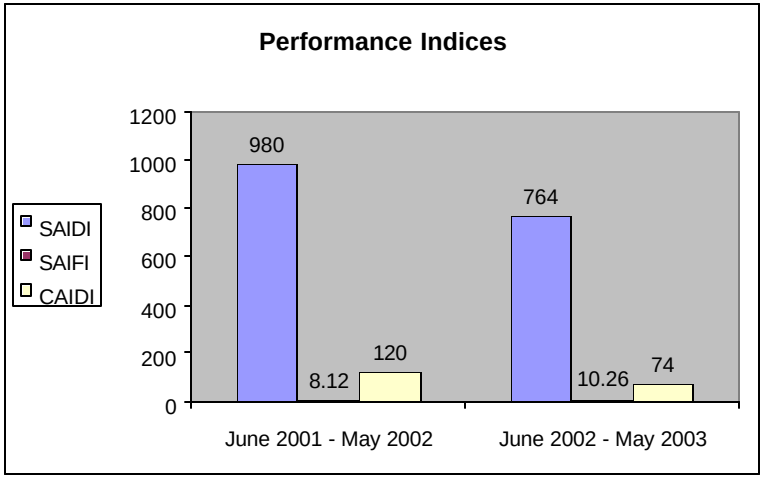


Reduction in interruption due to *cable end failure* - 72.09 %



Reduction in interruption due to *AB insulator failure* - 26.67 %

(iii) Optimal reconfiguration of 11KV network to increase reliability and loss reduction



Improvement in SAIDI (System Average Interruption Duration Index) - 22.04 %

Improvement in CAIDI (Customer Average Interruption Duration Index) - 38.33 %

The interruption duration has been considerably reduced even though there is marginal increase in the interruption frequency (SAIFI – System Average Interruption Freuency Index).

(iv) Better comprehension of system abnormalities and early initiation of corrective actions

(v) Increased system reliability due to RMU operations.

(vi) Streamlined network switching discipline resulting in reduced time to locate fault, isolation and supply restoration.

(vii) Reduced communication and associated delay & ambiguity between Substations and Central Control Room during 11 KV network emergencies resulting in faster , focussed restoration of power supply and improved safety for men & materials.

(viii) Improved profiling of individual feeder load across the network to help in identification of unbalanced sections, overloaded transformers etc.

(ix) Complete documentation of events through system MIS, enhancing consistency of system operation and safety.

(x) Improved customer satisfaction due to reduction in power interruption and improved supply reliability & quality of service. .