CNBOP-PIB

Report on the 3rd International Scientific Conference

Fire Safety of Photovoltaic Installations, Energy Storage, Electric Vehicles, their Points and Charging Stations, Smart Home Solutions

Patronage:

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SAFETY

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Organizer: Scientific and Research Centre for Fire Protection – National Research Institute [Centrum Naukowo-Badawcze Ochrony Przeciwpożarowej im. Józefa Tuliszkowskiego – Państwowy Instytut Badawczy (CNBOP-PIB) in Józefów].

Co-organizers:

- Institut für Feuerwehr- und Rettungstechnologie (IFR) der Feuerwehr Dortmund
- European Fire Safety Alliance
- Akademia Pożarnicza
- WSB Academy in Dąbrowa Górnicza
- Faculty of Mechatronics, Armament, and Aviation, Jarosław Dąbrowski Military University of Technology
- Provincial Headquarters of the State Fire Service in Warsaw
- District Headquarters of the State Fire Service in Otwock
- Fire Service Officer School in Poznań
- PZU LAB SA
- National Association of Manufacturers of Fire Protection Systems and Rescue Equipment
- Polish Chamber of Energy Storage PIME
- Polish Association of New Mobility
- Polish Association of Energy Storage
- Association of Fire Protection Engineers and Technicians

Honorary patronage: Chief Commander of the State Fire Service.

Date of the conference: 28 November 2024

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Chairman of the organization committee: Ilona Masna, M.A.

2. Purpose of the conference

The conference, as envisioned by its organizers and partners, is a recurring event for presenting and disseminating research results, current information, knowledge reviews, and solutions. It serves as a platform for the exchange of views and experiences among various groups concerned with fire safety in relation to increasingly applied technologies, such as photovoltaic installations, energy storage systems, electric vehicles along with their charging points and stations, as well as other solutions referred to as smart home technologies. The conference is aimed at manufacturers, designers, and installers of electric batteries, firefighters and civilian employees of the State Fire Service (PSP), specialists and experts in fire protection, property managers, users, and owners of buildings, as well as others interested in the aforementioned issues.

The circumstances that prompted the choice of the conference topic were previous experiences, research, and their results, the offering of new technical solutions and technologies, the growing number of buildings equipped with PV installations, energy storage systems, and charging stations, statistical data on incidents involving PV installations, energy storage systems, and electric vehicle charging points, including the challenges for fire protection related to their increasingly widespread use. Additionally, the development of this area is supported by ongoing research and forecasts, as well as experiences and solutions in this field from other countries.

Two conferences in the series are already behind us – Safety of New Technologies and Improvement of Rescue Technologies. The BNT conferences are one of the key elements of the Institute's work with partners on the safety of new technologies. During these events, we inform about the results of projects, research, publications, new solutions, projects, and implementations, but above all, they serve as a platform for discussion on the safety and use of new technologies. At the 1st and 2nd International Scientific BNT Conferences, we presented the results of a project independently funded by CNBOP-PIB, focused on the application of new and innovative technical security systems for fire protection of new technologies. This project is ongoing, being developed, and open to collaboration with technological partners and manufacturers of technical security systems. Continuing the topic, during the 3rd BNT Conference, we presented our new results and activities within the New Technology Centre at CNBOP-PIB, which integrates numerous activities of the Institute in the fields of scientific research, implementation work, expanding research capabilities, analytical work, and development strategies in fire protection.

The summary, key findings, and conclusions from the BNT Conferences I, II, and III are also published in the post-conference reports.

3. Previous experiences

The issue of fire safety in photovoltaic installations is not a new topic in the research and work of CNBOP-PIB. In 2021, the Institute published thematic publications on this subject, including *Selected Practical Issues and Safety in Photovoltaic Installations* and *Risk Assessment of Fire Hazards in Photovoltaic Installations: Defining Safety Concepts to Minimize Risks*. In 2024, guidelines for fire protection of garages in buildings intended for charging electric and plug-in hybrid vehicles were also released. These guidelines, in their respective chapters, include: basic and essential definitions, abbreviations, and symbols; formal foundations; related documents and key research findings; a collection of requirements and recommendations regarding the applied products, design, installation, and operation of electrical systems; and the characteristics of locations in buildings designated for the charging of electric and plug-in hybrid vehicles.

At CNBOP PIB, research stands have also been established to validate (through testing) the functionality of products (components of PV installations) that are crucial from the perspective of fire safety and the safety of rescue teams, such as:

- Detection of electric arcs and interruption of arc faults in DC circuits of PV installations, as well as alarm signalling.
- Disconnection of PV power supply and signalling of operating states of PV installations for rescue teams.

These stands enable research and functional testing of various PV installation configurations in terms of fire safety, compliance with fire protection regulations, and the safety of rescue teams. They also serve to disseminate knowledge, support education and training, including the development of model design documentation for PV installations in buildings, and the creation of technical standards for fire protection, such as guidelines, product requirements, testing methods, etc.

Independently, CNBOP-PIB conducts – both on its own and with technological partners – numerous other activities, research, and projects, the results and acquired experience of which authorize the formulation of conclusions, identification of hazards, risk assessment, determination of needs and requirements in fire protection, as well as their dissemination. Research on electric vehicle batteries carried out at the Institute over the past several years has provided specific experience, knowledge, and results for various products. Recently, this work has been expanded to include technical safety systems dedicated to fire detection and control at electric vehicle charging points, as well as equipment and tools intended for rescue operations during incidents involving electric vehicles.

The research and acquired experience, combined with collaboration with the State Fire Service (PSP) and technological partners, additionally contributed to the development of a guide for rescuers in 2023 titled *Conducting Rescue Operations During Incidents Involving Electric Vehicles* and the preparation and implementation of a dedicated training program on conducting firefighting and rescue operations involving electric vehicles. At the beginning of 2025, a new publication will be released, focusing on the safety of hydrogen propulsion systems in the context of risks for rescuers during rescue operations.

4. Conference Agenda

The CNBOP-PIB scientific conference was divided into four sessions, titled:

1. Lessons from the Past
2. Looking into the Future
3. Here and Now for a Safe Future
4. Partner Presentations and Discussion

As part of the third session, a discussion panel was held, during which the most important issues concerning the safety of batteries, modules, and electric vehicles were discussed.

