

Upgrade of Value Chains and the Effect on Resilience of Russia's Coal Industry and Receiving Regions on the Path of Energy Transition

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Abstract : Transition to renewable energy sources (solar, wind, bioenergy, etc.) and launching of alternative energy generation has weakened the role of coal as a source of energy. The Paris Agreement and assumption of obligations by many nations to orderly reduce CO₂ emissions by means of technological modernization and climate change adaptation has abridged coal demand yet more. This paper aims to assess current resilience of the coal industry to stress and to define prospects for coal production optimization using high technologies pursuant to global challenges and requirements of energy transition. Our research is based on the resilience concept adapted to the coal industry. It is proposed to divide the coal sector into segments depending on the prevailing value chains (VC). Four representative models of VC are identified in the coal sector. The most promising lines of upgrading VC in the coal industry include: •Elongation of VC owing to introduction of clean technologies of coal conversion and utilization; •Creation of parallel VC by means of waste management; •Branching of VC (conversion of a company's VC into a production network). The upgrade effectiveness is governed in many ways by applicability of advanced coal processing technologies, usability of waste, expandability of production, entrance to non-rival markets and localization of new segments of VC in receiving regions. It is also important that upgrade of VC by means of formation of agile high-tech inter-industry production networks within the framework of operating surface and underground mines can reduce social, economic and ecological risks associated with closure of coal mines. Such promising route of VC upgrade is application of methanotrophic bacteria to produce protein to be used as feed-stuff in fish, poultry and cattle breeding, or in production of ferments, lipoids, sterols, antioxidants, pigments and polysaccharides. Closed mines can use recovered methane as a clean energy source. There exist methods of methane utilization from uncontrollable sources, including preliminary treatment and recovery of methane from air-and-methane mixture, or decomposition of methane to hydrogen and acetylene. Separated hydrogen is used in hydrogen fuel cells to generate power to feed the process of methane utilization and to supply external consumers. Despite the recent paradigm of carbon-free energy generation, it is possible to preserve the coal mining industry using the differentiated approach to upgrade of value chains based on flexible technologies with regard to specificity of mining companies.

Keywords : resilience, resilience concept, resilience indicator, resilience in the Russian coal industry, value chains

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