

MID-TERM FRAMEWORK PROGRAMME OF THE BULGARIAN INSTITUTE OF METROLOGY IN SUPPORT OF INNOVATIONS AND COMPETITIVENESS

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Abstract: This report presents the developed by BIM “Mid-term Framework Program of the Bulgarian Institute of Metrology in support of Innovations and Competitiveness (2018-2020)”, which aims the partial achievement of the operative objectives, included in Priority 3.1. “Providing new and improved services” to the “Strategy for Development of the Bulgarian Institute of Metrology, 2016 -2020” The programme will be realized via three projects under Operative Programme “Innovations and Competitiveness”

Key words: BIM, metrology – framework programme, OPIC, modernization, national measurement laboratories, testing laboratories, verification laboratories

1. Introduction

In 2016, the Bulgarian Institute of Metrology (BIM) elaborated a mid-term strategical document for development in which the main goals, objectives, priorities and implementation measures were set.

Strategical objective 3 of the elaborated document foresees that BIM should bring its activities in accordance with the new achievements in the field of science and technological progress so that to be able to provide reliable, traceable and comparable services and effective metrological control, which has to result in improvement of business environment, promoting entrepreneurship and protecting consumers/customers.

A part of measures for implementation of this objective (especially those, in Priority 3.1 “Providing new and improved services”) include improvement and development of national measurement standards and certified reference materials in accordance with the national priorities; dissemination of units to accredited laboratories, to other production and company laboratories and clients; international and inter laboratory comparisons; establishing of new and modernization of existing laboratories; providing innovative services.

For implementing these measures and activities, it has been foreseen to use the financial resources of EU funds.

This report presents the developed by BIM “Mid-term Framework Programme of the Bulgarian Institute of Metrology in support of Innovations and Competitiveness” (MTFP), which aims the partially achievement of the operative objectives, included in Priority 3.1. The programme will be realized via three projects under Operative Programme “Innovations and Competitiveness”.

2. Link to other national/sector strategies/programmes

In support of the EU goals for the next decade, the Strategy “Europe 2020” focuses on efforts and instruments for achievement of smart, sustainable and inclusive growth. The initiatives and activities undertaken in this regard provide financial support, create new forms for business promotion and stimulate international cooperation to provide more resources so that European Innovation Area to be established and a favorable environment for entrepreneurship to be developed. In order to support and continue the progress as a result of the Lisbon Strategy, the Strategy “Europe 2020” puts forward seven flagship initiatives, aimed at improving the framework conditions and the access to EU funds for research and innovation, accelerating the transformation of innovative ideas into products and services so they can support the economic development, help in creating jobs and improve and support the business environment, with a focus on small and medium enterprises (SMEs). As a major driving force for innovation development and improving the competitiveness of the European economy, today SMEs face a number of challenges - a protracted economic crisis, dynamically changing markets, strong competition from new economies such as China and India.

As an EU Member State, Bulgaria faces the challenge of establishing a competitive and dynamic economy. The leading strategic and programming document is the National Development Programme: Bulgaria 2020 (NDP BG 2020), which defines the objectives of the socio-economic development policies of the Republic of Bulgaria until 2020, as well as the national growth decisions taken

under the Europe 2020 Strategy.

The “Mid-term Framework Programme of BIM” will contribute to the implementation of the National SME Promotion Program 2014 – 2020. The objectives and activities foreseen in it are aimed at improving quality and effectiveness of BIM’s services, as a main prerequisite for providing an appropriate and favorable business environment for the SME.

BIM has a complex role in establishing conditions in regards of applicable criteria for conformity assessment, traceability of measurement results and technical competence of the bodies, subject to accreditation/notification. The institute is an integral part of the National Quality Infrastructure (NQI) aiming at ensuring and guaranteeing the quality of production of Bulgarian enterprises. It is estimated that the role of metrology is crucial, as the development of the industry, research and everyday life of citizens depend on measurements, to which requirements for higher accuracy and low uncertainty are constantly increasing. International analyzes made by world experts in the field (for example, Peter Swann's "Metrology and Measurement Economics") show the following economic effects of measuring: increasing business productivity, supporting innovation in different ways, reducing transaction costs between suppliers and customers in a market economy and supporting a wider group of beneficiaries so far considered as such.

