

PROPER METROLOGICAL VERIFICATION OF SMART ENERGY METERS

Smart energy meters are an element of an advanced measurement infrastructure. The currently applicable legal acts have caused the need to replace traditional energy meters with smart energy meters. In the near future, smart energy meters will become the most commonly used measuring and recording devices in modern power networks. In addition to the scale of the meters' occurrence, it is also necessary to note the significance of their target application. The results obtained with such smart energy meters in the scope of energy measurements constitute the basis for commercial settlements, while in the case of measurements of parameters defining power quality, they constitute the basis for financially charging the side that is the source of disturbances of power quality. Smart energy meters are a distributed source of information in the power network, enabling, among other things, the acquisition of information on energy flows and power quality at consumers' supply points. Knowledge of the condition of the power network is of particular importance in the presence of distributed energy sources, and therefore, such meters are in practice unalternative diagnostic tools. The common use of such meters and competition among manufacturers force the pursuit of a low price. However, the complexity of these meters (software and hardware) and the pursuit of low price are in some way at odds. It is even more important to remember that any imperfections in the operation of smart energy meters can occur in a very large number of cases. As a result of the dispersion of meters, it is difficult to detect their incorrect operation. This results in the need to exercise extraordinary care when designing and performing comprehensive tests of such meters. Laboratory experience in the field of testing such meters and other measuring equipment, and observations of their operation in real networks, shows the need to expand research beyond the normative requirements. Therefore, it is important to thoroughly study the properties of meters that go beyond the normative tests. Furthermore, their diagnostic capabilities should be improved and expanded. Taking into account the above, it is necessary and necessary to develop a test procedure for smart energy meters to verify errors of measurement of energy and indicators defining power quality, taking into account the conditions that occur in real power networks.

The results of the project will be a metrological control procedure for smart energy meters focused on the assessment errors of measurement of energy and power quality measures. It was assumed that within this procedure, special test signals generated simulate and reproduce states occurring in real power networks.

The implementation of the project should result in an improvement in the quality of metrological control of smart energy meters. This should result in a better selection of such meters (worse meters will be eliminated). In the long term, in connection with competition in the meter market, an improvement in the quality of commercially available smart energy meters should be expected. Improved metrological control, in connection with the expected improvement in the quality of such meters, can increase public trust (of individual and industrial consumers) in the results of measurements of energy and power quality indicators. For example, increased trust will facilitate the resolution of disputes resulting from the negative impact of the operation of some distributed energy sources and burdensome consumers on the condition of the power grid. It is also worth noting that the Main Office of Measures presented estimates of annual losses resulting from errors in energy measurements by meters at the level of 0.5 billion PLN. However, in its analyses, the Main Office of Measures focuses on sinusoidal states (possibly taking into account single disturbances), which rarely occur in modern power grids. Therefore, this problem may, in fact, be much more serious. Furthermore, the newly applicable legal acts stipulate that smart energy meters will participate in the registration of power quality indicators, which is also why it is possible that, based on incorrect meter readings in the assessment of power quality, further financial losses may occur due to unjustified financial burdens. Hence, the results of planned research in the field of metrological control of meters in the context of measurement of energy and power quality indicators, in connection with the expected improvement in the quality of meters, will create the possibility of reducing significant financial losses in the amount of billions of PLN.