Effective management of rural loads by demand side management

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Background

During past two decades irrigation loads have grown exponentially. Growth in Power generation has been slow as compared to the load thus there is a deficit of power.

As subsidized/Free power is supplied to Irrigation Pump(IPset) consumers the utilities would like to control consumption beyond normal limits. Moreover IP sets can be scheduled to operate in time of off peak loading there by rationalizing the overall load curve.

Traditional method of rostering has not yielded desired result. The load shedding has caused interruption of power supply to domestic lighting & rural commercial load. Due to this lot of revenue is lost which is not subsidized.

Load Management Issues

The distribution system is generally overloaded as the utility has no control over the IPset loads. Presently the consumer can switch on the IPset load at any desired time. These IPset have poor power factor performance leading to lower voltages and increase of distribution loss at the supply points.

Using effective load management the utility would control the IP set consumption as per the desired time frame (Off peak hours), regular supply to the rural domestic and commercial consumers, ensure committed number of hour supply to IP loads.

Proposed Concept

In order to implement a scheme of effective load management on the IPsets, the feeders for the IPset and the normal consumers are separated. On the IP set feeder the Rural Load Management Unit(RLMU) is proposed to control the IP loads.

In this scheme each Transformer is divided into different feeders for Industrial, Rural consumers and IP consumers. Two different feeders are used for IP and one for rural commercial & domestic consumer. Complete IP load is divided into two parts and at a time only one feeder of IP load is switched ON where as non-IP loads are given supply continuously.

This means that at a time only 50% of IP load is switched ON. Our system works on full load for most of the time and efficiency is increased. The contactor is used to switch on/off the IP load according to availability of power where as the domestic consumers are provided with uninterrupted supply. It requires only negligible modification of existing system. The schematic diagram of scheme is shown below-

Schematic diagram for Rural Load Management
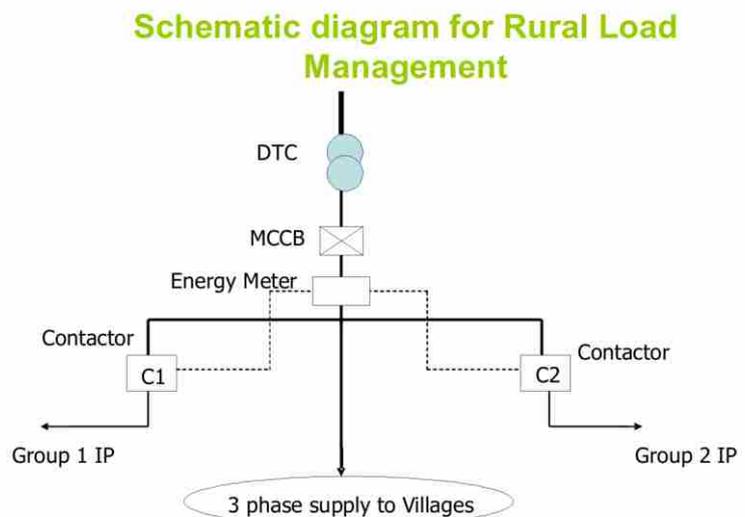
Rural load management scheme

The schematic diagram of the scheme is shown below-
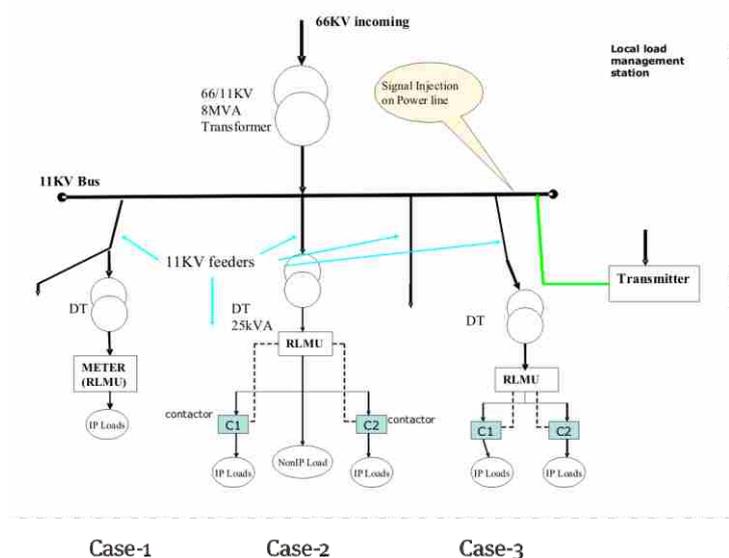
Our RLMU unit consists of

- Power line signal receiver unit which receives the power line signal for load management from substation and individual, group & load management configuration change message.

- Energy metering unit for kWh, kVArh, kVAh energy measurement. Load survey data, event recording, power on/off with date and time & Electronic data reading and transfer to computer center i.e. flexibility for AMR.

- Load management unit which has inbuilt switch for switching the loads.

- Communication Mode- The transmitter receives command from substation load management center and commands signal injection on 11KV bus for load management and configuration change to all the DT's connected to sub-station. This can be programmed for Event based, Time based, Load based and Individual/Group based Load Management as desired.

Case-1: One IP load feeder per DT

In this scheme there is only one IP load feeder which will be controlled by one RLMU unit which includes metering unit, receiver and load control switch. This will be used up to 100A.

Case-2 Two IP load feeders and one non-IP load feeder

In this scheme each Transformer is divided into different feeders for Industrial, Rural consumers and IP consumers. Two different feeders are used for IP and one for rural commercial & domestic consumer. Complete IP load is divided into two parts and at a time only one feeder of IP load is switched ON where as non-IP loads are given supply continuously as no contactor is connected in non-IP load feeder. This means that at a time only 50% of IP load is switched ON. The proposed system works on full load for most of the time and efficiency is increased.

The RLMU unit consists of main unit and contractors enclosed in a tamper proof box. The RLMU unit will individually control the two IP load feeders. The contactor is used to switch on/off the IP load according to availability of power where as the domestic consumers are provided with uninterrupted supply.

Case-3 Two IP load feeders

In this scheme the complete IP load is splitted in two parts and committed number of hour supply is given to both the IP loads separately. Since non-IP load is not present in this case provision for continuous supply is not provided.

Main advantages of RLMS-

- The scheme increases customer satisfaction by ensuring 24 hours supply to lighting and commercial loads.
- Committed number of hour supply is provided to IP loads.
- Utility revenue will increase as paying consumers will consume more electricity due to increased power availability.
- Remote communication facility will eliminate visit to site for configuration change of individual load management unit. Energy auditing & accounting can be done by using this system.
- It is possible to reduce feeder loading, losses and voltage drop almost by 50%.
- The system is future proof as it to cater additional Loads without any extra investment due to Capacity release.