4.1. First Session – Lessons from the Past

During the first session, st. bryg. w st. spocz. Paweł Rochala, M.Sc. Eng. delivered a lecture titled *"Lessons from the Past for the Present and the Future Based on the New CNBOP-PIB Publication: Józef Tuliszkowski. The Man, His Work, and Its Resonance."* The presentation provided an overview of the information contained in the publication dedicated to Józef Tuliszkowski, offering a comprehensive and detailed account of the life and legacy of the patron of CNBOP-PIB. The session highlighted the achievements of one of the pioneers of fire protection in Poland, whose work continues to serve as an inspiration and model for future generations of firefighters. The publication is available for free download on the CNBOP-PIB website under the *Publications-Books* section.

4.2. Second Session – Looking into the Future

During the second session, moderated by Maria Zielecka, DSc, PhD, Professor of the Institute, the following topics were addressed:

1. Safety of New Technologies – Challenge and Task – a lecture by Monika Wyszomirska, st. bryg. Jacek Zboina, DSc, PhD Eng.;
2. The Future of Energy Storage in the Power System – a lecture by Barbara Adamska;
3. Robotics and Artificial Intelligence in Fire Protection – a lecture by Paweł Bujny, M.Sc. Eng. and st. bryg. w st. sp. Jan Kielin, M.Sc. Eng.;
4. Home Energy Storage and Charging Station vs. Fire Safety – A Case Study – a lecture by Bartłomiej Derski.

4.2.1. Safety of new technologies

The presentation began by emphasizing that law is an essential area without which the state could not function, identifying legal norms as the foundation of social life and economic activity across all scales and areas. The challenges related to safety and the legal aspects of new technologies were discussed, particularly in the context of the dynamic development of technologies such as artificial intelligence, cloud computing, the Internet of Things, 5G, and nanotechnologies. During the lecture, the focus was primarily on four key areas:

1. **New Technologies and the Law –** The traditional understanding of law, based on legislation and the constitution, is not always sufficient to regulate new technologies. It is necessary to develop flexible solutions, including “soft law” , which encompasses, among other things, expert knowledge, guidelines, and standards, rather than rigid regulations.
2. **New Technologies and Safety –** Every new technology comes with new risks. The key is the process of identifying hazards, planning protective measures, designing installations, and their operation to ensure the safety of products, buildings, technological processes, users, and rescuers. In the area of fire safety, the industry cannot operate in isolation and must collaborate with other sectors to address new challenges in this area.
3. **New Technologies and Trust** – Safety is a prerequisite for the development of any new technology, particularly in terms of trust in these technologies. It was identified that trust in new technologies is crucial and is built through transparency regarding hazards, risks, and protective actions, through the implementation of activities such as:
    - Providing reliable information about hazards and risks,
    - Planning the scope of protection where necessary, designing protective measures, carrying out installations, and implementing solutions,
    - Raising awareness among users and rescuers,
    - Implementing technical and certification requirements aimed at ensuring the safety of products, buildings, technological processes, as well as the safety of users and rescuers.

It was emphasized that before introducing new technologies, appropriate safety conditions must be developed and implemented, and the technologies themselves must be supported by relevant legal regulations. The growing importance of technical documents and expert opinions reflects the evolution in the creation of laws concerning new technologies. Additionally, as research indicates, the presence of new technologies in our lives evokes extreme emotions, both positive and negative. Therefore, it is crucial to build trust in these technologies by ensuring functionality, safety, legal protection measures, and all necessary requirements for the application of the given technology.

4.2.2. The Future of Energy Storage in the Power System

The presentation by Barbara Adamska, representing the Polish Energy Storage Association, focused on the future of energy storage in the Polish power system. It was identified that energy storage plays a crucial role in the transformation of Poland's energy sector and in the development of a modern, low-emission energy system. It was also emphasized that current legal regulations in Poland are not sufficiently developed to fully implement business models related to energy storage. The rapidly evolving nature of this area was highlighted, with predictions that by 2024, battery storage systems with a capacity of 67 GW / 155 GWh will be installed worldwide, representing a 130% increase compared to the previous year. Furthermore, it is estimated that by the end of the decade, the installed capacity in battery storage systems will reach nearly 800 GW and over 2200 GWh. Forecasts for the energy storage market in Poland indicate further development, which by 2040 is expected to create 26,000 new jobs, increase domestic production by 69 billion PLN, and add 33 billion PLN to the value added.

During the presentation, the currently available funding programs for energy storage systems applied in Poland were also discussed, identifying the following:

- Cogeneration for the energy and industry sectors (application process ongoing),
- Cogeneration for district heating. Part 1 (Second call – Q4 2024),
- Cogeneration for county-level systems (Second call for funding applications – Q4 2024),
- Renewable Energy Sources (RES) as a heat source for district heating (applications accepted until 17 December 2024),
- My Wind Power Plant,
- My Electricity 6.0,
- Energy for the Village,
- Electricity storage systems and related infrastructure for improving the stability of Poland's power grid (currently under development),
- Program for funding thermal energy storage systems (currently under development).

4.2.3. Robotics and Artificial Intelligence in Fire Protection

During the first part of the presentation, Paweł Bujny, M.Sc. Eng. delivered a lecture on the application of robotics in fire protection, emphasizing modern technologies that will increasingly play a significant role in combating fires and rescue operations. Contemporary fire protection faces numerous challenges, such as climate change, which leads to increased frequency and intensity of fires, urbanization, which raises population density and infrastructure development, and the advancement of new technologies and materials, which also contributes to a higher risk of fires. In response to these challenges, the use of modern technologies like robotics and artificial intelligence becomes essential for effective crisis management. It was identified that robotics in fire protection is applied in various areas, including firefighting robots, which are used to extinguish fires in hazardous conditions, rescue robots, which assist in searching for trapped individuals, drones, which monitor fire situations from the air. The presentation also highlighted three key areas concerning the limitations and challenges related to the use of these technologies, including high costs of purchase and maintenance, the need to ensure reliability in critical situations, the need to adapt regulations to accommodate new technologies.

In the second part of the presentation, st. bryg. w st. sp. Jan Kielin, M.Sc. Eng. focused on the issues related to artificial intelligence (AI), identifying its application in fire protection, particularly in early fire detection systems, fire development forecasting, and evacuation management. AI was defined as the ability of machines to exhibit human-like abilities such as reasoning, learning, planning, and creativity. Furthermore, AI allows technical systems to perceive their environment, handle what they perceive, and solve problems, working towards achieving a specific goal. During the presentation, several examples of AI applications in firefighting were presented and discussed, including:

- Rapid analysis of available forces and resources that can be deployed for current operations,
- Quick delivery of information regarding affected objects, hazardous substances, etc., to facilitate decision-making by the Incident Commander (KDR),
- Analysis of past incidents based on specified criteria to plan for fire protection needs and fire prevention measures,
- Generating fire protection requirements for buildings with specific purposes, related to evacuation conditions and smoke control,
- Online qualification and continuing education training system for rescue workers in the State Firefighting and Rescue System (KSRG).

