Strategic and Economic Maintenance of Power Distribution System

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Abstract -- With the nonstop extension of energy conveyance framework, the quantity of dispersion types of gear has turned out to be bigger and bigger. Keeping in mind the end goal to ensure that every one of the supplies can work dependably, a lot of support errands ought to be led. In this manner, support planning of dispersion arrange is an essential substance, which has huge impact on unwavering quality and economy of circulation organize activity. Resource administration is one of the urgent parts of worry to chiefs, for example, control dissemination organizations and includes a few activities, for example, segment obtaining, upkeep, substitution, and mien. A standout amongst the most critical parts of advantage administration is preventive or remedial upkeep. The reason for upkeep is to broaden gear lifetime, or if nothing else the interim to the following disappointment whose repair might be exorbitant. Besides, it is normal that compelling upkeep arrangements can diminish the recurrence of administration intrusions and the numerous bothersome results of such interferences. Upkeep is only one of the devices for guaranteeing acceptable part and framework unwavering quality. Others incorporate expanding framework limit, fortifying repetition and utilizing more solid segments.

Indexed Terms -- Maintenance of power distribution system, Reliability, scheduling, Preventive maintenance, Maintenance optimization.

I. INTRODUCTION

In this paper we have talked about the scheduled, Strategic and Economic maintenance of power distribution system. With the continuous development of distribution network, maintenance scheduling of distribution equipment has become an important work of distribution network operation dispatching.

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In actual work, maintenance scheduling of distribution network is arranged artificially, according to the experience of power department, which is checked by operating crew to make sure the stability of power distribution system. However, this arrangement method only focuses on the security of distribution system, while neglects the economic efficiency. The concept of cost efficient maintenance achieved through reliability analysis, for power system networks, was presented already in the 1960's, when reliability models solved with computers were developed. Methods to support cost-effective maintenance policies have been developed for electric power systems presenting in this paper as Reliability Centered Maintenance. For the implementation of the RCM strategy, the electricity distribution companies try to optimally utilize the existing financial resources in order to reduce the maintenance costs and improve the reliability of the network. the optimum preventive maintenance budget is calculated by obtaining the cost functions of the critical elements and optimizing the overall cost function.

II. OBJECTIVE

The primary goal of this paper is to expand gear lifetime, or if nothing else the interim to the next failure whose repair may be costly. Furthermore, it is expected the effective upkeep arrangements can lessen the recurrence of administration intrusions and the numerous bothersome outcomes of such interferences. Upkeep is only one of the instruments for guaranteeing agreeable segment and framework dependability. Others incorporate expanding framework limit, fortifying repetition and utilizing more dependable parts. At once, be that as it may, when these methodologies are vigorously compelled, electric utilities are compelled to get the most out of the gadgets they effectively possess through more effective operating policies, including improved maintenance programs. In fact, support is turning into a critical part of what is frequently called resource administration.

