



**INTERNATIONAL FRAMEWORK FOR NUCLEAR ENERGY  
COOPERATION**

**INFRASTRUCTURE DEVELOPMENT WORKING GROUP WORKSHOP**

**NUCLEAR ENERGY BEYOND ELECTRICITY**

**Programme**

**24 - 25 September 2019**

**Ministry of Energy, Warsaw, Poland**

# Foreword

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The Infrastructure Development Working Group (IDWG) supports the development of the infrastructure needed to ensure that the use of nuclear energy for peaceful purposes proceeds in a manner that is efficient and meets the highest standards of safety, security and non-proliferation. Particular areas of emphasis include human resource development, radioactive waste management, small modular reactors, nuclear safety and regulation, nuclear security and emergency preparedness and response.

The topic of this IDWG workshop is "nuclear beyond electricity". Nuclear technology is today widely used to produce electricity without a negative impact on the environment. No harmful emissions, small footprints of nuclear power plants, relatively small amount of waste, are some of the key features of nuclear technology. Electricity however is only 18% of the energy used worldwide. The rest is mostly heat generation and transport, today almost entirely produced by high emission sources.

Industrial heat production, district heating by cogeneration of electricity and heat, hydrogen and synthetic fuels for transport could and should be the new territory conquered by nuclear energy, especially with a view to help decarbonise those sectors. The IDWG workshop will discuss the broad topics of non-electric applications of nuclear energy, and then will address the key role that High Temperature Reactors (HTRs) could play to provide both electricity and process heat applications. The last session of the workshop will focus on the role of hydrogen, one of the most promising low carbon energy vectors - which can be produced thanks to nuclear energy, and in particular from HTRs, and discuss other innovations such as micro-reactors.

Participants of the workshop are also invited to visit the National Centre for Nuclear Research NCBJ, involved i.a. in development of High Temperature Gas-cooled Reactors. The portfolio of NCBJ is wide, spanning from basic research in physics, through applied research on materials, detectors and accelerators, up to commercial production of radioisotopes and particle accelerator for science, medicine and industry. More details are included in this programme.

We look forward to welcoming you in Warsaw,

Al Burkart and Zbigniew Kubacki,  
IDWG Co-chairs

# Day 1 - 24 September 2019

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8:00 - 9:00	<b>Registration &amp; coffee</b>
9:00 - 9:20	<b>Opening Remarks</b> <ul style="list-style-type: none"><li>• IDWG co-chairs Zbigniew Kubacki and Al Burkart</li><li>• NCBJ Director General Krzysztof Kurek</li></ul>
9:20 - 9.30	Official group photo
<b>Session I</b>	<b>Non-electric applications of nuclear energy - economic and environmental benefits</b>
9:30 - 9:50	<b>Environmental aspects of energy production and cogeneration</b> , Professor Andrzej Chmielewski, Director of the Institute of Nuclear Chemistry and Technology
9.50 - 10:10	<b>Role of nuclear cogeneration in a low Carbon energy future</b> , Henri Paillère, NEA
10:10 - 10:30	<b>IAEA Activities on Non-electric Applications of Nuclear Energy</b> , Ibrahim Khamis, IAEA
10:30 - 10:45	Q&A
10:45 - 11:00	<i>Coffee break</i>
<b>Session II</b>	<b>High Temperature Reactors - beyond electricity generation</b>
11:00 - 11:25	<b>Very High Temperature Reactor, a Gen IV System</b> , Li Fu, Tsinghua University, on behalf of Gen IV International Forum VHTR system steering committee
11:25 - 11:50	<b>Scientific project for HTR in Poland</b> , Pawel Sobkowicz, Deputy Director General, NCBJ
11.50 - 12:15	<b>Chinese HTR program</b> , LI Fu, Tsinghua University
12:15 - 12:40	<b>Russian HTR program</b> , Vladmir Artisyuk, Rosatom
12:40 - 13:05	<b>Japanese HTGR development program</b> , Taiju Shibata, JAEA
13:05 - 13:15	Q&A
13:15- 14:30	<i>Lunch</i>

**Session III      Future role of Hydrogen and development of innovative nuclear systems**

**14:30 - 15:00            The Future of Hydrogen, Uwe Remme, IEA**

**15:00 - 15:20            Nuclear production of hydrogen, Xing Yan, JAEA**

**15:20 - 15:40            Micro-reactors for special applications and fuel cycle, Chris White, URENCO**

**15:40 - 16:30            Micro Modular Reactor, Francesco Venneri, Ultra Safe Nuclear Corporation**

**16:30 - 16:50            Nuclear Innovation 2050: HTGR cogeneration, Grzegorz Wrochna, NCBJ**

**16:50 - 17:15            Q&A**

**17:15 - 17:25            Summary of discussions, IFNEC Technical Secretariat**

**17:25 - 17:30            Closing remarks from the Co-chairs**

**18.00                      Official dinner hosted by the Ministry of Energy**

## Day 2 - 25 September 2019 - OPTIONAL

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9.00 - 15.00

### Technical visit to the NCBJ laboratories

The MARIA research reactor is located in the National Centre for Nuclear Research about 30 km south-east of Warsaw (about 5 km east of Otwock). The NCBJ provides bus transport for guests visiting the NCBJ.

