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Reactive Power Management in Power system Operation and Control

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ABSTRACT

While electrical energy consumption is increasing year after and power demand also requires to be added year after year to the National and regional grids. In deregulated power systems, isolated system operators are responsible for providing the limits of active power and bus voltages on the transmission lines. Reactive power management has very significant role for isolated system operators because of not only operating the power system safely but also the bus voltages and transmission lines loadings must be maintained with in stipulated limits. Apart from this, but also minimizing costs of the system. The aim is to emphasize significance of reactive power in the electricity market. Reactive power pricing and some boundaries are also to be explained to the government of Telangana and government of Andhrapradesh and the associated load dispatch centers. Usually the reactive power generation will be doubled every year and the compensation methods and equipments must be added to the power systems operation every year so that the reactive power generated should be consumed quickly to safe guard power system.

I. INTRODUCTION

Electrical power demand is rapidly increasing year by year and its associated generation also to be increased year after year by construction of Thermal, Hydro, Nuclear and Gas power stations to be added to the National Grids apart from synchronizing with load dispatch centers.

While electrical energy necessity is increasing all over the world, to parallel to this situation, the necessity of uninterrupted energy supply to the consumers. Maintenance of bus voltage such as 765KV, 400KV, 220KV etc plays a very important role if not system collapse will occur in Sweden, Newyork city, New Delhi and Eastern States and also the Denmark in 2003.

In simple words (1) KVAR (Reactive power) plays very vital role for improving the system voltages at transmission lines within the specified limits

(2) The magnitude of reactive power (KVAR), its effects on the system stability.

The compensation of reactive power generated and how to compensate it i.e. consumption of KVAR may be one by synchronous generators, synchronous condensers, fixed and switched capacitors, and Static VAR compensation etc.Hence, the reactive power should be produced and kept near the load ends.

The reactive power plays vital role in power system operation and control. One can remember it's how was played in operation in North-Eastern Grid with its regional load dispatch center (LDC) at Gauhathi, New Delhi (North) etc. the grid has been collapsed for want of reactive power in the system and was starved of VAR's and

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there by its bus voltages such as 765KV Network, 400KV Network, 132 KV Network and 66 KV Network and so on and because of voltage drops or in proper maintenance of VAR's in PSOC.

The North-Eastern Grid failed due to cascade tripping of transmission network and generating power stations. The state Indian natural capital i.e.NewDelhi,UP,Uttarakand,Assam and entire north eastern states has been plunged into the darkness for 36 to 40 hours and you can self imagine the situation of people living their in the states.

Such is the paramount importance of Reactive power management in PSOC.

I am, the author explains what is reactive power and its importance in PSOC.

Consider the VOLTAGE TRIANGLE in simple steps.

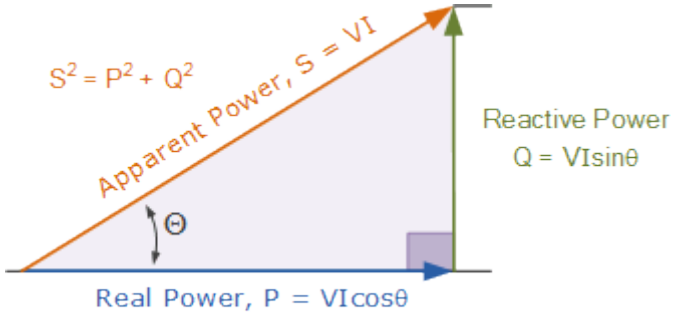

Figure no.1

The angle subtended as between KW and KVAR is the power factor angle as we know all i.e. Ɵ& COSƟ is its power factor.

If you want to know

Active power KW = KVA COSƟ

Reactive power KVAR=KVA SINƟ

The Apparent power KVA = KVA itself a diagonal in triangle as shown figure no.1

$$KVA = \sqrt{(KW)2 + (KVAR)2}$$

Now we say that

$$KVA(S) = \sqrt{(P)2 + (Q)2}$$

As seen from the voltage triangle shown in fig no .1 The voltage control solely depends upon the KV Reactive management and also the effect of poor maintenance of power factor leads to the voltage collapse there by Grid Failure such is the paramount importance of Reactive power management in PSOC.

II. Economical and Technical Issues of Reactive Power

$$TC = \sum_g C_g . \Delta Q_g + \sum_c C_c . \Delta Q_c + \sum_t C_t . \Delta Tap_t + C_L \Delta P_L \quad (1)$$

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Where C defines cost, Δ defines change, Q_g defines the reactive power output of the generators, ,TAPt defines the ratio of the tap-changing transformers and P_L defines the lost active power on transmission lines.

Cost of generators $\sum_g C_g . \Delta Q_g$,
Cost of compensators $\sum_c C_c . \Delta Q_c$,
Cost of transformers $\sum_t C_t . \Delta Tap_t$,
Cost of losses $C_L \Delta P_L$

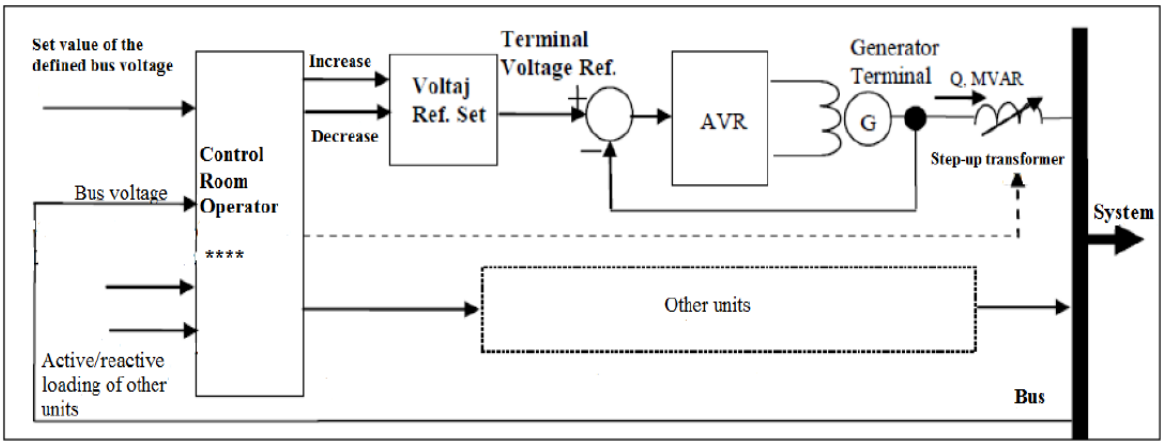

Figure no.2 Control via an Operator

III. CONCLUSION

The significance of reactive power management has been increase due to the demand is increasing in the electric power and followed by energy consumption thereby we can assess the demand in energy terms in million units/ day requirement of Andhrapradesh and Telangana Governments.

The paper has submitted reactive power generation studying AP Grid and present AP&TS grids and their equipments in various parts of the individual states.

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