Impact of transmission line towers on environment

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Impact des pylônes à haute tension sur l'environnement

Umweltbeeinträchtingung durch Hochspannungsmaste

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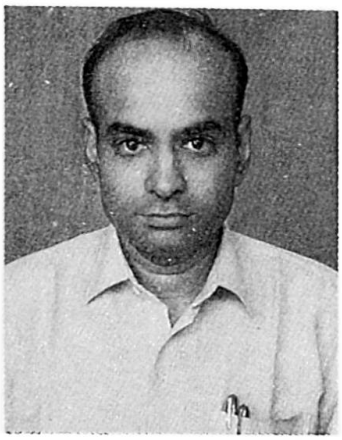

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SUMMARY
The paper investigates the land use and environmental issues which are becoming guiding criteria for the development of transmission lines and towers. The possibility of multicircuiting and higher transmission voltages for minimising ground space and overall dimensional requirements are discussed. Development of new shapes, forms, and issues which are important for safety have also been included.

RÉSUMÉ
L'article examine les coutumes du pays et les sujets relatifs à l'environnement en tant que critères directeurs pour le développement des lignes à haute tension et de leurs pylônes. Il envisage les possibilités de regrouper ensemble plusieurs lignes et d'augmenter les tensions transportées, en vue de réduire les tracés et leurs dimensions hors tout, de mettre au point de nouvelles formes et sections de pylônes. Les aspects de la sécurité sont également traités.

ZUSAMMENFASSUNG
Der Aufsatz untersucht den Landverbrauch und Umweltgesichtspunkte als Leitkriterien bei der Entwicklung von Hochspannungsfreileitungen und deren Masten. Es geht um Möglichkeiten der Zusammenlegung von Leitungen und Erhöhung der Übertragungsspannung zwecks Reduktion der Abmessungen, um neue Mastformen und Sicherheitsaspekte.

1. INTRODUCTION

In transmission line networks associated with power projects, the land use consideration becomes vital because of escalating land cost. In addition there is the question of impact on environment - this falls into two categories - (i) aesthetics and (ii) safty (effect on health).

2. RIGHT OF WAY

Way leaves are becoming costly and sometimes difficult to obtain. Both in densly populated countries and in industrial nations the shortage of land and enviornmental resources are being keenly felt.

Studies made in France [1,2] show that for the first 400 KV single circuit line using a 2 x 411 sq. mm conductor (year 1960), the transmisssion capacity was 1000 MW, that for double-circuit line using 3 x 570 sq.mm conductor constructed since 1980, the transmission capacity is 4000 MW for obout the same distance covered. Considering the tower confugaration employed for the two cases, it is seen that the transmission capacity has increased from 1.5 MW per Sq.metres covered area to 4 MW per Sq.meters. This is a distict better use of scarcely available space (land use) as shown in Fig. 1.

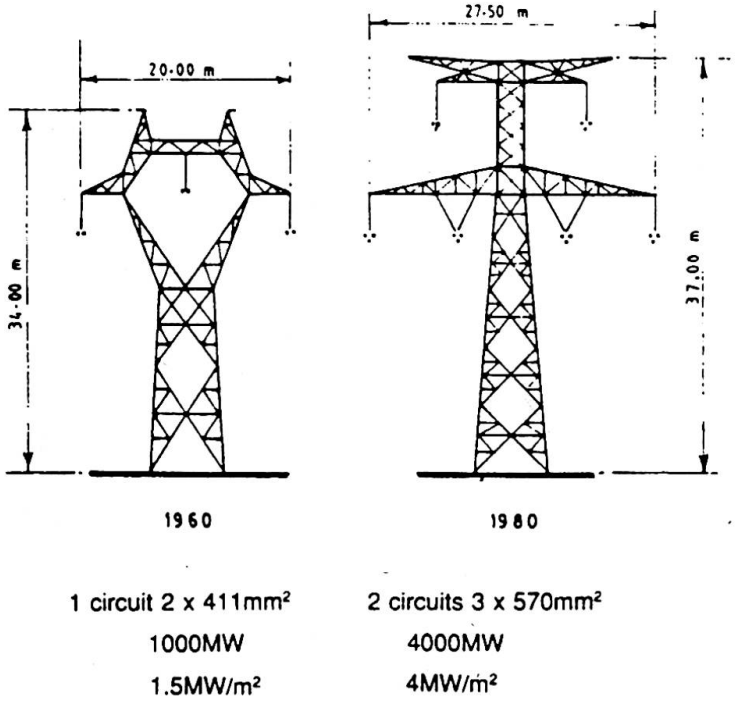

Fig.1 Power carrying capacity of lines

Fig. 2 compares the right of way for a 1100 KV and 500KV transmission. The advantage of UHV transmission with respect to land use is more than three fold. Fig. 3 compares land use for 800 KV with that required for 400 KV for the approximately same transmission capacity.