The tour will include a visit to:

- control room and preparatory hall of the reactor Maria (30 MW),
- NCBJ computing centre CIS,
- bunkers for testing accelerators,
- exhibition of Education and Training Division,
- Labs of Science and Technology Park PNT.

The bus from Warsaw to NCBJ departs from Wspólna Str. 6 (at the entrance of the Ministry of Energy) at 9.00 am. Return from NCBJ to Warsaw no later than at 3.00 pm.

# Practical information

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## Location of the meeting

Ministry of Energy Headquarters  
Room 116 (1<sup>st</sup> floor)  
ul. Krucza 36/Wspólna 6  
Warsaw, Poland

Please remember to bring your ID or passport to the meeting. It is necessary to issue a pass to the building.

## Equipment available for the presentation

The meeting room is equipped with projection directly from a personal computer (available in the meeting room).

## Transportation

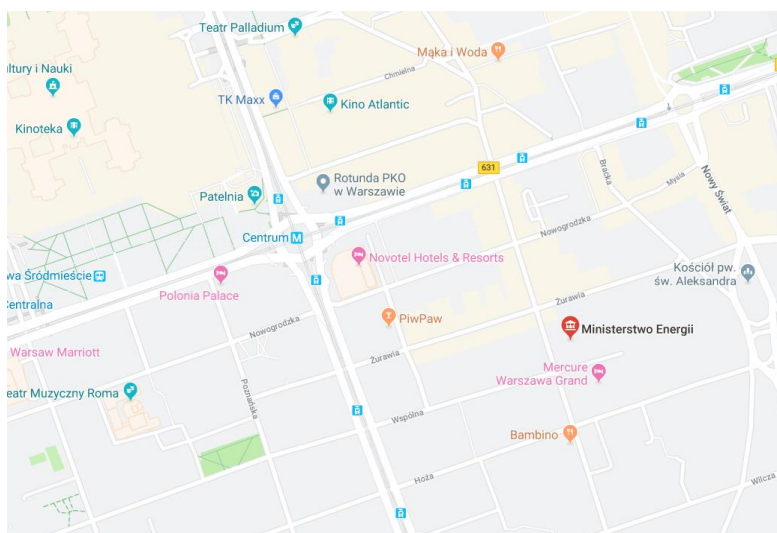
The Ministry of Energy Headquarters is close to metro and bus lines (<https://www.ztm.waw.pl>, <https://jakdojade.pl/warszawa/trasa/>). It is 10 minutes' walk from the Centrum subway station, 5 minutes' walk from the tram stop. There are many bus stops nearby.

## Accommodation

There are a number of hotels close to the Ministry of Energy Headquarters, but the Ministry of Energy made a reservation for 40 participants in the Hotel Mercure Warszawa Grand. The Hotel is close to the Ministry of Energy (only 3 minutes' walk).

<https://www.accorhotels.com/pl/hotel-3384-mercure-warszawa-grand/index.shtml> (Polish)

<https://www.accorhotels.com/gb/hotel-3384-hotel-mercure-warszawa-grand/index.shtml> (English)



## Visas

Participants who require a visa to enter Poland should request a letter from the Ministry of Energy as soon as practical to support your travel.

## Free time

You can find directions on where to go on the website:

<https://warsawtour.pl/en/main-page/>

<https://warsawtour.pl/en/brochures/>

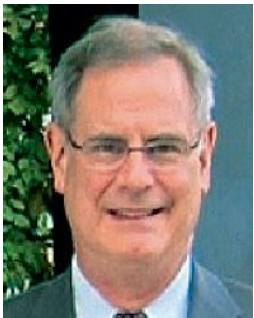
# Speakers

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## Zbigniew KUBACKI, Deputy Director Nuclear Energy Department Ministry of Energy, Poland