4.2.4. Home Energy Storage Systems and Charging Stations: Fire Safety Considerations

Mr Bartłomiej Derski discussed issues related to electricity storage and highlighted the growing role of renewable energy sources and technologies associated with energy storage systems in the context of the energy market. He also presented information on trends in energy production, noting that in 2024, Poland achieved its highest share of renewable energy in history. It was identified that a significant factor driving the increased interest in energy storage technology is the steady decline in battery prices and the high electricity prices. Additionally, data on the number of installed energy storage systems was presented, illustrating a steady increase in their use: in Q1 2024, there were 10,197 installations, and by Q2 2024, this number had risen to 18,077 installations. In the later part of the presentation, Mr Derski presented and discussed examples of battery applications in residential homes and charging stations in multi-bay garages, including an identification of the fire protection measures used.

4.3. Third session – Here and Now for a Safe Future (Discussion Panel)

During the third session, moderated by Jarosław Tępiński, Ph.D. Eng., the discussion panel addressed the following key issues:

1) Identification of hazards and risk validation related to electric batteries and energy storage systems – Experts discussed the importance of identifying the risks associated with electric batteries and energy storage systems, and evaluating the potential hazards they may present in various scenarios.
2) Examples of hazards and dangerous incidents caused by batteries – The panel reviewed several real-life examples and case studies, supported by video materials and commentary, demonstrating the risks and incidents involving battery malfunctions or failures.
3) Key factors influencing the safe use and storage of electric batteries and energy storage systems,
4) Fire, physical, and chemical protections at the battery cell level,
5) Electric devices, vehicles, and renewable energy installations equipped with batteries as potential fire hazards,
6) Fire safety assessment of photovoltaic (PV) modules and energy storage systems,
7) Fire safety requirements for buildings containing batteries and energy storage systems,
8) Firefighting and rescue operations during incidents involving electric batteries and energy storage systems,
9) Energy storage systems as a critical infrastructure element,
10) Development of fire protection systems in energy storage installations, both prosumer and large-scale,
11) Scientific research on the use of electric batteries, PV systems, and energy storage systems, and their fire protection and emergency response procedures,
12) Safety and use of new technologies.

The discussion panel was attended by:

- Mr Krzysztof Bukała, Polish Chamber of Energy Storage;
- st. bryg. Michał Gigoła, M.Sc. Eng., District Commander of the State Fire Service in Otwock;
- Dariusz Gołębiewski, Ph.D. Eng., President of the Management Board of PZU LAB SA;
- st. bryg. Robert Haponik, Provincial Headquarters of the State Fire Service in Warsaw;
- st. bryg. Paweł Janik, Ph.D. Eng., Director of CNBOP-PIB;
- Mr Marcin Kobylski, Polish Chamber of Energy Storage;
- Zenon Małkowski, Ph.D. Eng., National Association of Manufacturers of Fire Protection Systems and Rescue Equipment;
- st. bryg. w st. sp. Paweł Rochala;
- Piotr Szczeciński, Ph.D. Eng., Polish Chamber of Energy Storage;
- Mr Jan Wiśniewski, Director of the Research and Analysis Center, Polish Association of New Mobility;
- Mr Mieczysław Wrocławski, Vice President of the Board of the Polish Association of Energy Storage.

4.3.1. Discussion panel

The discussion panel was divided into four thematic modules. The first module focused on *electrochemical batteries, their operation, safety, and fire-fighting measures*. The next module addressed *electric vehicles, safety, and the conduct of rescue and firefighting operations, along with relevant statistics*. The third module concerned *photovoltaic installations, prevention, and rescue-firefighting operations*. The final module focused on *electric energy storage systems*. Below are the questions and answers from the panel participants.

Question 1:

What is the composition of electrochemical batteries, and can it pose any hazards?

Answer:

The answer was provided by st. bryg. w st. sp. Paweł Rochala.

The composition of electrochemical batteries is so diverse, and the associated hazards are so varied, that each time a different type of harmfulness is discussed. Currently, a lot of attention is given to hydrogen as a potential risk, but there are many other heavy and light metals used in battery cells that also pose their own risks, especially considering the reactivity of these metals, which are highly reactive. Additionally, it should be noted that each battery is a source of metals that can be fuel, poison, mutagenic, or carcinogenic. Bringing such factors into our homes creates not only fire hazards but also health and explosive risks in the event of their release. In the case of a battery fire, gases are released as a result of thermal decomposition of the cells, including hydrogen, methane, hydrogen cyanide, and many other strong substances, such as acid and base anhydrides, which, when combined with water, form strong acids and bases.

Question 2:

Which types and kinds of batteries are safe?

Answer:

The answer was provided by Zenon Małkowski, Ph.D. Eng.

In energy storage systems, the main issue to overcome is trust. We need to ask ourselves whether, as users, we would be willing to place an energy storage system under our own bed. Probably, no one would find such a brave person. Therefore, the problem with energy storage systems is more complex than just issues related to fire resistance and fire safety measures. In the case of fire events, one has to deal with very high temperatures in a short time and the potential for explosions. Thus, the decision regarding which batteries will be used in homes is a fundamental aspect in rebuilding user trust, as the current assumption is that every battery can catch fire.

Question 3:

How to determine if the batteries in use are still functional and who should verify their condition?

Answer:

The answer was provided by Zenon Małkowski, Ph.D. Eng.

From the prosumer level, where small energy storage systems are of interest, the selection of batteries should be very thoughtful. It is worth considering whether batteries with smaller capacities but greater reliability should be used. The energy storage systems should primarily be monitored by verifying the increase in battery temperature along with remote signalling, which will allow for early detection of the energy storage system's behaviour and condition (in case of its malfunction – editorial note). Regardless of the above, the importance of using fireproof enclosures was also emphasized.

Question 4:

Are there devices available that have proven ability to detect electrolyte vapours from lithium-ion batteries and are capable of acting before the occurrence of thermal instability?

Answer:

The answer was provided by Mr Marcin Kobylski.