3. Main issues that will be solved by implementing MTFP

The main problems, faced by BIM as a whole, are related to the state of the national measurement standards and technical equipment/means of testing and verification in certain areas of measurements:

- some of the measurement standards and equipment are amortized and do not meet the current requirements in terms of accuracy and measurement ranges;
- part of the equipment of national measurement standards has depleted resource, which greatly limits the opportunities that compromises the international equivalence of the measurement standards as well as the provision of metrological traceability for the country;
- the internationally recognized Calibration and Measurement Capabilities (CMSs) of BIM, published in the database of the International Bureau of Weights and Measures (BIPM) are endangered;

- with existing equipment, it is impossible for BIM to fulfill commitments related to participation in international projects, part of the European Metrology Program for Innovation and Research (EMPIR);

- impossibility with the existing equipment to cover the defined legal range of metrological control;

- lagging behind with the implementation of the measurement methods used in testing of products in order to meet the requirements of the legislation in the field and to meet the needs of the business.

The expected contribution from the implementation of the MTFP will lead to an increase in innovation activity through:

- improvement of the business environment and the quality infrastructure;

- increasing the productivity of enterprises;

- speeding up the introduction of new technologies in production;

- Long-term competitive advantages of Bulgarian manufacturers in the development, certification/conformity assessment and marketing of new products.

4. Objectives of the MTFP

The overall objective of the MTFP is to provide improved services and to create a favorable environment and infrastructure for the needs of the business, supporting innovation activities to provide metrological traceability, performing quality and reliable metrological control of measuring instruments and conducting standardized tests for electro-magnetic compatibility and safety of products by modernizing, retrofitting and expanding the scope of activities of the national measurement standards, testing and verification laboratories in the Bulgarian Institute of Metrology.

For achieving the overall objective, the following specific objectives will be realized:

- Modernization and retrofitting of technical capabilities of two national measurement laboratories;

- Modernization, upgrading and extending the scope of three testing laboratories;

- Modernization and retrofitting of technical capabilities of twenty-three verification laboratories.

5. Measures envisaged in the MTFP for modernization, retrofitting of technical capabilities and extension of scope of activity

5.1. National measurement laboratories

In the field of the temperature measurements, BIM has a national measurement standard for temperature unit, which is the primary measurement standard of the modern level and has proven international equivalence. BIM has published 32 CMCs in the database of BIPM. Part of the standard equipment included in the measurement standard, namely some fixed points cells according to the International Temperature Scale, ITS-90 has a depleted resource. Their replacement with new ones will allow the work of the measurement standard for a further period of 8-10 years. As a result of heavy workload and long-term use, temperature baths for calibration are amortized and need to be replaced with new ones. By replacing of the old equipment with a new one metrological traceability for the country at the required level in one of the main areas of measurement - thermometry, will be provided.

For this purpose, delivery of ampoules with reference points to the national temperature standard of mercury, indium and tin, as well as supply of low temperature, medium and high temperature baths is foreseen.

In another very important area – electrical measurements, BIM needs multifunctional standard calibrators of electrical quantities and a precision oil bath. The existing equipment included in the measurement standards for AC and DC voltage, electrical current and electrical resistance should be replaced. Without its replacement, the provision of metrological traceability for the country as well as the maintenance of the recognized CMCs in this field, become impossible.

MTFP is also focused on extending the scope of providing metrological traceability for quality parameters of electrical energy in order to respond to increased needs, and also to support the EMPIR project in this area. For the purpose, it is needed delivery of digitizer such as the national metrology institutes of other European countries use.

5.2. Testing laboratories

BIM's efforts to provide improved services and a favorable business environment are focused on modernization, supplementation of technical

capabilities and extension of the scope of activities of the testing laboratories as well. For the purpose of type approval of legally controlled measuring instruments, resources will be provided for testing of electricity meters, pressure gauges and breath analyzers. This equipment will allow meeting of the legally relevant requirements to these measuring instruments related to their mechanical and electrical characteristics as well as to their pulse and electromagnetic characteristics.