In 1979 Mr. Zbigniew Kubacki completed his university education at the Warsaw School of Economics. In 1984-85 he finished post-graduate management studies at the A/M University. He actively participated in various specialized courses and professional programs, devoted to the problems of nuclear energy, management and international economic relations. He sits on the Boards, Technical Working Groups and Committees at the Nuclear Energy Agency and the International Atomic Energy Agency (IAEA). In 2005-2011 he served as Minister Counselor/Head of the Economic and Commercial Division of the Embassy of the Republic of Poland in Washington, supervising inter alia US - Polish cooperation in energy sector. In July 2011, he was promoted to the position of the Director of the Nuclear Energy Department at the Ministry of Economy. His main responsibility was the development of the Polish Nuclear Power Program. After the creation of the Ministry of Energy in 2016, he was appointed Deputy Director of the Nuclear Energy Department, supervising its legal division, international and nuclear infrastructure section. He is the author of several publications on nuclear energy and international economic relations.



## Alex BURKART, Senior Level Advisor for Nuclear Energy Bureau of International Security and Non-proliferation Department of State, United States

Alex R. Burkart is the Senior Level Advisor for Nuclear Energy in the Bureau of International Security and Nonproliferation of the Department of State. Dr. Burkart has been with the U.S. Government for over 40 years in a variety of positions related to nuclear energy and nuclear nonproliferation. His current areas of focus are international nuclear cooperation, the responsible development of nuclear energy in newcomer countries, proliferation resistance and advanced nuclear technologies. He is a member of the IAEA's Technical Working Group on Nuclear Power Infrastructure. Alex Burkart holds a B.S. and a Ph.D. in Nuclear Engineering from North Carolina State University and is a Distinguished Graduate from the Industrial College of the Armed Forces. He is a member of the American Nuclear Society and a licensed Professional Engineer in the State of Virginia.



## Krzysztof KUREK, Director, National Centre for Nuclear Research, Poland

Prof. Krzysztof Kurek graduated from the Warsaw University of Technology Technical Physics and Applied Mathematics Faculty in 1980. His PhD on hadrons, partons, quarks and chromo-dynamics was defended at Warsaw University Physics Faculty in 1986. In 2012, he finished his DSc proceedings with a thesis entitled "Understanding the Nucleon's Spin Structure. The Direct Gluon Polarisation Measurement at the COMPASS Experiment". In 2019 he was awarded the title of professor. His professional interests include physics of elementary particles/particle interactions, quantum field theory (in particular quantum chromo-dynamics), structure of the nucleon, application of neuron networks in high energy physics. Professor Kurek worked on high energy physics experiments with muon beams in CERN, and is a member of the Polish team working on the LHCb experiment run at the LHC accelerator also in CERN. Author or co-author of more than 250 papers published in international recognized scientific journals. Former Head of NCBJ PhD Studies and former NCBJ Scientific Secretary, he is the NCBJ Director General since 25 October 2015.



### Andrzej Grzegorz CHMIELEWSKI, Director, Institute of Nuclear Chemistry and Technology, Poland

Andrzej Grzegorz Chmielewski graduated from the Warsaw University of Technology in 1967 where he obtained his Ph.D. (1974) in chemistry and D.Sc. (1984) in chemical engineering. He was appointed Titular Professor in 1992. 15 Ph.D. theses and over 70 M.Sc. diploma theses were performed under his supervision. In 1967-1983 and 2002-2013 he was employed at the Warsaw University of Technology (Institute of Process and Chemical Engineering). In the period 2003-2005 he was employed by the IAEA Department of Sciences and Applications, to oversee scientific and technical programs in the field of radiation technology. Since 1983 he has been working at the Institute of Nuclear Chemistry and Technology, at the beginning as Head of the Department, and from 1986 to 2001 as Scientific Director of the Institute. He became Director of the Institute in 2008. He is a Board Member and Director of International Irradiation Association and Deputy Chairperson of the Council for Nuclear Safety and Radiological Protection. He lectured in many universities around the world, and served as UN experts in many countries. He is the author and co-author of over 150 papers, seven textbooks and monographies, and over 60 patents. In 1999, he was awarded the title "Engineer of the Year" by the prestigious Polish professional journal "Technical Review", and many international and national distinctions, including Chevalier and Officer Crosses of Polonia Restituta by the President of the Republic of Poland. He has been a member of the Polish Engineering Academy since 2003.



