Project Title: Feasibility study on the use of high-capacity power transmission corridors for Iran power system network

Department:	Bulk power Transmission Technology Center	***Employer:***	Niroo Research Institute
Project/Program Manager:	M. Jafarian	***Executor:***	H. Berahmandpour
Project Financial Code:	126002	***Project Quality Code:***	PPTPN01
Type of Project/Program:	***Research***	***Assistant:***	Technology Deputy

Project Staff: M. Jafarian, J. Nezafat Namini, A. Esmaili, O.Shahhosseini

Keywords: Power System Architecture, Power System Master Plan, Bulk Power Transmission Technology, Electric Energy Transmission Corridors, UHVAC, E/UHVDC

Project Necessity:

Electric power Corridor is the route for the bulk movement of electrical energy from a generating site, such as a big power plant, to an electrical substation or consumption load center. Iran has a wide country with a variety of primary energy can be converted to electrical energy such as natural gas, coal, nuclear, hydro and renewable resources mainly wind and solar. On the other hand, the consumption centers are commonly far from the energy resources. Also the environmental considerations and limitations such as water restrictions and environmental pollution force wide limitations on the power plant sitting. All of these considerations may lead to have a bulk power generation in a small area near the primary energy resource named as generation center. On the other hand, the big cities with high electric power consumption or the large industrial areas are the consumption centers. If the Generation centers are far from the consumption centers and if the transmission electrical power is high (in the order of some gigawatts), then the electric power corridors can be used to transmit high electrical power from the generation centers to the consumption centers. In this project a feasibility study is done to show the need of these corridors for the future of Iran power system master plan in the next decade.

Project Goals:

Nowadays, Bulk Power Transmission Technology (BPTT) is one of the most important technology in power system planning and extension especially in wide and high capacity generation/demand power systems. This technology is completely the necessity of Iran transmission grid because of the fast growth of electrical power generation in the next decades. The main symbol of this technology is the high capacity electrical corridors which are responsible to transmit high amounts of electrical power in long distances. The main goal of this project is a feasibility study of using these corridors for Iran transmission grid for the future power system general plan. As said before, these corridors relate the generation bulk centers to the consumption bulk centers as the base of the transmission system architecture.

Abstract:

The first and main step for the mentioned feasibility study is to create a clear and accurate view about the generation/consumption evaluation in the future and to have a bright map about the concentration of the generation/consumption in the country area. This task should be done by using the load forecasting and generation planning studies which are done and are available. This is the most challenging task in the project because of the serious uncertainty in both of the generation/consumption evaluation. The conventional solution to overcome this challenge is to form all the probable situations as the feasible scenarios where each scenario shows the one of the case

of the generation/consumption growth and also the form of their concentration map. In this project 36 scenarios are formed to cover all the situations. In the next step, all the feasible corridors to connect the generation/consumption centers are identified as the initial suggestions includes their routes, distances and also the required technology to implement these corridors. The detail technical-economic feasibility study should be done to determine the final corridors the form the main structure of the power system architecture. The detail results include the route and distance of the final corridors and also the needed technology to implement them. Also, the technical requirements should be considered for the secure operation are the other results achieved by this detail study.

Steps and Methodologies:

Step 1: Electricity generation assessment in Iran different areas based on Regional Electricity Companies (REC's) in 1410.

Step 2: Long term load forecasting up to 1410 again based on Regional Electricity Companies (REC's) in 1410 and following to find the regional generation/consumption balance.

Step 3: Extending the suitable routine for power system planning based on the high capacity electric corridors referenced to the engineering works in the other countries.

Step 4: Review on the bulk power transmission system and the suitable strategies to use it for Iran power system architecture.

Step 5: Identifying the suitable high capacity electrical corridors for Iran power system architecture to transmit bulk power from generation centers to load centers.

Step 6: Technical-economical study to determine the main corridors specification mainly the suitable technology to implement them in 1410

Main Results:

In this project 36 scenarios were formed to cover all the generation/load growth and geographical diversity cases. In the next step the generation/consumption centers were derived by these scenarios. The main generation centers were located in north-east, north-west, and south-east in Iran where the load centers were located in Tehran, Isfahan and Zanjan provinces. Also to these generation/load scenarios, three main scenarios as optimistic, probable and pessimistic were defined to cover the main uncertainties in generation and load trends. Then the initial corridors to connect the generation centers to the load centers were defined based on these assumption an at last the final corridors were found by a detailed technical-economical feasibility study as shown in Fig. 1.