There are already many solutions on the market that protect energy storage systems, including the so-called BMS (battery management system). In general, all energy storage systems should be equipped with all available means to prevent the escape of any electrolytes. However, one should consider whether such protective solutions are available for fire protection. Most of the currently used protective measures come from the area of technical and electronic means, which generally work, but it is unclear whether they are suitable for fire protection, for example, in communication with fire protection systems. It is equally important that the fire protection device used is capable of detecting electrolyte vapours before thermal runaway occurs, so that there is still a chance to manage the risk and take corrective actions to prevent thermal runaway.

Question 5:

How to prevent the development of a lithium-ion battery fire using nitrogen?

Answer:

The answer was provided by Mr Marcin Kobylski.

There are many solutions available on the market from various manufacturers to prevent fires, one of which is the use of nitrogen. Inertization seems like an excellent solution for large-scale energy storage systems. Unfortunately, it is also a solution that is difficult to implement due to the way the protected spaces are used and the need to ensure an adequate level of gas. To reduce the issues associated with maintaining the system, methods can be employed to detect threats early in order to start inertization just before an event, without the need for continuous maintenance while the system is functioning correctly. Regardless of this, nitrogen is an excellent protective solution due to three main aspects: its inert properties (it does not engage in any chemical reactions, is natural, and safe for people), its eco-friendliness (environmentally friendly), and its cost-effectiveness due to its price and availability.

Question 6:

What firefighting agents are effective in extinguishing battery fires by stopping the ongoing chemical reactions?

Answer:

The answer was provided by st. bryg. w st. sp. Paweł Rochala.

To interrupt thermal runaway reactions, it is necessary to prevent the ignition of additional substances that have progressively higher ignition temperatures and are ignited in this chain of events. In this case, we cannot talk about extinguishing the fire per se, but if cooling is carried out quickly enough, it can prevent many incidents by cooling the remaining components, reducing the risk of their ignition. Apart from the cooling process, inertization is also considered a very good protective solution. It is important to realize that a fire usually starts from the failure of a single cell, not the entire battery. So, if the surroundings can absorb the energy of the damaged cell without raising the temperature above the thermal runaway point of nearby cells, nothing should theoretically happen. However, for this to occur, the enclosures must be much sturdier. Proper ventilation and fire separation from the rest of the building and other rooms are also crucial.

In terms of dedicated firefighting agents, aside from the use of water, there are no other solutions.

Question 7:

Do electric vehicle fires pose a greater problem than internal combustion engine vehicle fires?

Answer:

The answer was provided by st. bryg. Michał Gigoła, M.Sc. Eng.

In terms of electric vehicle fires compared to internal combustion engine vehicles, the percentage of such incidents is really small, so the scale is limited. Considering fire statistics from the Otwock district, there has been only one incident involving a hybrid-powered vehicle in the past three years.

Question 8:

What is the process of conducting rescue and firefighting operations in the case of electric vehicle fires?

Answer:

The answer was provided by st. bryg. Michał Gigoła, M.Sc. Eng.

In the State Fire Service (PSP), appropriate procedures have been developed for carrying out rescue and firefighting operations related to incidents involving electric or hybrid vehicles. These procedures are frequently updated, and based on them, firefighters are trained, and refresher courses are held with the participation of both PSP and Volunteer Firefighters (OSP). In terms of actual operations, when it comes to a fire involving such vehicles, the primary extinguishing agent is water. During the operation, a water stream is applied, and the batteries are monitored using measurement devices such as thermal cameras and pyrometers. After the operation is concluded, it is necessary to stabilize the vehicle, if possible, by deactivating the battery.

Question 9:

Does the fire department, considering the difficulties in carrying out rescue and firefighting operations with electric vehicles, see the need to limit the possibility of introducing parking spaces for such vehicles in garages?

Answer 1:

The answer was provided by st. bryg. Robert Haponik.

Innovation is advancing so quickly that limiting parking spaces for electric vehicles in garages may not be entirely justified. It will be necessary to find a balance that takes this innovation into account. A few years ago, we were asking similar questions about gas-powered cars (whether they are safe, whether they explode?), and today we are a market with a significant number of these vehicles. The same will likely happen with electric cars. Therefore, it's not about limiting opportunities, but about how we prepare for the upcoming changes – how we prepare the laws, raise awareness among users, drivers, and housing communities. Fire protection aims to reduce the number of fires, but it's important to remember that wherever there is combustible material, the right atmosphere, and an ignition source, the so-called fire triangle, a fire can occur. Therefore, the key is to reduce the probability of fire and minimize the risk of its occurrence. It is crucial to use both domestic and international experience and knowledge to define and implement appropriate legal provisions based on technical knowledge principles to find an optimal approach for new solutions.

Answer 2:

The answer was provided by st. bryg. w st. sp. Paweł Rochala.

As for the statistics on electric vehicle fires, they are quite sparse, mainly due to the relatively small number of such vehicles in Poland. However, global data shows that the number of electric vehicle fires is not significantly different from the number of fires involving internal combustion engine vehicles. It is worth noting that electric vehicles in question are relatively new. When it comes to garage-related issues, however, this problem is much broader than just electric vehicles. In general, modern cars perform worse in terms of fire safety than those for which standards were established several decades ago. The use of thermal insulation materials in vehicles, such as polyurethane foam, which burns very intensely and produces toxic fumes, poses a serious threat. Additionally, most cars are equipped with air conditioning systems that use refrigerants, typically propane. In the case of vehicle damage, propane can be pumped into the cabin through the cooling system. Given these factors, it is clear that regulations regarding garages should be updated not only with electric vehicles in mind but also in relation to other hazards present in modern vehicles.

Question 10:

What is the purpose of the fire protection guidelines for garages in buildings intended for charging electric and plug-in hybrid vehicles (2024)?

Answer:

The answer was provided by Mr Jan Wiśniewski.

The issue of electric vehicle fires is becoming increasingly important for three main reasons. First, the number of such vehicles is still growing. In 2019, there were just over 1,000 fully electric and plug-in hybrid vehicles registered in Poland, while currently, their number has exceeded 130,000. Second, users of these vehicles prefer to charge them from private sources, mainly in single-family homes and underground garages (more than two-thirds of all charging sessions come from private sources). Third, despite continuous amendments to regulations, drivers wishing to install a charger in an underground garage often encounter difficulties. Building administrators often misinterpret or are unaware of the applicable regulations. To simplify the process for all parties involved – vehicle users, building administrators, relevant services, designers, and contractors of garage spaces – special guidelines have been developed. This document is based on numerous foreign studies, tests conducted at CNBOP-PIB, and available materials. The guidelines cover definitions, design, implementation, and operational issues related to garage spaces where electric vehicles will be charged, and also address rescue and firefighting issues. One of the main reasons for creating these guidelines was market feedback indicating the lack of a document that comprehensively addresses these issues. Currently, the guidelines serve as the foundation for many processes related to the installation of such systems in garages.