III. OVERVIEW OF MAINTENANCE APPROCHES

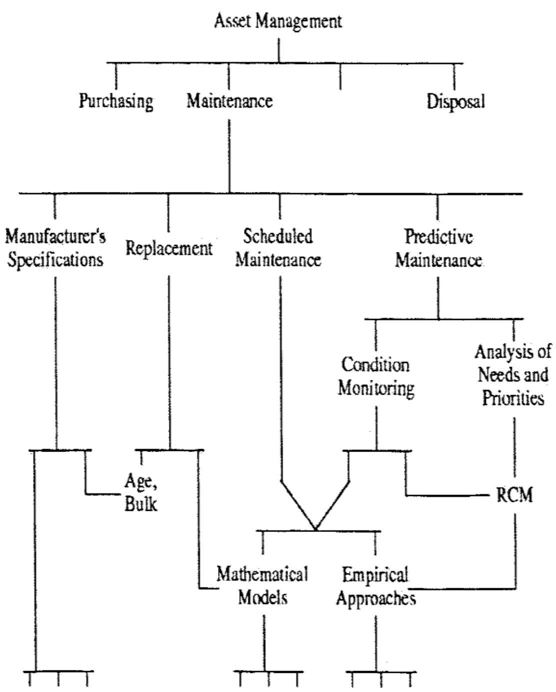
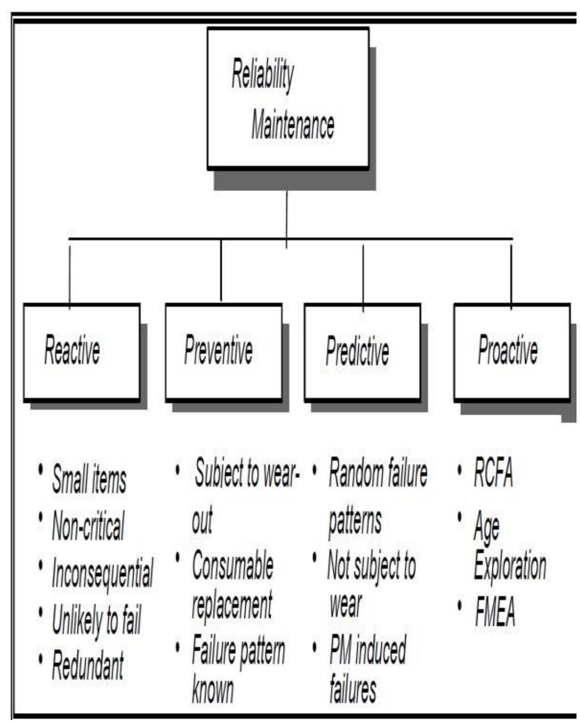


Fig. 1: - Overview of maintenance approaches.

Support programs go from the extremely easy to the very modern. Maybe the least complex arrangement is to receive an inflexible upkeep plan where pre-characterized exercises are completed at settled time interims. At whatever point the segment falls flat, it is repaired or supplanted. Both repair and substitution are thought to be substantially more expensive than a solitary support work. We select support on the premise on lengthy timespan articulations. The RCM approach alluded to in the Introduction is intensely in light of consistent evaluations of hardware condition The RCM approach alluded to in the Introduction is vigorously in view of general appraisals of gear condition. The approach we specified in the paper which is more productive than RCM is Preventive Maintenance. it depends on broad errand examination instead of framework investigation, with a capacity of definitely lessening the required number of upkeep assignments in a plant. Projects, for example, RCM and PREMO have been exceptionally helpful in guaranteeing the financial task of energy stations. In any case, they won't give the full advantages and adaptability of projects in view of scientific models.

IV. REVIEW OF MAINTENACE STRATEGIES



a) Reliability centered maintenance:

Unwavering quality focused upkeep (RCM) is a corporate-level support technique that is executed to enhance the support program of an organization or office. The last aftereffect of a RCM program is the usage of a particular upkeep methodology on every one of the benefits of the office.

b) Preventive Maintenance:

Preventive maintenance (or safeguard support) is upkeep that is frequently performed on a bit of hardware to decrease its probability coming up short. Preventive support is performed while the hardware is as yet working, with the goal that it doesn't separate out of the blue

c) Reactive Maintenance:
A Reactive Maintenance design is one that basically works on the hurried to-disappointment system. This is an extremely hands-off way to deal with machine upkeep and keeping in mind that it keeps routine support costs low, such a program can be exorbitant over the long haul. The repair and substitution of hardware likewise turns into an issue, and at times, move down gear is important to keep the plant running. At last, this is a wasteful utilization of staff as it implies that laborers need to stop what they're doing to take care of the issue.

d) Predictive Maintenance:
Prescient Maintenance includes routinely assessing machines with different advancements including infrared and ultrasound innovation. NASA revealed that this support mode attempts to wipe out unforeseen breakdowns and booked upkeep down time that would somehow or another be utilized to investigate a machine piece by piece.

e) Proactive Maintenance:
Proactive Maintenance contrasts from the other three upkeep modes since it tends to considerably more fundamental components of a support program, as opposed to analyzing the machine itself. This approach is considerably more constant and hopes to control the issues that can prompt machine wear and tear instead of the crumbling itself.

