Prospects for HVDC links in the electricity network of Vietnam

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ABSTRACT

Opportunities and challenges for the power network of Vietnam are presented with as objective to identify cases where cable links could be applied. As a rapidly developing country and with the changes in the primary source of energy, the electrical grid of Vietnam will deeply evolve and strengthen in the next decades with a demand in energy estimated to twice as today in a twelve year time. The development of renewable energy sources, the upgrade of HVAC to HVDC lines, the introducing of MVDC links once mature and accessible technology could be the successive steps in the future evolutions.

KEYWORDS

Energy grid, HVDC, energy sources.

INTRODUCTION

HVDC technologies will certainly represent a growing part of energy transmission systems owing to the new sources of energy introduced, especially renewable energy, and to the need for strengthening energy networks with the de-carbonation of the energy. To cite an example of such an evolution, in prospects proposed by Cigre working group C1.35 on global energy network, 99% of the lines would be HVDC, either submarine between continents or overhead on the land [1]. China is also developing extra high voltage corridors to transmit energy from the east of the country where most of the hydropower is concentrated to the consumption area of megapoles of the west of the country with some innovative challenges of hybrid LCC and VSC technologies in the same 'branched' network [2].

This massive introduction of DC links is a reality today for example in Europe with the France-Spain 320kV line made with extruded insulation cables, the construction of the Savoy-Piemont line, the building of offshore windfarms connected to the shore with DC link, and the decision to build HVDC corridors through Germany fully made with buried cables. All these examples are with HVDC cables. The switch from HVAC to HVDC systems has this great advantage that there is virtually no limit to transmission length, even for cable technology owing to the fact that the compensation of the capacitive current is no longer a necessity. Besides, for off-shore cables, at equivalent capacity, DC cables technology constitutes a great simplification in manufacture, reducing the cable from a 3-core for HVAC to a single core, and also reducing the weight and facilitating transport and laying of the cables [3].

Today, it seems that the main limitation to the development of cable links is the cost itself when compared to overhead solutions. So, in developing countries, overhead lines will certainly be preferred for a while but when technologies will be mature no doubt that cable technologies will spread.

However, still with DC cables, some issues remain. The progressive switch from oil-filled insulation to extruded insulation that has been operated over the last 40 years for HVAC cables is much more recent for HVDC. The behavior of extruded cables under DC stress, regarding space charge build-up and field redistribution, particularly at polarity reversal stages as used in converter technologies using IGBT, is not fully under control [4]. Materials improvement, characterization and modelling are still intensively researched, both for cables and accessories.

The paper is a summary report of a workshop [5] organized in Hanoi in September 2018 on green energy and networks. The objective was to present opportunities and challenges with HVDC cable links and to put it in relation to the current situation of the energy network in Vietnam and to the evolution forecasted for the energy generation and management in the country and at its borders. It was also a milestone of a joint project in which a relevant case study of energy transmission link that could be turned to HVDC. We report herein mainly on the current evolution of the Vietnamese electricity network.

FACTS AND FIGURES FOR THE ENERGY SOURCES AND DEMAND IN VIETNAM

Vietnam has a relatively late development of electricity systems compared to other countries in the world due to the historical impact of the wars. The power system only really developed when the 500 kV lines is put into use, along with the strong opening of the economy. This late development is illustrated in Fig. 1 with the evolution in terms of energy consumption over the last 17 years [6]. The peak power follows the same trend. The growth rate is of the order 10-15%/year over the whole period.

In 2018, the total electricity consumption of Vietnam was nearly 215 TWh, increased by 11% compared to 2017 with 198 TWh. Vietnam power system now is ranked a 2nd among ASEAN countries (after Indonesia) and 25th in the world. Demand for electricity is largely driven by factors such as GDP, pricing, wealth and population size. In a near future, Vietnam power system could face a lot of difficulties to secure the supply, especially with the reduction of fuel sources supply (domestic coal, natural gas...). According to the demand forecast, Figure 1, the growth rate should remain at 11 ~ 13% per year up to 2020, decreasing to 8 ~ 8.5% per year for the period of 2021 – 2030.