Question 11:

What false information are we encountering in the context of electric vehicles?

Answer:

The answer was provided by Mr Jan Wiśniewski.

In terms of the most commonly spread false information, one can identify misleading messages regarding the number of electric vehicle fires, which are still relatively few in Poland. According to official PSP (State Fire Service) data, in 2021 there were only two fires involving electric vehicles, in 2022 there were seven, and in 2023, there were 21 recorded fires. Despite the fact that these are isolated cases, they are often treated as sensational news, and the media hastily and unjustifiably attribute these fires to electric vehicles.

Question 12:

What is the safety status of using energy storage systems in conjunction with electric vehicle charging stations?

Answer:

The answer was provided by Mr Mieczysław Wrocławski.

It should be noted that with the increase in the number of electric vehicles, charging stations will also appear more frequently in parking areas. Although in newly developed residential areas it is possible to design installations that ensure the appropriate power level for charging electric vehicles without the need for energy storage systems, these systems will become more common. It is also important to emphasize that there is currently a lack of appropriate regulations and standards that precisely define the requirements for various aspects, including the installation locations for energy storage systems.

Question 13:

Do photovoltaic installations pose a problem during rescue and firefighting operations?

Answer:

The answer was provided by st. bryg. Michał Gigoła, M.Sc. Eng.

If the photovoltaic installation is properly constructed, with the use of circuit breakers and appropriate signage, rescue and firefighting operations are typically carried out based on established procedures. In such cases, the risk is minimized. However, if the installations are built without proper technical knowledge, problems can arise regarding the safety of firefighters during operations. For freestanding installations, ensuring the safety of rescuers is not a major issue. However, when the installation is on a roof, it becomes more problematic, with the highest risk still being associated with unauthorized photovoltaic systems combined with energy storage units built using "DIY" methods.

Question 14:

How does the State Fire Service address preventive measures regarding the introduction of new technologies in buildings, such as photovoltaic installations or electric vehicles?

Answer:

The answer was provided by st. bryg. Robert Haponik.

We primarily rely on technical knowledge and solutions available within the framework of current laws, such as technical conditions that buildings and their location should meet, especially in the case of garages. A key aspect for firefighters is the implementation of passive fire protection, such as the possibility of creating fire zones and installations that allow for fire detection and initial suppression. It is also crucial to create and limit the potential for fire spread. While this may be difficult to achieve in the case of vehicles, it may be easier to implement for energy storage systems. Of course, it is also important to remember that when introducing such storage systems into public utility buildings, we must consider that during a fire, the toxicity of the materials involved will also pose a problem. In contrast, when looking at fires involving internal combustion and electric vehicles, the main difference is the spread of the fire. In the case of electric vehicles, we have a dynamic fire, so one could anticipate safety measures that would limit the dynamics or spread of the fire in its initial phase. On the other hand, with photovoltaic installations, the issue often lies in the lack of detailed information about the installation used. There are often gaps regarding the building where the installation is located, and a lack of knowledge about the structure of the roof on which the system is installed. In summary, regarding fire prevention, the Fire Service currently uses solutions based on the current state of knowledge, experience, and applicable laws, with the body of information applied expanding as new guidelines are introduced and our technical knowledge grows.

Question 15:

Do fire safety regulations take into account protections that ensure an appropriate level of safety when energy storage systems are installed?

Answer:

The answer was provided by st. bryg. Paweł Janik, Ph.D. Eng.

Currently, there are no specific regulations, however, a certain approach has been developed in practice. In most buildings, a fire scenario must be prepared, so the designer and expert should analyse the risk and select appropriate protections based on that risk. However, regulations do not yet exist, and for some time, they likely will not, but at present, it seems that the bigger issue is not the lack of regulations, but rather the fact that we do not have sufficient knowledge of how energy storage systems will behave in the event of a fire and how firefighting operations should be carried out. Based on current knowledge, we know that energy storage systems are a source of not only electrical energy but also energy that can be released in the form of a fire or the creation of explosion hazard zones. Additionally, the issue of thermal runaway and the formation of explosion hazard zones leads to discussions about whether the rooms where energy storage systems are located should be treated as explosion hazard areas, with all the legal consequences and requirements that come with this classification. Regarding rescue operations, ensuring firefighter safety is equally important. This is particularly relevant when energy storage systems are installed in apartments or garages, which cannot be turned off during rescue and firefighting operations. Therefore, operationally, it will be a significant challenge to develop solutions and methods that ensure the safety of responders. In direct response to the question asked, we can identify that there are no direct regulations in place, and worse, we still lack precise technical knowledge on how to address this phenomenon from the perspective of fire safety engineering.

Question 16:

Is it safe to use energy storage systems in apartments?

Answer:

The answer was provided by Zenon Małkowski, Ph.D. Eng.

During tests of prismatic batteries, the flame temperature reached 1500 degrees Celsius and lasted for about 25 seconds, which means it was a very short but extremely intense fire. Additionally, the fire in this case was caused by an explosion. From this study, we can observe and visualize the scale of the problem that arises when both of these factors occur one after the other. Therefore, in domestic applications, where there is still a great deal of fear regarding batteries, it seems that modern lithium-ion batteries are not suitable. It is important to emphasize that in this topic, trust in the energy storage systems used is key; society needs to be convinced that these solutions are safe.

Question 17:

What are the safe distances from electro-chemical storage facilities?

Answer:

The answer was provided by st. bryg. w st. sp. Paweł Rochala.

This is a highly debated issue; however, for example, the distance between an energy storage facility (located outside a building) and evacuation routes should be at least one and a half meters. It is also recommended that energy storage systems used in a facility be located in the technical part of the building, rather than in residential areas or near evacuation routes. Generally, it is advised that storage systems be enclosed and positioned as far away from people as possible.

Question 18:

What are the biggest challenges faced by energy storage designers operating in the Polish market?

Answer:

The answer was provided by Piotr Szczeciński, Ph.D. Eng.