V. NEED OF STRATEGY

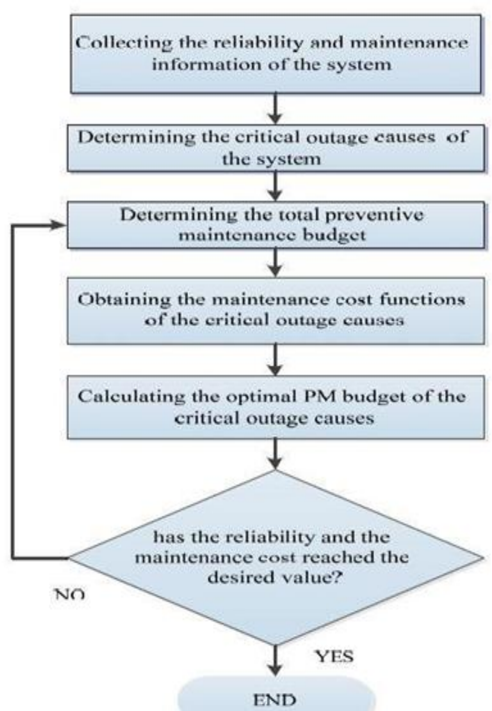
Without a well-thought-out maintenance strategy, you may see patterns like these in your operation:

- Equipment failures result in lost production and expensive repairs.
- The same equipment failures happen again and again.
- Maintenance schedules are the same for all similar equipment, regardless of application or economic impact.
- No maintenance standards or best practices exist.
- A good maintenance strategy can address all of these symptoms, improving process operations while reducing costs. In fact, the maintenance strategy can be as important to your business results as your quality program.

VI. PROPOSED METHODS FOR MAINTENANCE

For appropriate support spending arranging, to start with, it is important to devise a reasonable upkeep methodology for the blackout causes. A suitable support technique is chosen in light of the part of various components in arrange dependability and the costs forced on the framework. it is important to set up the correct connection between the PM spending plan and system unwavering quality and to decide the cost of keeping up organize parts, which for the most part incorporates the cost of repairs, cost of vitality not supply, cost of HR and the cost of preventive support. the PM spending arranging process contains three noteworthy advances:

- Prioritizing the outage causes and choosing the critical outage causes
- Approximating the maintenance price functions of the critical outage causes
- Calculating the optimum budget of the critical outage causes.



picking a proper preventive upkeep technique for touchy and powerful hardware in the dissemination organize instead of spending enormous aggregates of cash on the support of all system components, paying little respect to their part and significance in the framework, will prompt more temperate and also ideal choices. Those blackout causes that impact organize dependability and the upkeep cost forced on the system are known as the "basic blackout causes". factors, for example, the substitution cost of hardware, number of gear, and the elements of components in accomplishing system dependability must be considered in the determination of the basic blackout causes.

VII. VALUE OF PREVENTIVE MAINTENANCE

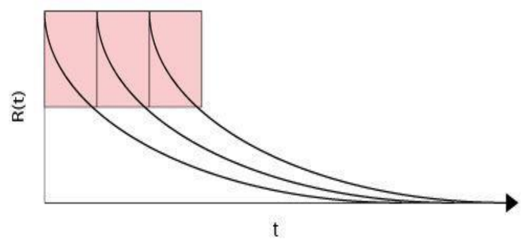
This rationale directs that it would cost more for routinely planned downtime and upkeep than it would typically cost to work hardware until the point when repair is totally vital. This might be valid for a few parts; notwithstanding, one should look at the expenses as well as the long haul advantages and investment funds related with preventive upkeep. Without preventive support, for instance, costs for lost generation time from unscheduled hardware breakdown will be acquired. Likewise, preventive upkeep will bring about funds because of an expansion of powerful framework benefit life Long-term benefits of preventive maintenance include:

- Improved system reliability.
- Decreased cost of replacement.
- Decreased system downtime.
- Better spares inventory management.

Long haul impacts and cost correlations more often than not support preventive upkeep over performing support activities just when the framework comes up short.