### Henri PAILLÈRE, Deputy Head, Division of Nuclear Technology Development and Economics, OECD Nuclear Energy Agency

Dr. Paillère is the Deputy Head of the Division of Nuclear Technology Development and Economics at the OECD Nuclear Energy Agency (NEA) which he joined in October 2011. He contributed to several NEA publications, including *Nuclear Energy Today*, *Nuclear Energy: Combating Climate Change* as well as the *Nuclear Technology Roadmap* published jointly with the International Energy Agency. He is working on studies on the resilience of nuclear power plants against extreme weather events, the assessment of non-electric applications of nuclear energy, and the role of advanced reactor technologies. He also coordinates the NEA Technical Secretariat activities of two important international initiatives, the *Generation IV International Forum* (GIF) and the *International Framework for Nuclear Energy Cooperation* (IFNEC). Before joining the NEA, he worked for 13 years at the French Alternative Energies and Atomic Energy Commission (CEA) and for three years at Alstom Power company.



### Ibrahim KHAMIS, Senior Nuclear Engineer, Project Manager for Non-Electric Applications of Nuclear Power

Dr. I. Khamis has earned his M.Sc. (1986) and Ph.D. (1988) in nuclear engineering from the University of Arizona, Tucson, Arizona, USA. Currently, he is the Project Manager of the Non-electric applications of nuclear energy at International Atomic Energy Agency (IAEA).

His duties involve activities related to non-electric applications of nuclear energy i.e. for seawater desalination, hydrogen production, district heating and other industrial applications. During his career, he has authored and co-authored more than 150 refereed journal and conference papers, book chapters, and technical reports. His main interest is non-electric applications of nuclear energy, simulation and tools development, and safety of nuclear reactors.





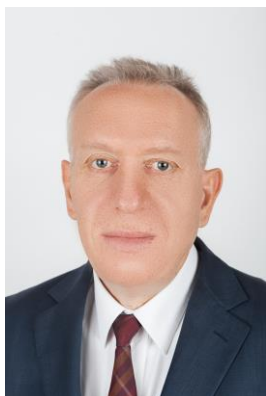
**Fu Li, Deputy Chief Engineer, Institute of Nuclear and New Energy Technology (INET), Tsinghua University**

Prof. Li Fu is deputy chief engineer of Institute of Nuclear and New Energy Technology (INET), Tsinghua University, China. He earned his bachelor and Ph.D. from Tsinghua University, majored in Nuclear Engineering. After that he worked at INET, Tsinghua University. He works at fields of reactor Physics, digital I&C, general design of HTGR, besides the supervision of Ph.D. students in the University. Now he is the Chinese representative to Generation IV International Forum System Steering Committee for the Very High Temperature Reactor (VHTR).



**Paweł SOBKOWICZ, Deputy Director for Innovation and Commercialization, National Centre for Nuclear Research (NCBJ), Świerk, Poland**

With a PhD in theoretical physics, he worked between 1982 and 1993 at the Institute of Physics, Polish Academy of Sciences. Author of 56 research papers, cited over 400 times. Since 1993, he has been a member of management teams of several high-tech companies, both international (Silicon Graphics Inc. Network Appliance Inc., Fujitsu-Siemens Corporation, Bull) and Polish. In June 2012, he joined the National Centre for Nuclear Research, with the task of managing the technology transfer processes and management of commercialization efforts. The experience gathered during the 20 years of commercial career covers many aspects, including human resources management, financial planning, sales management and general understanding of the decision processes in commercial environments. It is especially important in the context of efficient cooperation between the research communities and industry. Since 2018, in addition to the duties of Deputy Director of NCBJ, Dr Sobkowicz is the Scientific Operations Director of the NOMATEN Centre of Excellence in Multifunctional Materials for Industrial and Medical Applications, which has received the prestigious grant in the EU Teaming for Excellence programme in 2019.



**Vladimir ARTISYUK, Councilor, Advisor to Director General, State Atomic Energy Corporation "Rosatom"**

Vladimir Artisyuk has PhDs in Nuclear Engineering from Obnisk Institute for Nuclear Power Engineering (1990, Russia) and Tokyo Institute of Technology (1997, Japan). He is a summa cum laude Engineer from the Moscow Engineering & Physics Institute (MEPhI), where he specialized in Nuclear Power Plants and Facilities. He has over 200 publications in leading scientific journals on transmutation of nuclear wastes and advanced fuel cycles with increased proliferation resistance to unsanctioned proliferation of nuclear materials.

He has been a coordinator of Russian training programmes to provide nuclear knowledge transfer in support of national nuclear infrastructure development in embarking states. Since November 2018, he is a Vice Chair of IFNEC's Steering Group.



