



### Introduction

Achievement of the targeted GDP growth of 9% of the Indian economy requires massive growth in infrastructure facilities, especially Power. India, which inherited a little more than 1,300 MW at the time of its independence in 1947, today has an installed generating capacity of around 1,51,000 MW.

Power transmission refers to bulk transfer of power over a long distance at high voltage. In India, transmission infrastructure has increased from 3,708 ckm in 1950 to more than 3, 00,000 ckm up till now. This is made up of a combination of lines carrying different voltages such as 132 kV, 220 kV, 400 kV and more recently 765 kV.

In the 11th five year plan, power generation capacity addition of about 78,000 MW is planned and in 12th five year plan capacity addition of about 100,000 MW is planned. With the launch of Ultra Mega Power Projects, the signing of the nuclear deal and the large Hydro-Power potential that can be exploited in the North-Eastern region of India, no significant slippages are envisaged.

As per normal industry estimates, for every rupee spent on generation, another rupee should be spent on creating associated transmission, sub-transmission and distribution systems. To meet the 11th and 12th plan proposed capacity additions for generation, it is expected that huge investments will be made by various power utilities (central, state and private) in Transmission and Distribution ("T&D") sector. Now many State transmission utilities are increasing their

T&D line network capacity and associated High Voltage ("HV") and Extra-High Voltage ("EHV") Sub-Stations.

Insulator is a critical component of the T&D network. Successful operation of T&D network depends significantly on the performance of Line Insulation.

### Types of Insulators

Modern civilization floats on a sea of electricity, but the electricity would be useless without insulators. Electric currents seek the easiest path to a conductor or ground. For safety purposes and to keep the currents from getting mixed up, overhead power lines use insulators. Insulators keep electricity a powerful thing, in its place and prevent unintended current flow.

Insulators used in Transmission and Distribution are normally classified into:

#### Transmission Line Insulators

- Pin, Post, Shackle, Guy & Disc Insulators are used in Sub-Transmission and Transmission Systems
- Pin, Post, Disc of 45 kn/70 kn are used in distribution system up to 33 kV.
- Disc insulators of higher rating 90 kN, 120 kN, 160 kN are all used in EHV Lines up to 420 kV transmission system
- Disc Insulators of 210kn, 320kn are used in UHV Lines i.e. 765 kV and above.



Use of Insulators in typical Distribution Line

## Substation Insulators

Can be classified as - Hollow insulators and Solid core insulators

### Hollow Tubular Insulators

- Hollow insulators are used in wide range of electrical apparatus like Instrument transformers, lightning arresters, circuit breaker etc.
- Hollow insulators are used in all apparatus across the voltage spectrum.



Typical sub-station depicting use of hollow insulators for equipments

### Solid Core Insulators

- Solid Core insulators are used in sub-stations for bus support as well as Isolator support.



Solid Core Insulators in 400kv switchyard

## Profile of Insulator Manufacturers

In India ceramic insulators are used predominantly for distribution, HV, EHV and UHV applications. The Indian insulator industry is a highly mature industry with a no. of players in large, medium and small domain.



Typical 400 kV sub-station where Disc, Tubular and Solidcore Insulators are used

The Industry has very rich experience in supplying ceramic insulators for all voltage levels and for all applications. The Indian ceramic insulators are in the field for number of years, working well and have demonstrated high degree of reliability.

The small and medium scale industries that have come up in the last few years, manufacture Insulators predominantly for Distribution segment. The ceramic insulator manufacturers provide employment and job opportunities to large numbers of semi-skilled (apart from skilled) personnel, which directly support the employment opportunities for rural population.

### Polymer/Composite Insulators

In the last five years manufacture of polymer insulators has also commenced in India. Apart from a few bigger manufacturers, number of small scale manufacturers have also commenced manufacture of polymer insulators. Polymer insulators are used in distribution segment and for specific applications in HV.

## Exports

The Indian insulator industry has made India a global brand in insulators for all applications and today, Indian insulators are present in around 75 countries across the globe. The industry is a significant net foreign exchange earner for the country. The ceramic

insulators manufactured by Indian manufacturers enjoy global acceptance due to proven reliability and consistency in performance.

Export of insulators generally to EHV customers requires investment in state-of-the-art infrastructure, advanced facilities for raw material evaluation, use of proper equipments for manufacture and end product testing, and employment of competent technical manpower.

### Capacity Adequacy

The Indian insulator industry have kept pace in adding capacity to the expected increase in requirement of insulators for the ambitious power sector programme of Government of India and also to increase its global market share.

The industry is totally committed to the plans of the Government of India and has demonstrated this by significant capacity additions every year and by developing products that are required for power sector development programmes.

The proven manufacturing capacity of ceramic insulator plants for EHV & UHV stands at 141,000 CMT/year. In addition, the capacity is 50,000 CMT/Year for Distribution segment. The estimated insulator requirement to meet the 11th five year plan is 89,653 CMT / year and that of 12th five year plan is 1,03,729 CMT/year. The actual requirement for 11th five year plan is likely to come down due to the slow down witnessed presently.