There are many issues. One of the more problematic aspects is access to water, specifically to water supply systems, where designers currently utilize the option of introducing large water tanks. However, water itself also raises concerns regarding the handling of large amounts of contaminated water after a fire. At present, there are no guidelines that provide consistent directions and recommendations to avoid certain design errors at an early stage while still meeting all safety requirements. Currently, during the design phase, energy storage facilities are treated similarly to refineries, with the highest fire safety requirements and restrictions applied.

Question 19:

How to approach the analysis and assessment of the threat posed by energy storage facilities?

Answer:

The answer was provided by st. bryg. Paweł Janik, Ph.D. Eng.

This is both a question and a challenge, and developing guidelines will help us find an answer. The goal is to strive for the simplest possible form of this assessment so that it can be widely applied. Currently, it is planned to recommend in the guidelines the use of a prepared checklist, divided into three sections, identifying small, medium, and industrial installations, which would allow for an assessment of the safety level.

Question 20:

What is the insurers' approach to energy storage insurance as of today?

Answer:

The answer was provided by Dariusz Gołębiewski, Ph.D. Eng.

The current approach of insurance companies to this issue is very pragmatic. Insurance companies base their assessments on risk, understood as a combination of two factors: probability and consequences. Regarding energy storage facilities, we cannot yet say much about probability due to the limited amount of available data, which forces us to focus on consequences. Therefore, at present, no insurance company will insure an energy storage facility located inside a high-value industrial plant, as the consequences of a fire would be extremely severe. As a result, the separation of storage facilities is crucial, meaning the establishment of an appropriate distance between the energy storage facility and buildings. In industrial plants, this distance is typically set at a minimum of 15 meters, unless the storage facility is enclosed by a fire-resistant wall that can effectively separate the two complexes. Additionally, it's worth mentioning that insurers are cautious about the use of active systems, generally assuming during risk assessments that these systems may not function correctly. In the future, the adoption of flow batteries could be considered, as they offer a significantly safer alternative compared to the currently used battery technologies.

Question 21:

Are insurers working on developing their own safety standards that will condition the insurability of energy storage?

Answer:

The answer was provided by st. bryg. Paweł Janik, PhD Eng.

Insurers are, of course, working on standards that will largely focus on separation and ventilation. It's important to realize that we are dealing with a rapidly evolving field, where no standards or regulations can keep pace with the relentless technological progress. Therefore, when discussing a standard that takes years to develop, we must acknowledge that by the time it is published, the technological landscape will likely have already shifted. As a result, insurance companies strive to respond swiftly to new incidents and damages to incorporate them as updates to existing standards. In essence, we can say that the standard learns about new risks in real-time.

Question 22:

Can battery management systems (BMS) or energy flow management (EMS) be used to improve fire safety?

Answer:

The answer was provided by Mr Krzysztof Bukała.

These are excellent tools for fire protection systems. Energy storage facilities are equipped with numerous IT and measurement systems using open communication standards, which can be integrated with fire detection systems. These systems provide access to a wealth of useful information, such as internal and external temperature measurements of each cell, real-time temperature rise data, and can also include essential physico-chemical information for firefighters about each cell. This integration appears to be a key factor in the development of this market segment, as it enhances safety, facilitates more effective emergency responses, and allows for proactive monitoring and risk mitigation.

4.4. Fourth session – Partner Presentations and Discussion

During the final session of the conference, moderated by Jacek Roguski, PhD Eng., Prof. of the Institute, the following presentations were delivered:

1) Information on the Development of Fire Protection Guidelines for Energy Storage Facilities – presented by Jarosław Tępiński, Ph.D. Eng.
2) Safe Energy Storage Concepts in Urban Areas – SEKUR – presented by Ms Philine Mielisch, M.Sc.
3) Polish Technology for Extinguishing Lithium-Ion Batteries: Fire Safety of the Green Transformation – presented by Ms. Diana Kuprianow, President of the Management Board, VERMICULITE POLAND Sp. z o.o.
4) Mass Adoption of Home Energy Storage Systems – Trends and Needs in Emergency and Fire State Detection – presented by Mr. Jarosław Wiche, M.Sc. Eng., President of the Management Board, NEURON Sp. z o.o. Sp. k.

5) Localized Fire Suppression Systems, iSprink Type – Case Studies – presented by Mr Dariusz Kot, Gras PPPH.
6) Batteries and Energy Storage Facilities in the Context of Fire Safety – presented by Mr. Grzegorz Sypek, M.Sc. Eng., Warsaw Branch of SITP.

4.4.1. Information on the Development of Fire Protection Guidelines for Energy Storage Facilities

Jarosław Tępiński, Ph.D. Eng. discussed the currently developed guidelines, which are being created through collaboration among experts from various fields, including the Scientific and Research Centre for Fire Protection (CNBOP-PIB), the Polish Chamber of Energy Storage and Electromobility (PIME), and the Association of Fire Protection Engineers and Technicians (SITP). Representatives from the Headquarters of the State Fire Service (KG PSP) and the National Association of Fire Protection Equipment and Rescue Equipment Manufacturers (OSPZPiSR) have also been invited to participate in the development process. The primary objective of these guidelines is to establish conditions for fire protection and the safe operation of electrochemical energy storage facilities. Work on the document began in August 2024, with the goal of creating recommendations that consider legal and regulatory foundations, analyses of past fire incidents, and the results of research conducted both internally and by other scientific institutions. The guidelines will include definitions and classifications of energy storage systems, requirements for designing, constructing, and operating energy storage facilities, principles for firefighting and rescue operations, as well as risk assessment related to the location and usage of storage systems, divided into home, industrial, and large-scale storage facilities. The planned completion date for the guidelines is 2025. These guidelines aim to provide a comprehensive and consistent framework for improving safety standards in the rapidly evolving field of energy storage.

4.4.2. Safe Energy Storage Concepts in Urban Areas – SEKUR

Ms. Philine Mielisch, M.Sc., presented information on the SEKUR project (Safe Energy Storage Concepts in Urban Areas), which was launched in April 2024 and is planned to be completed within two years. Statistical data shows that there are currently approximately 1.6 million energy storage systems installed in Germany, primarily in households. Together with photovoltaic systems, these installations are rapidly increasing in number. The project has identified multiple risks associated with battery storage systems, highlighting challenges for firefighters and building occupants, including:

- Electrical or thermal overload,
- Mechanical damage,
- Internal short circuits,
- Fires occurring near energy storage units,
- Water damage.