### **Taiju SHIBATA, Leader, International Cooperation Group, Japan Atomic Energy Agency (JAEA)**

Dr. Taiju SHIBATA is the Leader of International Cooperation Group, Sector of Fast Reactor and Advanced Reactor Research and Development of JAEA. He is in charge of promotion of international cooperation related to R&D and deployment of HTGR. His research background is application of graphite material to HTGR. He had worked as a member of Materials Project Management Board of VHTR in GIF for a several years and currently he is a member of GIF Expert Group from 2018. He is engaged in the activities of TWG-GCR and TWG-SMR in the IAEA as a member of Japan. Recently, he played a key role to organize the JAEA's Side Event concerning the near-term SMR deployment based on Japanese HTGR technologies in the IAEA General Conference in this year.



### **Uwe REMME, Energy Modeller, International Energy Agency**

Uwe Remme leads the energy supply-side analysis within the Energy Technology Policy Division of the International Energy Agency (IEA). He has more than fifteen years' experience in the analysis of energy systems and technology policies.

Prior to joining the IEA, he worked as researcher at the University Stuttgart on several national and European projects in the fields of energy systems modelling and technology assessment. Uwe studied chemical engineering at RWTH Aachen University, Germany, and Carnegie Mellon University, Pittsburgh, and completed a PhD degree in mechanical engineering at the University Stuttgart.



### **Xing L. YAN, Deputy Director of Reactor Systems Design Department, Japan Atomic Energy Agency**

Xing L. Yan is Deputy Director of Reactor Systems Design Department, the Sector of Fast Reactor and Advanced Reactor Research and Development, Japan Atomic Energy Agency. He leads design of advanced reactor systems and associated development and innovation for fuels, materials and components. He has taken part in various international programs, among the current are IAEA Coordinated Research Project on Near-term Deployment of Nuclear Hydrogen, OECD Ad Hoc Expert Group on Nuclear Cogeneration, and OECD/NEA LOFC advanced reactor safety demonstration project. He received his Ph.D. from the Massachusetts Institute of Technology in 1990.



### **Chris WHITE, Director, Government Affairs, URENCO Limited**

Mr Chris White is Director, Government Affairs, URENCO Limited, the company behind U-Battery, and one of the leading Uranium Enrichment Companies, operating four facilities across Europe and the USA.

Located in the United Kingdom, Mr White has responsibilities covering government affairs across the UK. Mr White is Chair of the World Nuclear Association's Law Group, co-Chair of the Nuclear Industry Association's Legal & Financial Affairs Working Group, a Member of FORATOM's Legal Experts' Group and Brexit Taskforce, a Member of NIRAB (Nuclear Innovation & Research Advisory Board) and the Organising Committee for the annual UK Civil Nuclear Showcase.



### **Francesco VENNARI, Chief Executive Officer, Ultra Safe Nuclear Cooperation**

Francesco obtained his PhD in Nuclear Engineering from the University of Illinois in 1988. His work dealt with dense plasmas, magnetized plasmas, x-ray production and diagnostics. He performed a Post Doc in physics at the University of Wisconsin, Madison, where he worked on MST fusion experiment, density and temperature diagnostics. From 1982 to 2002, he worked at the Los Alamos National Laboratory Physics Division on topics such as Z-pinch x-ray diagnostics, Inertial liner implosion plasmas. He was the National Project Leader for the Accelerator-driven Transmutation of nuclear Waste (ATW) project. He joined General Atomics in 2003 where he worked until 2007 as Chief Scientist, Energy Group (fission systems), working on Deep Burn destruction of nuclear waste using TRISO fuel and Deep Burn applied to gas-cooled reactors. Between 2008 and 2010, he was the Head of Nuclear Systems at Logos Technologies, working on Fully Ceramic Microencapsulate (FCM) Fuel and Compact transportable reactors. In 2011, he became CEO of the Ultra Safe Nuclear Corporation (USNC).



### **Grzegorz WROCHNA, International Cooperation Manager, National Centre for Nuclear Research, Poland**

Prof. Grzegorz Wrochna was born on 13 March 1962 in Radom, Poland. He graduated at the Warsaw University Physics Faculty and was assistant between 1986-1991. Between 1991 and 1998, he worked at the CERN Geneva on Large Hadron Collider experiments. From 1999 he worked at Andrzej Sołtan Institute for Nuclear Studies at Świerk, Poland, and since 2006 was its director. He is currently International cooperation manager at National Centre for Nuclear Research (NCBJ) at Otwock-Świerk, he was its director between 2011 and 2015.

He is the chairman of Nuclear Cogeneration Industrial Initiative (NC2I). Member of: Governing Board of European Sustainable Nuclear Energy Technology Platform (SNETP), Board of Governors of Joint Research Centre (JRC), Council of European-XFEL GmbH, Euratom Program Committee and Euratom Scientific and Technical Committee