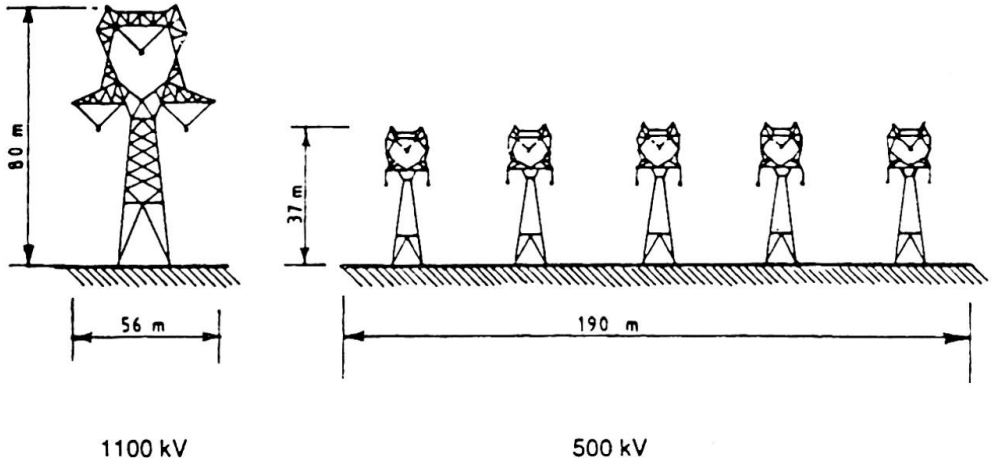

Fig.2 Right of way comparision between 1100 KV and 500 KV

For carrying power at UHV very low profile lines have been conceived. These designs have high degree of flexibility so that lines can accomodate characterstics of land (Fig. 4).

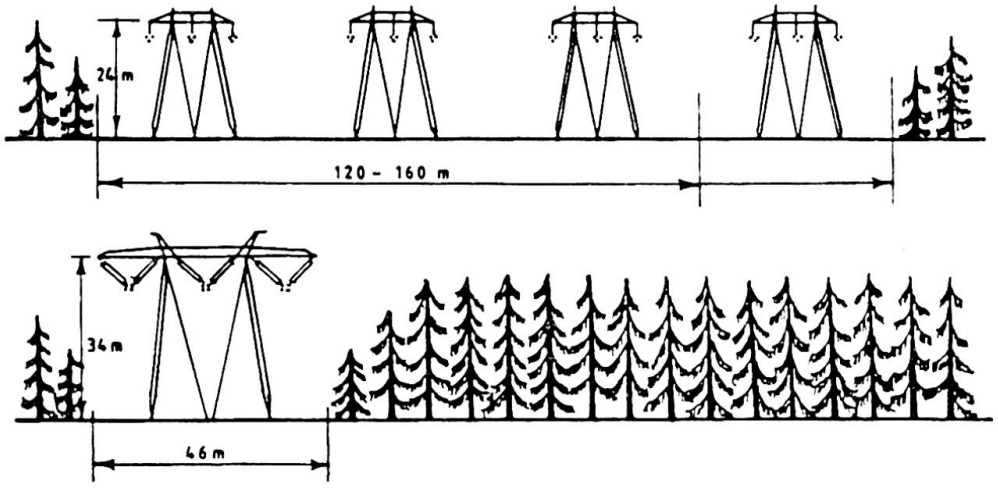

Fig.3 Destruction of forests caused by lower voltage transmission

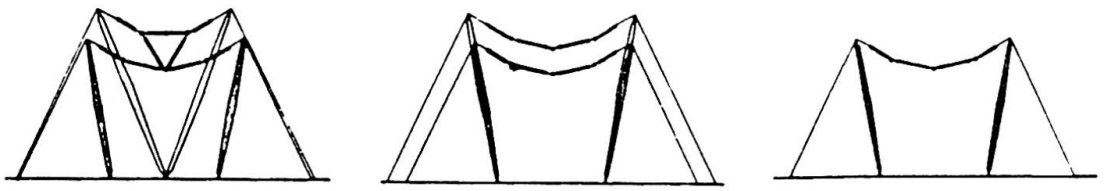

Fig.4 Non-conventional UHV Line

An unconventional 1065 KV tower has dimensions comparable with that of existing 765 KV lines and also fits better with the environment.(Fig. 5)