Entering new technologies in measuring instruments results in the development of smart instruments and systems functionally controlled via software. This software is essential for their metrological and technical parameters, which leads to entering new technical requirements to the test methods, implementation of which passes through replacement of the existing measurement standards and auxiliary equipment, as well as introduction of technical means for validation of the metrological characteristics and software of measuring instruments. Carrying out high-technology tests for the business and produced by them measuring instruments and software is essential for increasing innovation and technological capacity of the Bulgarian producers.

Because of these reasons the existing software testing laboratory will be modernized by delivery of standard and technical equipment, including standard computer configurations and periphery, two-channel digital oscilloscope, power supply blocks, functional generator, communication interfaces (GPIB, RS232, RS422/485) and specialized software for elaboration of test applications used in software testing.

With regard to the entry into force of new versions of the EMC standards, new requirements are also required for technical devices - increasing the frequency range of measurements and tests, increasing the levels of applied interference, changing the design characteristics of the used coupling / de-coupling circuits. New requirements for verification of methods as well as uncertainty assessment requirements are introduced. This requires replacing some of the existing equipment as well as purchasing additional technical means to ensure that the necessary verification can be carried out before each measurement/testing and the uncertainty of the used methods to be assessed.

For a significant part of the EMC Laboratory equipment, the manufacturers do not provide maintenance due to replacement of the product

demand. It is a practice after a ten-year period not to offer servicing of old models of devices. This creates considerable difficulties in maintaining the technical equipment. It is virtually impossible to service any damage that may have occurred, as well as maintenance and additional factory settings required before the calibration is performed.

As a part of the quality infrastructure, the EMC testing laboratory is striving to face the challenges of the market trends and regulatory requirements in the field of electronic and electro technical devices and to enable manufacturers, on the one hand, to control the quality of their products by conducting high-tech tests, and on the other hand BIM will be able to provide testing of the measuring instruments necessary for their type approval. The implementation of the program will allow BIM testing capacity to be maintained according to the requirements of Directive 2014/30/EU and ensure the sustainable development of the technical infrastructure for the effective implementation of legislation in the field of conformity assessment for EMC. The activities will also provide support to Bulgarian producers, saving them time, logistics and financial costs for carrying out lengthy and costly tests in laboratories outside Bulgaria, a process that makes Bulgarian producers uncompetitive in foreign markets, and in the putting on the market and/or in use of the measuring instruments.

In this area, it is planned to be delivered and put into operation:

- technical equipment (set of generators, AC voltage sources, coupling/decoupling circuits, control software) for testing of resistance to transient processes and disturbances that are transmitted in a conductive way via the power supply network, resistance to magnetic fields, other elements of the electromagnetic environment. This equipment will modernize the existing one and will improve the quality of tests carried out according to BDS EN 61000-4-4, BDS EN 61000-4-5, BDS EN 61000-4-6, BDS EN 61000-4-8, BDS EN 61000-4-9, BDS EN 61000-4-11;

- technical measuring instruments (analyzer of harmonics and flicker effect with control software, short-time interference analyzer), which will modernize the existing equipment for analysis of harmonic constituents of current and flicker effect according to BDS EN 61000-3-2, BDS EN 61000-3-3 and click measurement equipment according to BDS EN 55014-1.

5.3. Laboratories for verification and metrological expertise

Annually, BIM carries out about 170 000 verifications of measuring instruments and above 10 000 metrological expertises, primarily of electricity meters and water meters.

Because of the large variety of types and their massive application, as well as the presence of Bulgarian manufacturers, 54 000 initial and subsequent verifications of pressure gauges are carried out per year (i.e. more than 30 % of the volume of verifications carried out by the institute). The equipment for performing these verifications has been in use for more than 25 years and has extremely depreciated. Frequent failures of this standard equipment lead to a delay in execution of pressure gauge verifications and, in some cases, to the suspension of production activities by Bulgarian manufacturers. Replacement of the existing equipment is urgent. This will result in increasing the quality and effectiveness of the verifications carried out by BIM, which will affect the reliability of pressure vessels and equipment, reduce the risk of occurrence of events dangerous to human health and society as a whole.