It has also been shown that the most common causes of energy storage fires are electrolyte contamination during production, improper storage, indirect fire hazards, excessively high temperatures (in summer) or excessively low temperatures (in winter), damage during installation, an energy storage system incompatible with the photovoltaic system, improper installation, and mechanical damage.

The consequences of incidents involving energy storage systems may lead to:

- the spread of fire,
- thermal runaway (temperatures reaching up to 800 degrees on the surface),
- the release of toxins affecting the respiratory system (e.g., hydrofluoric acid),
- explosions,
- chemical substance leakage.

For firefighters, the lack of information regarding the location of these energy storage systems (most commonly identified locations include basements, garages, and attics) poses a problematic and hazardous challenge. Additionally, they often have to deal with installations created using "DIY" methods, which do not adhere to appropriate safety standards or technical knowledge.

The main objectives of the ongoing project are to develop an early detection and notification system dedicated to firefighters (providing information about gases, temperature, and the system's location) and to residents of households (warnings and information in visual and acoustic forms). Additionally, key outcomes of the project, specifically for the Dortmund Fire Department, include simplifying operational planning, saving time on exploration, minimizing risks, increasing safety for firefighters and residents, and improving fire prevention.

4.4.3. Polish Technology for Extinguishing Lithium-Ion Batteries: Fire Safety of the Green Transformation

Ms. Diana Kuprianow presented data on lithium-ion battery firefighting methodologies, identifying that in the era of the green transition, lithium-ion battery technology plays a key role in daily life. Despite their convenience and durability benefits, these batteries can pose a fire hazard. Currently, several extinguishing agents are used, including:

- **Water-based agents** – These use water in the form of mist or stream for cooling and extinguishing fires. Their advantage lies in their high cooling capacity and the ability to modify their chemical composition, reducing the risk of reignition. However, their effectiveness is limited in large fires, and the use of water can lead to short circuits.
- **Powder agents** – These involve the use of powders to quickly suppress flames. They provide rapid extinguishing of open flames but have low cooling capacity and an increased risk of reignition.
- **Gaseous agents (CO_2)** – Such as carbon dioxide, which reduces oxygen levels to extinguish the fire. They are effective in enclosed spaces and quickly lower the temperature, but their efficiency decreases in open spaces, and there remains a risk of reignition.

- **Foam agents** – These use specialized foams that cover burning surfaces and block oxygen access. They are effective in extinguishing open flames and preventing fire spread. However, their cooling capacity is low, which may also lead to a risk of reignition.

It can also be observed that water is the most commonly used agent for extinguishing lithium-ion battery fires due to its effectiveness as a cooling medium. Depending on the situation, powder, gaseous, and foam agents are also employed. Each of these methods has its advantages and disadvantages, and their common characteristic is the risk of lithium-ion batteries reigniting. Another key challenge is limiting the release of harmful substances during fires and minimizing environmental damage caused by contaminated water after extinguishing. As a result, fire extinguishing agents specifically designed for combating lithium-ion battery fires are being developed. In response to this need, a method using dispersive and granular fire extinguishing agents based on vermiculite (a natural mineral) has been created. The effectiveness of vermiculite application stems from the following aspects:

- **Even Distribution:** Water dispersions with vermiculite allow for uniform surface coverage, which enhances firefighting effectiveness. Mechanism of action: vermiculite particles consist of thin, flat flakes containing microscopic water layers. The flakes formed in the dispersion settle on the surface of the burning fuel, creating a protective layer over the fire. This layer dries out, and thanks to the high surface-to-volume ratio, the vermiculite particles overlap and bond, forming a barrier between the fuel and the atmosphere,
- **High-Temperature Resistance, Non-Flammability (Class A1):** Vermiculite retains its properties at high temperatures (up to 1200°C), making it effective under intense combustion conditions. Even in fully developed fires, it does not ignite. Cooling effect: this process has a cooling effect on the fuel source. As the liquid contained in the vermiculite dispersion evaporates, vermiculite particles begin to accumulate, helping to control the fire.
- **Absorption of Toxins and Smoke:** Vermiculite has a high cation exchange capacity, enabling it to effectively bind various ions. The material also exhibits excellent insulating properties, and in the form of a water dispersion, it can absorb toxic substances released during combustion, reducing environmental harm,
- **Lightweight and Voluminous Structure:** Thanks to its lightweight and voluminous nature, vermiculite can quickly cover large surfaces. As a good insulating material, it creates a fire barrier, preventing the fire from spreading. Its structure consists of thin, flat flakes, and due to a high surface-to-volume ratio, vermiculite particles overlap and bond, forming a barrier between the fuel and the atmosphere.
- **Chemical Inertness:** Vermiculite is chemically inert, making it safe for use in various conditions without causing unwanted reactions.

4.4.4. Mass Adoption of Home Energy Storage Systems – Trends and Needs in Emergency and Fire State Detection

Jarosław Wiche, M.Sc. Eng. discussed issues related to home energy storage systems, including their applications, fire risks, and hazard detection methods. It was identified that lithium-ion batteries have a high calorific value of 5.8 kWh/l (for comparison, gasoline has 8.6 kWh/l), making them highly flammable and hazardous materials. Considering the associated risks, ensuring an adequate level of protection for these systems is extremely important. Traditional fire detection methods, such as smoke and temperature detection, are insufficient because smoke appears only in the advanced stages of a fire. Therefore, it is essential to implement hazard prediction systems that operate proactively. A key element of safety is the Battery Management System (BMS), which monitors the battery's technical parameters, such as temperature, voltage, and current, enabling early detection of issues such as overheating or current surges. It is also crucial to integrate the BMS with safety systems, conduct infrared thermographic analysis, and ensure the detection of explosive gases that may be emitted by batteries during their "swelling" process.

4.4.5. Localized Fire Suppression Systems, iSprink Type – case study

Mr Dariusz Kot began by presenting data from South Korea (2021), which indicates that fires in electric and internal combustion vehicles occur at a similar frequency. However, fires in electric vehicles are more dynamic, necessitating faster and earlier intervention. Nevertheless, it is important not to demonize electric vehicles as the worst fire hazard source. The most commonly used systems for extinguishing electric vehicle fires in garages are indoor fire hydrants for personal use or sprinkler systems, which, unfortunately, are not always available in garages. The use of indoor hydrants is legally required under the provisions of the Regulation of the Minister of Interior and Administration of 7June 2010, on fire protection of buildings, other construction facilities, and areas. In §19.2, it is specified that Type 33 hydrants must be installed in garages:

- Single-story enclosed garages with more than 10 parking spaces;
- Multi-story garages.