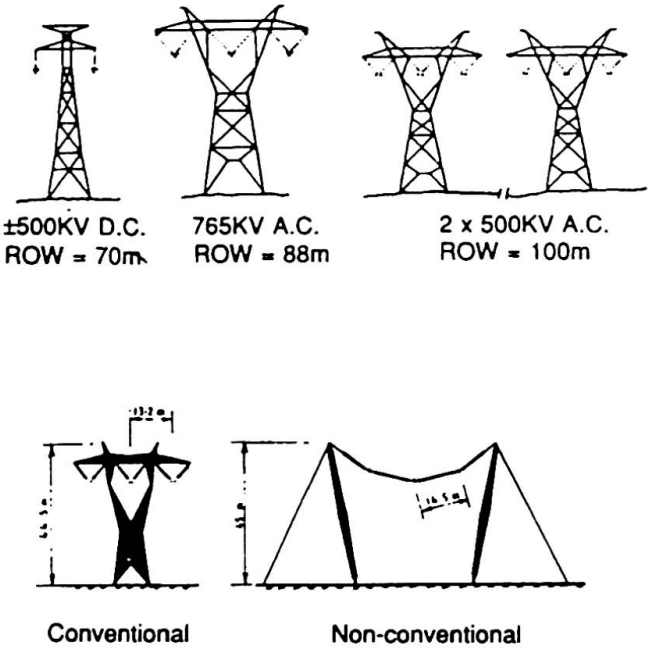

Fig.5 Better aesthetics of non-conventional tower

3. AESTHETICS

Ground occupancy and overhead clearence are basic considerations for right of way whereas the appearance and how the tower merges with the surrounding landscape to achieve an overall harmony becomes important for aesthetic aspect..

Aesthetic considerations have forced the development of towers designed specifically for appearance over and above thier structure and functional purposes.

Novel computer applications have been advocated for route planning. A digital terrain modelis used from which computer produced visibility contours can be mapped. Subsequently this can be used for tailoring the shape of the tower.

The above method enables to select the direction of a line in a particular terrrain under consideration and fix up the line route in such a manner that architectural features, picturesque scenes and touristic interests are retained and that environment as a whole is subjected to least possible damage. Electricity de France has now established a "Silene" workshop at which models of landscapes where transmission lines is to be located is developed.

4. SAFETY

The principal factors of environmental interference related to UHV lines are

* Corona effect - audible noice,radio interferece, generations of ozone and nitrous oxide.
* Effect of fields - Interference due to electronic and magnetic fields on human lives.

The importance of the above are briefly discussed [5,6] below.

4.1 Biological effects

Occasional exposure to the electric field generated by transmission lines do not present a hazard to human life. It is possible (but not established) continous long term repeated exposure to electric field exceeding 2.5 kV/m might be harmful. Allowing for a safty factor an interim 1.6 kV/m edge of right of way should be recommended.

4.2 Audible noice

Potential effects of noise on human ears include temporary or permanant of ear's functioning, nevous tension, fatigue, sleep interference and attendant annoyance. The number of time the sound level goes beyond 52 db(A) should be kept low.

4.3 Electric shock

Grounding of fixed metal objects on right of way will ensure minimization of risk against electric shock.

4.4 Effect on pacemaker

The fields produced may interfere with cardiac pacemaker. It is important to check the operation of cardiac pacemake to verify this.

5. CONCLUSION

The land use and environmental considerations will become more and more the guiding criteria for develoment of transmission lines. Therefore the long-term perspective of system network should be evolved and improved from time to time. This will enable multicircuiting and higher transmission voltages to be adopted consistant with system reliability. The object of reducing the ground space and overall dimensions of structure can thus be achieved. In the end aesthetic and safty aspects of these lines which are not considered thus for are likely to become deciding issues in future.

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