VIII. THE DECEPTION OF "CONSTANT RATE FAILURE AND "PREVENTIVE MAINTENANCE"

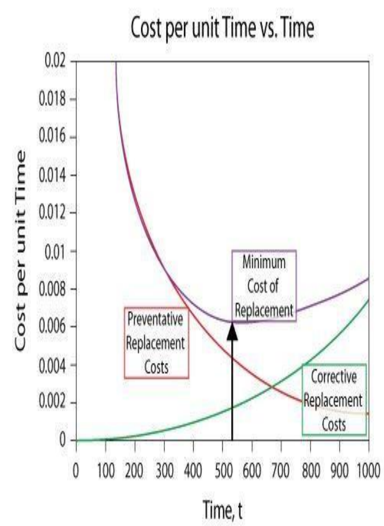
It is vital to make it unequivocally certain that if a part has a consistent disappointment rate (i.e., characterized by an exponential dispersion), at that point preventive support of the segment will have no impact on the segment's disappointment events. To represent this, consider a segment with a MTTF =100 hours and with preventive substitution like clockwork. The unwavering quality versus time chart for this case is delineated in the accompanying figure, where the segment is supplanted at regular intervals, accordingly resetting the segment's unwavering quality to one. At first look, it might appear that the preventive upkeep activity is really keeping up the segment at a higher dependability.



However, consider the following cases for a single component:

The component's reliability from 0 to 60 hours:

- With preventive support, the segment was



supplanted with another one at 50 hours so the general dependability depends on the unwavering quality of the new segment for 10 hours, R(t=0) = 95.48%, times the unwavering quality of the past segment, R(t=50) = 65.65% The outcome is R(t=60) = 54.88%

- Without preventive maintenance, the reliability would be the reliability of the same component operating to 60 hours, or R(t=60) = 54.88%

IX. PREVENTIVE REPLACEMENT TIME

In the event that the segment has an expanding disappointment rate, at that point a painstakingly outlined preventive support program is valuable to framework accessibility. Something else, the expenses of preventive upkeep may really exceed the advantages. The goal of a decent preventive upkeep program is to either limit the general expenses (or downtime, and so forth.) or meet an unwavering quality goal. With a specific end goal to accomplish this, a suitable interim (time) for planned upkeep must be resolved. One approach to do that is to utilize the ideal age substitution display.

(CONDITIONS)(1) The failure rate of the component is increasing with time.

(2) The cost for planned replacements is significantly less than the cost for unplanned replacements.

The Cost Per Unit Time vs. Time plot and it can be seen that the corrective replacement costs increase as the replacement interval increases. In other words, the less often you perform a PM action, the higher your corrective costs will be. Obviously, as we let a component operate for longer times, its failure rate increases to a point that it is more likely to fail, thus requiring more corrective actions. The opposite is true for the preventive replacement costs. The longer you wait to perform a PM, the less the costs; if you do PM too often, the costs increase. If we combine both costs, we can see that there is an optimum point that minimizes the costs. In other words, one must strike a balance between the risk (costs) associated with a failure while maximizing the time between PM actions.

X. AGE REPLACEMENT POLICY OF EQUIPMENT

To determine the optimum time for such a preventive maintenance action (replacement), we need to mathematically formulate a model that describes the associated costs and risks.

The cost per unit time is defined as:

$$\text{CPUT}(t) : \frac{\text{TOTAL EXPECTED REPLACEMENT COST PER CYCLE}}{\text{EXPECTED CYCLE LENGTH}}$$

(EQUATIONS): The equations used to calculate the costs of planned and unplanned tasks for each item based on its associated URD are as follows:

- For the cost of planned tasks, here denoted as PM cost:
  PM COST = (PM DOWN TIME RATE + BLOCK LEVEL DOWN TIME RATE)* (MTTPM +POOL DELAY + CREW DELAY +CREW LABOUR COST*MTTPM +COST PER PM+ COST PER POOL + COST PER CREW)

Only PM tasks based on item age or system age (fixed or dynamic intervals) are considered. If there is more than one PM task based on item age, only the first one is considered.

XI. CONCLUSION

The implementation of preventive maintenance programs for an electricity distribution system: the improvement of network reliability and the reduction of maintenance costs. In this paper, a method has been presented for selecting the proper strategy for the maintenance of network components and for planning an appropriate preventive maintenance budget, with the goal of improving network reliability and reducing the maintenance cost. The establishment of an appropriate relationship between preventive maintenance, network reliability and maintenance cost in this method makes it possible to optimally spend the PM budget for the improvement of network reliability and the reduction of maintenance cost. Since the implementation of the RCM strategy based on the cost/benefit studies of different maintenance scenarios for network components runs into many in electricity distribution networks with numerous power outage causes, by applying this method, a favorable RCM strategy can be implemented.

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