The regulation also specifies the minimum water flow rate measured at the nozzle outlet, identifying:

- For hydrant 25 – 1.0 dm^3/s;
- For hydrant 33 – 1.5 dm^3/s (approx. 5400 l/h) – 90 l/min;
- For hydrant 52 – 2.5 dm^3/s (approx. 9000 l/h) – 150 l/min.

In order to combine both solutions and achieve both availability and effectiveness of the equipment, a device has been developed that utilizes the hydrant infrastructure to supply water from the sprinkler system. This internal hydrant set, due to its early fire detection and location capabilities, is used for suppressing and controlling the fire in its initial phase, preventing the fire from spreading to other vehicles.

4.4.6. Batteries and Energy Storage Facilities in the Context of Fire Safety

Mr. Grzegorz Sypek, MSc, addressed the topic of fire safety for batteries and energy storage systems, focusing on lithium-ion cells. He presented the main causes of failures in these cells, including mechanical damage, exceeding operational parameters (voltage, current, temperature), and their consequences, such as thermal runaway. It was identified that, once thermal runaway occurs, the reaction produces explosive gases like hydrogen and methane. During the presentation, the importance of the so-called "window of stable cell operation" was emphasized, which defines the range of safe operational parameters. Exceeding the critical temperature leads to an automatic thermal runaway reaction. In terms of fire protection, the critical role of the Battery Management System (BMS) was highlighted, as it is responsible for precisely controlling the operational parameters of the cells and preventing failures. It was also emphasized that this system should be equipped with redundancy, be free from programming errors, and provide adequate cooling of the cells, as well as module separation to limit fire propagation. Current methods for assessing the consequences of fires were also presented, including real-scale tests and computer simulations that predict the behaviour of lithium-ion modules under emergency conditions. At the end of the presentation, three methods for reducing fire hazards in lithium-ion modules were identified:

- ❖ The necessity to develop and implement cells and BMS dedicated to energy storage applications.
- ❖ The use of solutions that enable early detection of fire hazards.
- ❖ The application of combined passive fire protection measures and water-based systems for fire suppression.

4.5. Thesis and conclusions

Contemporary challenges related to the implementation of modern technologies, such as energy storage systems, photovoltaic installations, and electric vehicles, require a comprehensive approach to fire safety issues. During the conference, key issues were identified in the form of relevant theses categorized into the following areas:

1. **Challenges of New Technology Security:**
   - ❖ The development and widespread use of new technologies, including but not limited to photovoltaic installations, energy storage systems, electric vehicles, smart home systems, robotics, etc., require the adaptation of regulations and fire protection measures.
   - ❖ Widely used lithium-ion batteries can pose a significant threat due to the possibility of thermal runaway, leading to explosions and fires.
2. **Key Role of Battery Management Systems (BMS):**
   - ❖ BMS systems are essential for monitoring and early detection of hazards, such as overheating or voltage spikes in battery cells.
   - ❖ BMS, therefore, must be reliable, fault-tolerant, and integrated with other safety systems.
3. **Need for Guidelines and Regulations:**

- Currently, there is a lack of dedicated, detailed regulations and requirements regarding fire protection for energy storage systems.
- The guidelines being developed should take into account the requirements for the design, installation, and operation of energy storage systems, as well as rescue procedures.

4. **Advanced Fire Protection Methods:**
   - The development of new technologies is accompanied by the advancement of fire protection measures, including their adaptation to identified hazards.
   - The introduction of new extinguishing agents, systems, and solutions is aimed at improving the safety of new technologies.
5. **Robotics and Artificial Intelligence in Fire Protection:**
   - These technologies assist in early hazard detection, risk analysis, and the effective execution of rescue operations.

During the conference, a comprehensive analysis of the topics outlined above was conducted, highlighting the need for the implementation of advanced protection systems and the development of new standards and guidelines. The following conclusions summarize the key areas that require attention in order to ensure the safety of users and infrastructure.

1. **Development of New Technologies and Their Security:**
   - There is a need to further develop detection and extinguishing systems that are tailored to the specifics of lithium-ion batteries and other widely used modern technologies.
2. **Education and Public Awareness:**
   - It is essential to raise awareness about the risks and the proper operation of energy storage systems, especially in home environments.
3. **International Cooperation:**
   - The exchange of experiences and knowledge between countries and different industry sectors is crucial for developing effective solutions.
4. **Need for Investment in Research and Development:**
   - Testing in real-world conditions and computer simulations are essential for properly identifying the hazards of new technologies and effectively countering them.
5. **Standardization of Rescue Operations:**
   - Fire departments should have access to detailed procedures and tools that enable effective action in the event of fires related to new technologies.
6. **Future Perspective:**
   - Energy storage systems will play an increasingly important role in the energy transition, which requires their specific characteristics to be considered in fire safety strategies.

4.6. Conclusion and Summary of the Conference

During the conference, key aspects of fire safety related to photovoltaic installations, energy storage systems, electric vehicles, and other modern technologies were discussed. Both technological and regulatory challenges were addressed, with particular emphasis on the need to develop new standards, guidelines, and fire risk management systems.

Key conclusions include the need for the development of advanced threat detection and prediction systems, such as Battery Management Systems (BMS), which are essential for ensuring the safety of both domestic and industrial energy storage systems. The importance of scientific research and real-world testing was also highlighted, as these help to better understand the risks and develop effective protective measures.

Participants also emphasized the significance of international cooperation, knowledge exchange, and the inclusion of various stakeholders—from fire services, technology manufacturers, to end-users. The organizers of the conference expressed gratitude to all co-organizers and participants, underlining the importance of joint efforts in ensuring the safety of new technologies. They also expressed hope for the continuation of such initiatives and encouraged the use of educational materials available on the CNBOP-PIB website.

In presenting this report, the conference organizer extends thanks to its co-organizers and participants and invites them to engage in future initiatives within the CNBOP-PIB's "Safety of New Technologies" program. It is hoped that upcoming events will receive the same level of interest, lively discussion, and constructive, practical conclusions as this year's BNT III conference. Video materials from the conference and educational resources will be made available on the CNBOP-PIB website: https://www.cnbop.pl/.

Chairman of the Scientific Committee of the Conference
st. bryg. Jacek Zboina, D.Sc., Ph.D. Eng.