

**BANGLADESH RURAL ELECTRIFICATION BOARD  
DHAKA, BANGLADESH**

**PBS INSTRUCTION 300-49/100-19**

**SUBJECT : LOAD MANAGEMENT**

Date of Approval : 30-01-1986

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**PURPOSE :**

In an electrical system demand of various consumers occur at different time, at different monsoon, As a result load is not constant throughout the day or throughout the year. In the PBVS's all lighting loads come on at the evening and decrease at late night; irrigation load come on seasonal basis, small industrial loads normally come at day time and evening hours specially at Hats and Bazzars. To decrease the load variation i.e. to run the electrical system more efficiently load management is necessary. To outline efforts which must be made in order to:

- A. To made maximum productive use of the electrical capacity of the PBS's and the BPDB's Distribution, Transmission & Generating System; and
- B. Reduce the need for load shedding to the maximum degree possible: overloading of power supply facilities and thereby improving operational efficiency that would reduce future investment and
- C. Reduce system technical losses which are partially a function of the square of the current; and

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- D. In effect, allocate scarce electrical capacity to consumers in accordance with their real need, avoid excessive and un-necessary peaks in the systems demand caused by loads which might easily run during off-peak hour.,

#### GENERAL :

It is not economically feasible to make the investments necessary to supply sufficient capacity in electric plant to serve 100% of the electric loads in Bangladesh at the same time, and for the volume of electric energy used during other times to be only a fraction of the PBS's ability to supply electric capacity. If investments were made to carry the entire load simultaneously, the tariffs necessary to support the investment would make the cost of electricity prohibitive for most uses.

In the more developed nations, the natural diversity of millions of loads tends to provide a base of electric consumption to power automatic refrigerators, water pumps, water heaters, air conditioners and /or electric heat for homes & business. These appliances cycle on & off automatically 24 hours per day 7 days a week and thus provides a base load with a very high annual load Factor( high utilization of the investment made to provide electric capacity). However in the village of rural Bangladesh the typical domestic consumers now uses electric service primarily for lighting, and mostly between the hours from 6:00 PM to 9:00 PM. Electric service to these Domestic consumers has very little value during other hours of each day. Thus the Load Factor of these consumers is very low, the utilization of investment made to serve these consumers is very low. However, the return on the investment to serve these consumer class is a social value and not a Cash Value. Whenever there is any shortage of electrical capacity, the PBS systems must be hold capacity primarily for Domestic and all commercial consumers from 6:00 PM until 10:00 PM daily.

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Domestic consumers are consuming approximately 29% -30% of total PBS consumption.

In rural hats and bazaars, commercial shops operate from 9.00 AM to 8.00 PM. Commercial consumers are using approximately from 8% to 9% of total PBS consumption and it has got upward trend. Though it very little, still if these shops are closed down by 6 PM, substantial amount of load would be reduced.

The next most important loads to the PBS's are the General Power Consumers who use large quantities of Power and Energy for operations such as Rice Mills, Jute Mills, Weaving & Spinning Mills, Tea plantations and Cold Storage Plant. These loads normally operate during the daylight hours, with a reduced demand for Power after sunset. Capacity as required must be reserved for these plants to process the products of Bangladesh which creates jobs for the people of Bangladesh

The third most important category of loads would be electric irrigation pumps which are seasonal load. These increase the productivity of the land and thus provide additional income for the farm owners and laborers, and foreign exchange when the agricultural products are exported. Irrigation is best done at night, after the domestic peak load time, and after the ground has cooled from the days sun. During the hours from 10:00 PM until 8:00 AM the electrical capacity can be largely reserved for irrigation loads, Electric capacity is available at lower cost during these hours, as it is not required for other loads. By following this arrangement there should be adequate electrical capacity for all requirements without the need for excessive load-shedding and without the need for excessive investment to build new capacity unless the new capacity can operate at a high load factor.

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## POLICY:

It has always been the implied policy for capacity to be reserved largely for Domestic, small commercial and street lighting consumers during the systems peak load hours. This policy has been implied by restrictions in the contracts for service to Irrigation and General power consumer rather than in a PBS policy Instruction, it is now necessary to place emphasis and priority to ensure that these restrictions are enforced. In addition the following policy is established:

### A. General Power Consumers:

Whose operation cannot be limited to the hours from 6:00 AM to 6:00PM, when required for the PBS to maintain an annual Load Factor of at least 55%, the following shall apply:

#### 1. Annual Demand Charge:

Pay an annual demand charge which reflects the full cost of reserving generating, transmission & distribution capacity exclusively for their use, or

#### 2. Time of Day Tariff:

At the option of the PBS, and /or as directed by BREB, have a Time of Day meter installed and pay for service under a rate schedule established to recover the cost of reserving capacity in generation, transmission and distribution exclusively for their use during the Peak Load Hours. Some PBSs have already installed TOU Meters.

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### 3. Time Switch :

During dry season, irrigation pump run by electricity should remain off during evening peak hour. The pumps may be fed through time switch. To implement this distribution line should be built with time switch.

4. For industrial plants which operate a full 3 shifts per day, paragraphs IIIA 1 & 2 above shall be applicable.

### B. Irrigation Consumers:

Whose operation cannot be limited to the hours from 10 PM until 8:00 AM each day, shall be required to:

1. Pay an annual capacity charge which reflects the full cost of reserving generation, transmission & distribution capacity exclusively for their use, except.

At the option of the PBS, and/or as directed by BREB, have a Time of Day meter installed and pay for service under a rate schedule established to recover the cost of reserving capacity in generation, transmission and distribution exclusively for their use during the Peak Load Hours.