The requirement of Distribution Insulators for schemes like Rajiv Gandhi Gramin Vidyutikaran Yojana (RGGVY), Restructured Accelerated power development and reform program (R-APDRP) is 36,898 CMT/year.

Apart from ceramic insulators, polymer insulators also cater to T&D requirements.

### Industry Preparedness

It can be seen that the total capacity for Insulators presently available is very much more than what are required for the 11th as well as 12th five year plans. The industry therefore is suffering as of today from overcapacity and looks forward to speedier implementation of the announced programmes.

The industry has invested large amount of money for expanding capacities and infusion of latest technology. It is well prepared to meet the requirement of Indian power sector needs. The industry is also ready for further timely augmentation in the event the requirement goes up further too.

## Technology Advancements

### Transmission Line Insulators



#### 765KV AC Application

More than 4,00,000 Nos. of 210KN Disc Insulators have been supplied by IEEMA members and they are working satisfactorily.

#### 600KV HVDC Application

160KN & 210KN Insulators – IEEMA members have already developed and supplied.

#### 800KV HVDC Application

320KN / 420KN – Insulators are under development.

#### 1200KV AC Application

320KN – Developed, 420KN – Developed

Polymer Insulator manufacturer have also now taken development of 320KN.

### Sub-station Equipments



#### 765KV / 800KV AC Application

Bus Post Insulators already supplied by one of the IEEMA members.

Insulator industry is ready to supply Hollow Insulators on regular basis for 765KV AC application.

#### 1200KV AC Application

Station post Insulator design under development. Hollow Insulator for CVT already developed.

Insulator industry has kept pace with advancement and technology.

### Insulator Material

**Ceramic Insulators** - are manufactured in India.

**Glass Insulators** - no manufacturing plant in India.

**Polymer Insulators** - are now established in India.

**Ceramic coated with Silicon** - These are gaining prominence in India. Coating can be done on existing Insulators as well as new Insulators. Coating imparts hydrophobicity recovery to porcelain / glass insulators resulting in improved pollution performance. It

reduces periodicity of maintenance at site. It leverages mechanical integrity of ceramics and improves surface performance.

In the Indian grid, at some locations, pollution is on the increase. In some of these locations excessive high Relative Humidity, high level of particulate matter seems to aggravate the problem causing flashovers. In most such locations, Insulators chosen were for normal pollution levels. With passage of time, due to the advent of polluting type of industries coming up, presence of slaughter houses etc adds to the difficulty of maintaining the lines. The industry feels that for such high polluted areas, pollution mapping should be done on regular basis and insulators with proper creepage profile should be chosen.

### Issues of Insulator Industry

#### Ceramic Insulators

- Huge surplus capacity for both Line and Sub-station porcelains exists due to recent capacity addition based on macro indicators and government announcements.
- The industry is vulnerable to huge increases in the cost of inputs since its main costs are commodities, especially fuel.
- The industry is also witnessing dumping of Insulators by certain Chinese manufacturers at unworkable prices.
- Wood which is used predominantly for packing of Insulators is becoming scarce. Development and acceptance of alternate material in the medium term perspective is important.
- When the industry already has capacity which is unutilized, trends of diluting the qualifying requirements are also observed in the zeal to add more vendors. For a product like Insulators where proven long term performance and reliability are important criteria, caution is to be exercised in choosing reliable vendors.

#### Polymer Insulators

- Recently, in particular after the onset of global recession, a number of Chinese suppliers have started selling in India Insulators at much cheaper price than the international price.
- It is reliably understood that some Chinese manufacturers are selling at cheaper prices, which are reportedly even lower than the prices they sell such products in China. The price difference between the cheaper imports from China and the

local price is to the extent of 50%. Such cheaper imports hurt Indian Polymer Composite Insulator Industry which is in its infancy at present.

### Conclusion

- The Insulator industry has capacity to meet the total requirements of ambitious plans of Ministry of Power for power developments in India for 11th as well as 12th Five year plans.
- The industry with its proven capability of supplying products upto UHV System is geared to meet requirements of the demand in coming years.
- With global acceptance for Indian insulators, it is a given that the requisite required infrastructure and reliability are well established.
- The Industry feels that any new technology / material / vendor, be it domestic or international, are to be considered only after detailed and careful investigation into their capability and proven field performance of their product. For e.g. Insulators for EHV and UHV applications, which are to be manufactured in India so as to give 24x7 service to customers.
- This is especially true for Products used in EHV and UHV systems which have to be very reliable like century old ceramic Insulators.
- In order to reduce the source of contamination, near EHV & UHV transmission lines, which accelerates in particulate matter it is suggested that stringent statutory regulations be brought in and the area near the transmission lines be classified as restricted area prohibiting the presence of any slaughter houses, any other polluting industry in the vicinity and enforcing strict pollution control guidelines for all other industries near the vicinity of transmission lines.
- The industry has invested huge capital so as to meet the demand of the power sector growth. They also provide job opportunities for large number of semi-skilled personnel. Apart from this they are foreign exchange earners for India.



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