Since the beginning of electricity markets deregulation in the early 90'ties, the markets are still evolving, bringing new challenges to the market participants. Electricity is different than other commodities due to its limited storability. As a consequence, traders of electricity experience high uncertainty and the prices are much more volatile than in any other markets. In the last decade a significant increase in the share of electricity from renewable energy sources (RES) has been observed. As a consequence, electricity prices have become even less predictable. This is due to the fact that supply and demand are less predictable as they change with weather conditions. The development of RES is the cause of an increase of importance of complimentary markets that allow to balance prices from the day-ahead markets in response to changes in weather conditions and other unforeseen events. The major share of electricity is sold in the day-ahead markets, in which contracts on a delivery of electricity within a given time period (e.g an hour or half an hour) during the next day are settled. Since both the future demand and the future supply cannot be exactly determined on the day before delivery, the main power exchanges are usually complemented with intraday or/and balancing markets. The intraday markets allow for a trade up to few minutes before a delivery while the balancing markets are usually used by system operators to finally balance electricity supply and demand.

The planned research focuses on the point of view of a small electricity supplier who has to decide in advance where to sell the produced energy. He sells all available electricity through a large energy company and hence is a price taker and can only decide on the amount of energy to be sold in the day-ahead and complimentary markets. This is a current problem due to the development of small energy generation caused by the increase of RES production. In the project, we will extend the existing approaches by an adoption of probabilistic forecasting methods but also combine them for different markets and utilize in a decision making process. The probabilistic prediction takes into account not only the best estimate of a future value but also uncertainty of the forecast. As a consequence, it brings much more information to a decision maker and allows e.g. for a direct risk management. This is a crucial issue for an electricity producer, since the current costs of over- or undercontracting of electricity can cause severe losses and even lead to its bankruptcy.

The main aim of the project is the development of effective tools supporting decision making process for a participant of electricity market. Based on the probabilistic forecasting methods, we will provide algorithms for an optimal choice of sharing of sale between day-ahead and complementary markets. The proposed strategies will aim the maximization of the profit and minimization of the sellers risk with respect to the share of electricity sold in one of the markets.

The research will be conducted in two main directions:

1. Development of the optimal selling strategy based on probabilistic forecasts of the future portfolio value, complemented with:
   i) an analysis of the optimization results for different risk and profitability measures;
   ii) a verification of the applicability of the proposed algorithms based on data from the major energy markets.
2. Application of a recently proposed risk measure - expectiles:
   i) as a risk measure in strategies construction;
   ii) as a new method in probabilistic forecasting.

We believe that the outcome of the project would significantly improve a decision making process for electricity sellers. It can be also easily extended to electricity buyers or other markets where a decision on a selling platform is an important issue.