In this area, the delivery of 16 sets of technical equipment for measuring and control of pressure gauges is planned, so that to cover the most used pressure ranges and fluids in the country.

Regarding the state and municipal receivables and commercial payments in order to protect the interests of the state, economic operators and end users, about 21 000 subsequent verifications of systems “taximeters-automobile” (TA) are carried out annually by BIM. Due to the lack of a suitable building stock for the installation of fixed standard rigs and the necessary infrastructure for access of TA, the verifications are carried out using a 1000 m roadway for which a straight horizontal road section is required. These sections are located at a distance from the buildings of the structural units of BIM and are often connected with the difficulty of the traffic in the defined area. This leads to an increase in the duration of verifications and a reduction in the work capacity, as well as additional costs for the applicants. In recent years the legislation requires extraordinary subsequent verifications after a change in tariffs and re-registration of taxable persons, which leads to a large number of cars being screened simultaneously in a single structural unit of BIM. In order to eliminate these problems in the control of TA, it is proposed to implement an innovative solution, namely mobile control rigs. When delivered, the

need for additional building stock will be eliminated. It will eliminate the risk of road traffic accidents and shorten the duration of the verification. This will allow an increase in the number of verifications per day. The conditions under which applicants are subjected to control will be relieved and the waiting time for extra verifications will be avoided. It will also be possible to divert more than one mobile stand to extraordinary verifications within a structural unit or to carry out the check in the settlement where the taxi service provider is performing its activity. Increasing work capacity will provide a greater number of timely verifications of TA, which in turn will increase the trust of citizens in using the service. At the same time, it will increase the satisfaction of those involved in the taxi industry. For the purpose, delivery of 5 mobile control rigs is provided.

In recent years there has been a significant increase in incoming applications for metrological expertise of electricity meters. Demanders of metrological expertise are both consumers/citizens and electricity distribution companies. The reason for the applying is due to consumers' doubts about inaccurate reporting of energy consumption and amounts paid, which leads to public uncertainty about the services offered in one of the most important areas of the economy. On the other hand, there is a massive practice of unlawful actions, in order to manipulate the electricity meters for non-reading of the actual consumption of electricity, leading to big losses for the electricity distribution companies and unfavorable business environment, and hence indirect increase of the price of the electricity from non-technical losses.

Very often, problems in this area are also related to court proceedings, which requires timely submission of the findings with the results of the metrological expertise. Failure to act swiftly reduces the effectiveness of judicial activity.

Approximately 10 300 expertises are carried out annually with the available technical capacity. Automated measuring systems used in the expertise are highly overloaded, which results in damping and frequent damage. Strong annual financial resources are needed to repair the stations, which BIM does not have. Stopping due to repairs and putting the systems back into operation takes a considerable amount of time and violates the timetable for execution of applications. This leads to delays in the execution of the requested expertise. Approximately 5 000 applications are not executed annually, distributed on the territory of the country.

Additionally, the work is made difficult by a new

generation of modern meters put on the market or into operation, the expertise of which requires additional and adequate equipment, with the possibility to examine the software components of the meters.

In order to improve the performance and meet the requirements of the applicants regarding the quality and timing of the metrological expertise of electricity meters, it is necessary to establish two new laboratories with automated stations for measuring the metrological characteristics and with possibilities for accessing the internal memory of electricity meters.

The stations will be located in structural units that currently lack the technical capabilities to perform this service but fall into the areas with the most applications for ME. This, in turn, will make it easier for citizens and businesses to apply for and deliver the electrometers to the closest place for laboratory research.

This will also facilitate the work of the busiest structural units in carrying out metrological expertise. Even distribution of workload and equipment workload will be optimized, which will also reduce maintenance and repair costs.

With the opportunity to purchase the necessary equipment, the socio-economic climate in the country will be improved and the processes for resolving the available problems of supply, distribution and use of electric energy will be accelerated for both domestic and production needs. It will also lead to a timely crossing of the theft and the reduction of the losses of the electricity distribution companies, which in turn will provide additional financial resources for investments in the electricity distribution network in the country.

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