As can be seen the specifications of these corridors such as the route, distance, capacity, voltage level and desired technology are determined which can be used to implement them.

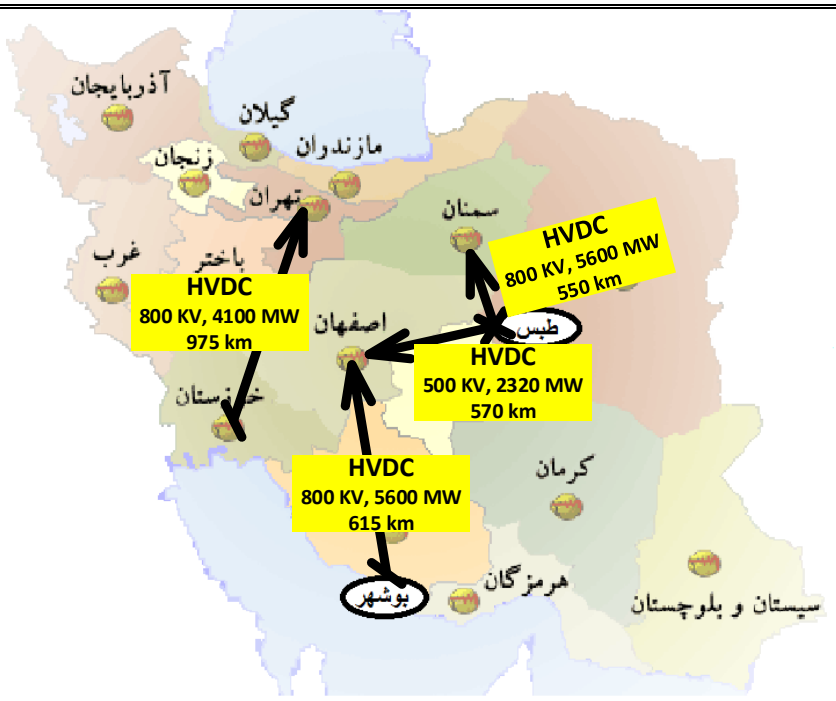

Fig 1. Suggested corridors for Iran power system architecture in 1410

Papers:

[1] – Irannejhad, Berahmanpour, Jafarian, “Reliability Evaluation of EHVAC and HVDC Bulk Power Corridors”, 32nd Power System Conference (PSC) Tehran, Iran, 2017

[2] – Aranizadeh, Jafarian, Berahmanpour, Ranjbar, Amirfakhrian, “An Algorithm for Identifying Electric Energy Exchange Corridors to Convert Iran to the Energy Hub of the Region”, 32nd Power System Conference (PSC) Tehran, Iran, 2017

[3] – Esmaili, Jafarian, Berahmanpour, “Determination the Proper Time Zoon for Voltage level Promotion and its Implementation in Iran Power Transmission System”, 32nd Power System Conference (PSC) Tehran, Iran, 2017

[4] – Esmaili, Jafarian, Berahmanpour, “Main Features in the Technology Selection for Bulk Power Transmission Systems”, 32nd Power System Conference (PSC) Tehran, Iran, 2017

[5] – Aranizadeh, Jafarian, Berahmanpour, “Explaining the Perspectives of HVDC and EHVAC Technologies for Iran with regard to the Main Corridors of Electric Power Transmission in 1410”, 32nd Power System Conference (PSC) Tehran, Iran, 2017

[6] – Shahhosseini, Aranizadeh, “Preliminary Selection of Bulk Power Transmission Corridors on the Horizon of 1410 based on Load/Production Balances” 12nd International Energy Conference (IEC), Tehran, Iran, 2018

[7] – Shahhosseini, Aranizadeh, “Identification of the Electric Power Centers in Iran on the horizon of 1410”, 12nd International Energy Conference (IEC), Tehran, Iran, 2018

[8] – Aranizadeh, Jafarian, Berahmanpour, “Advantage of Technology Development of Direct Current and Alternating Current Systems for Future Infrastructure of Iran Transmission Network”, 33rd Power System Conference (PSC) Tehran, Iran, 2018