ENERGY CONSERVATION IN PUMPING SYSTEMS: A STUDY OF AGRICULTURAL AND LARGE SCALE CITY WATER SUPPLY PUMPING SYSTEMS

techno-economic and technology

Abstract

The subject matter of energy conservation as applicable to agricultural pumping systems is receiving substantial attention for the last 4-5 years. During the last 3-4 years, there have been number of studies that have: (a) identified the types of defects in pumping systems; (b) identified the reasons for these defects; (c) estimated the energy losses due to these defects; (d) identified and implemented various measures to rectify the defective pumping systems; and (e) estimated the savings and costs of various conservation measures and have thus estimated the potential savings achievable.

However, inspite of several studies, there are some important issues in the domain of energy conservation policy which need to be addressed before any comprehensive and meaningful policy can be formulated. Further, it is also observed that besides agricultural pumping systems, even the public water works and other lift irrigation pumping systems are one of the major consumers of electric power and not much by way of planned activity has been done to study energy conservation with respect to these large-scale pumping systems.

The present study attempts to address some of the important issues related not only to agricultural pumping systems but also to large scale city water supply pumping systems.

As far as agricultural pumping systems are concerned, the basic objectives covered under this section are:

(1) Whether or not --- savings in energy obtained (as a result or adoption of identical energy conservation measures in existing pumping systems) is same for pump-sets belonging to different size classes in terms of horse power?

(2) Evaluate conservation measures 'V', 'VS', 'VSD' and 'M' with respect to their net benefits.

(3) To find out, whether or not, (within a conservation measure) the net benefits are different for pumps belonging to different size classes?

(4) To find out, whether or not, (within a conservation measure) the value of net benefits is different for pumping systems belonging to different states of India?

(5) To have knowledge about awareness status motivational orientation and "willingness to pay status" of farmers, Land Development Bank Workers and Pump-set Dealers about the (a) Concept of Energy Conservation; (b) Methods that can be used to bring about energy conservation in existing systems; (c) To adopt energy conservation practices.

(6) To have knowledge about barriers (Nature and cause)faced by farmers, LDB Officer and Pump-set Dealers in adopting energy conservation practices in agricultural pumping.

(7) To find out, how the value of static suction lift affects the value of savings in energy obtained due to adoption of conservation measure V, VS, VSD or M?

Conservation measures are:

'V' = Change the existing Foot Valve with low friction foot valve.

'VS' = 'V' + Change the existing pipe on suction side with Rigid PVC pipe of suitable diameter.

'VSD' = 'VS' + Similar change as in 'VS' but on the delivery side.

'M' = Changing the entire existing systems including pump and prime-mover.

Following Conclusions have been reached with respect to Various Objectives:

(1) Pump size has bearing on energy savings and net benefits obtained as a result of adoption of conservation measure in existing pumping system. Higher the pump-size, higher are the energy savings and net benefits.

(2) Conservation measure 'M' has overall best profitability, followed by measures VSD, VS and V in descending order of profitability.

(3) Pumpset belonging to different states yield different values of net positive benefits with States of Gujarath, Punjab and Uttar Pradesh yielding net benefits for all conservation measures whereas states of Madhya Pradesh and Karnataka yielding net negative benefits for all four conservation measures.

(4) Energy savings are affected if HSS is not kept same before and after the rectification. If HSS before HSS after then savings in energy are over-estimated and if HSS before HSS after then savings in energy as a result of rectification are under-estimated. Absolute value of HSS also affects the energy savings. Higher the HSS value, higher the savings.

(5) Majority of electric pumpset owning farmers in Karnataka have no motivation for going-in for energy conservation. However, diesel engine driven pumpset owners do have felt-need for reducing energy charges.

(6) Majority of farmers have no awareness about the concept of conservation or about the methods that can be used for bringing about conservation.

(7) Majority of farmers are wary of taking loans for rectification of their existing pumpsets. Thus, faced with the choice of taking loan or using own money, they prefer using their own money rather than taking loan.

(8) Majority of farmers do not follow scientific practices while selecting, buying or installing a pump.

(9) Pumpset Dealers and Technical Officers of financial institutions have no incentive or motivation to recommend "matching" pumping equipment to farmer and hence, even if good quality pumping equipment is produced by manufacturers and demanded by farmers, the energy efficiency of the pumpset in actual operation is likely to be low, as "matching" is not likely to be ensured.

As far as large-scale pumping systems are concerned, the basic objectives covered under this section are:

(1) To study the effect of pump efficiency, pipe diameter and pipe material on energy requirements of a pumping system.

(2) To develop systematic methodology to make new installation pumping system energy efficient from the techno-economic and techno-energy view points.