



GENERATE (Renewable Energies Geopolitics and Future Studies on Energy Transition) is a two years research project (2018-2020) on the Geopolitics of Renewable Energy, on behalf of the French National Research Agency, in a consortium with IFP Energies Nouvelles.

The purpose of the project GENERATE is to analyse the geopolitical consequences of a spread of renewable energies worldwide. This project will focus particularly on three major issues, namely (1) the criticality of energy transition materials for energy technologies (electric vehicle, solar panel, wind turbine, etc.). (2) the new geography of patents for the renewable energy technologies and (3) the oil producing countries development model, and their places on the international energy scene.

Raw materials criticality in the development of energy transition technologies: GENERATE aims to analyse key markets (copper, cement, cobalt, platinum, some rare earths metal and water) in terms of a criticality-vulnerability matrix. Many of them are essential in decarbonisation technologies in the transportation sector and in the energy production sector. They could become a key driver of technologies prices and could contribute to a limitation (or at the opposite to an expansion) of the diffusion of different technologies. The widespread diffusion of energy transition technologies could then trigger or expand tensions in those commodity markets. The energy transition factor could then add a new piece of complexity for these markets. Specific factors such as the substitutes on the market, the market size, the existence of futures market, the industrial organization will be studied in order to get a complete picture from an economic, technological and geopolitical point of view. A preliminary work based on Times Markal model will contribute to give a big picture of the energy technologies diffusion around the world in 2050.

Industrial property rights (patents): In 2015 the investment in the four major decarbonisation technologies (biofuels, wind, solar photovoltaic and solar thermal) reached a record around 286 billion dollars. For the first time developing countries' investments in renewable energies exceeded those of developed countries. Among the

emerging countries China represented about one third of global investment. These dynamics create many geopolitical concerns regarding the localization of renewable energy innovation and the existence of a new “market power” for the different countries (companies) or group of countries: the United States, Asia (Japan, China) Europe (notably Germany). GENERATE proposes to analyse the new geography of energy transition technologies and to review the new form of cooperation (or struggle) into this field. This mapping will contribute to enlarge the scope of the energy transition analysis. It will contribute to studying the new forms of interaction between industrial actors and to propose a normative framework of global environmental architecture regarding technology transfers and decarbonisation technology financing for developing countries.

The development model of hydrocarbon-producing countries: the diffusion of renewable energies in the global energy mix would also affect fossil fuel-producing countries in several ways: energy prices, fossil-fuel consumption, energy investments in the petroleum sector, international finance (petrodollars recycling, etc. Energy transition dynamics could then become a game changer in the regional and international balances and more especially in the Middle East and Caspian Sea countries. GENERATE will study the energy transition within the hydrocarbon-producing countries in order to understand the diversification process in those countries and the strategy of the different players involved in this scheme (States, national company, etc.). A geopolitical analysis will also be carried out in order to build a matrix of risk associated to energy transition. Scenarios for those the two different regions will be explored and we will analyse the consequences of the transition dynamics for the consuming countries and more especially for the European countries.

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