2. For so long as the Peak demand on the PBS substation is from 8:00 AM to 6:00 PM does not equal the Peak Demand during the hours from 6:00 PM to 10PM, Irrigation Consumers may be allowed to operate at any time except from 6:00 PM to 10:00 PM without being billed for the Annual Capacity Charge in III B1 above, and

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3. Whenever the Annual Peak Load during the hours from 8:00 AM to 6:00 PM approaches the Annual Peak during the hours from 6:00 PM until 10:00 PM all irrigation consumers will be notified in writing of the additional high charge which will be imposed for operation during the 6:00PM to 10:00 PM hours, and suitable metering will be installed when deemed necessary to monitor compliance.
- C. PBS systems whose mix of Irrigation, Domestic & GP Consumers indicates a potential low annual load factor problem may, at the option of PBS, have their substation meters replaced (or modified) with a meter suitable for recording the peak demand separately for every 15 minute interval during each month. Analysis of the tapes or charts from these advance type substation meters will be done monthly by BREB personnel with advice and assistance of the consultants. Whenever the 8:00 AM to 6:00 PM Peak Load approaches the 6:00 to 10:00 PM Peak Load, the PBS will be notified that the provisions of paragraph III B3 shall immediately become effective.

#### **SOCIAL-MANAGEMENT:**

- A. Each PBS will begin motivation on the use of power & benefit of load Management by the village electrician and meter reader during house-wiring and consumption meter(KWH) recording respectively. Motivation for non using of electricity during system peak will also be made at the time of village energization programme, and at annual General Meeting.
- B. Miking for non consumption or minimum consumption of electricity during system peak hours by the categories of consumers who can afford to do so are to be done specially at the time of power crisis and at the

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time of frequent load shedding. It is also to be motivated that domestic appliance such as electric iron, heaters, water pumps, Irrigation Pumps, Mills and factories should not be operated during peak hours.

- C. Each PBS will immediately begin training of Directors, Lady Directors, Village Advisors, Village Electrician and PBS Key Staff in order to acquaint them with the elements of cost associated with the operation of any electric utility, and the need for and benefits of achieving and maintaining a high annual Load Factor.

When the above persons thoroughly understand the economies of electric utility operations, the educational process will be expanded and disseminated through the above persons to the Irrigation and General Power Consumers, in order that they might better understand and accept the need for restrictions and cost penalties required to enforce operation of the PBS so as to achieve a high Load Factor and Low costs.

- D. PBS should also organize meetings area-wise to educate and motivate consumers in respect of use of power in a planned manner and benefits thereof. This issue can also be discussed in Annual General Meeting,

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## ECONOMIC EFFECTS :

Whether the system is worked at its full capacity or not, there are certain fixed charges like interest, depreciation, taxes, insurance, part of staff salaries which are adding up continuously. On the other hand electric energy unlike gas or water cannot be stored but must be produced as and when required basis to meet every consumer's full requirement at all hours of the day.

As PBS pays bill for the consumption of power as well as for the peak demand contribution, this means PBS has to pay peak demand charge it would be better to consume power all the time nearer to its peak value. This is actually indexed by load factor. Higher load factor is required from the stand point of economy. Therefore if PBS can distribute their load more or less equal throughout the day, or in others words if PBS makes good load management, it will make the PBS economically sound.

## TECHNICAL WAYS FOR LOAD MANAGEMENT:

Sometimes it so happens that having no shortage of power PBS is unable to connect consumers due to overloading of phases or feeders. Sometime they have to make load shed on the same feeder repeatedly for overloading of the feeder. But if the feeders are uniformly loaded, they can load shed all the feeder by rotation. The same situation also occurs for sub-station overloading. In many occasions it is observed that though there is no apparent power crisis, yet there is load shedding specially in irrigation season, for overloading of the sub-station in one particular area but nearby sub-stations are not adequately loaded. The situation can be easily overcome by meticulously balancing phases, feeders and sub-stations.

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**A. Phase Balancing**

The load unbalance on a distribution feeder occurs when the single phase load is not effectively divided among the Red, Yellow & Blue phases. Sometimes it is also found that the phases balanced at a particular time of a day is unbalanced in other time. Therefore to achieve maximum benefit, phases are to be balanced for the peak hours. To balance the phases, phase loading throughout the week are to be collected. Phase-wise connected load are to be listed section-wise. Demand KW is also to be recorded for bulk load. It would be appropriate if phase balancing is done for sectionalizing point to sectionalizing point. This will provide added advantage in the event that; if a section or tap is disconnected for any reason, the source end section or the section beyond disconnected section will still remain balanced. To facilitate phase balancing transformers with the number of consumers category-wise are to be plotted on to the detail maps, for loads that are swapped between phases.

**B. Feeder Balancing**

Feeder unbalance occurs primarily due to unplanned extensions. To balance the feeders, the feeder loads and number of consumers category-wise are to be tabulated. All the lines of feeders are to be plotted on detail maps (1:15840) and key map (1:63360). Branch load or section loads are to be shown on key map. With the aid of the above information at hand and carrying out necessary studies, feeders can be balanced by cutting a section of line from one feeder and adding that section to another feeder, thereby shifting load bear one feeder to another.

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### C. Sub-station Balancing

It is often found that in the same PBS area, one sub-station is overloaded while the other sub-station is under loaded,. Sub-station balancing can be carried out in the similar way like feeder balancing. This techniques are very much inexpensive and the remarkable benefit can be derived with.

Sometimes circuit re-conductoring i.e. replacing of high impendence small capacity conductor with lower impedance large capacity conductor is thought to be appropriate for4 coping the situation. But considering cost, man-power, time requirement, reconductoring does not provide as much benefit as can be obtained by feeder balancing and sub-station balancing.

balancing of load will not only reduce system peak but only increase the use of electrical capacity by providing more connections to the system, reduce technical losses.

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