In recent decades commodity markets have been subject to deregulation and liberalization, which enabled competitive prices determination according to the market forces of demand and supply, and have greatly influenced their dynamic development. In the project the term "commodity markets" is understood in a broader sense. We adopt the definition found in the description of the *Commodity Markets Conference 2016*: "Commodity markets in this context include the entire range of commodities, i.e. energy (including electricity and renewables), metals, agricultural products and fish, and also related markets such as markets for shipping and transportation services, emission quotas and weather derivatives" (cf. http://www.ccmr-hannover.de/english/2016-conference/).

Modelling and forecasting prices, moments of jumps occurrences and their size are a crucial element for many business entities, as well as for the economy of the whole country. Natural gas, oil and coal are the most important sources of energy and basic ingredients in so-called the energy mix. Energy retailers buy electricity or gas on volatile spot markets and resell it to the consumers at constant prices. The former are under risk pressure of a sharp prices increase. Prediction of prices and periods with a high probability of jumps might limit the cost of enterprises which rely on electricity or natural gas for their core production processes. They might hedge their position by buying or signing profitable future/forward contracts or (if it is possible) change the schedule of the production process. On the other hand, identification of periods with a greater probability of rapid changes in prices gives an opportunity to speculate on the derivatives market. Long-term forecasts of electricity prices, CO_2 emission allowances and energy resources are relevant to the valuation of derivative instruments, the assessment of the economic viability of investment in technologies for reducing energy consumption and CO_2 emissions or the assessment of the validity of government programs for e.g. the development of renewable energy. On the other hand, the prices of energy, gas or CO_2 emission allowances are dependent on various factors, such as political decisions, economic situation, temperature or faults at power plants. In effect, modelling and forecasting prices pose a considerable challenge, largely on account of their featuring time-variable volatility and sharp movements. The latter are usually referred to as jumps (or spikes), although the term has not earned a unique, widely embraced definition as yet. The proposed project deals with the methods and models which will contribute to a better understanding of the nature of the price dynamics on selected commodity markets and in particular the mechanisms of formation of jumps, the role of fundamental variables or the identification of high volatility periods in order to get more precise forecasts and reliable risk management methods.

The models considered in the project have their origin in continuous-time jump-diffusion processes, in which "small" prices movements are accounted for by the diffusion part, whereas the sharp ones – by the jump component. In practice one observes commodity prices which are further transformed into logarithmic rates of return. In such a series one can easily spot "large" values (in absolute value terms), yet still cannot be certain as of whether it results from the jump and/or the diffusion component, since pure jumps are not observed. These issues transfer directly to discrete-time models as well, allowing for at most a single jump per time interval, which are considered in the project. Moreover, stochastic volatility is unobservable as well. The way of dealing with unobservable quantities consists in introducing them into the model as latent variables. The approach is also adopted in our research with regard to jumps and stochastic volatility alike, enabling a precise formulation of a unique way of understanding a jump, thereby facilitating formal statistical inference about jumps (their identification, frequency of occurrences, and distribution) and predicting them in the future. Furthermore, by means of introducing exogenous and dummy variables into the model, one can also take into account some external factors affecting price dynamics, including predicted demand and supply, prices of other energy resources, seasonality and weather patterns. However, all this leads to a large number of all the unknown quantities of the model – the number of parameters in the mathematical model and latent variables describing jumps and stochastic volatility. In view of this we resort to the Bayesian statistical framework, which is widely recognized as the one capable of managing model specifications with latent variables in a formal and internally consistent manner. The results obtained from the Bayesian models (with particular focus on the ones pertaining to jump detection, jumps' values, frequency and forecasts) will be compared with those from some non-Bayesian methods, currently prevailing in the literature.

The objective of the research is examination and comparison of the common and authors' new Bayesian models propositions with common non-Bayesian methods for detecting jumps, modelling and forecasting prices on selected commodity markets, with respect to their strengths and weaknesses. The comparison of methods and models considered in the project should allow to isolate crucial mechanisms that should be incorporated into viable tools for an effective analysis and prediction of prices on commodity markets. Finally, the results of the project should provide valuable tools for forecasting and risk management.