Informal Webinar for the IAEA TWG-SMR members

SMR activities in NPTDS

Frederik Reitsma

Team Leader (SMR Technology Development)
Nuclear Power Technology Development Section
Division of Nuclear Power, Department of Nuclear Energy
The Department fosters the efficient and safe use of nuclear power by supporting existing and new nuclear programmes around the world, catalysing innovation and building indigenous capability in energy planning, analysis, and nuclear information and knowledge.
IAEA Programmatic Activities

Major Programme

MP1 Nuclear Power, Fuel Cycle and Nuclear Science

MP2 Nuclear Techniques for Development and Environmental Protection

MP3 Nuclear Safety and Security

MP4 Nuclear Verification

MP5 Policy, Management and Administration Services

MP6 Management of Technical Cooperation for Development

Programme

1.1 Nuclear Power

1.2 Nuclear Fuel Cycle and Waste Management

1.3 Capacity Building and Nuclear Knowledge for Sustainable Energy Development

1.4 Nuclear Science

1.1.1 Strengthening Integrated Engineering Support for Nuclear Power Programmes

1.1.2 Integrated Management and Human Resource Development for Nuclear Power

1.1.3 Infrastructure and Planning for New Nuclear Power Programmes

1.1.4 International Project on Innovative Nuclear Reactors and Fuel Cycles

1.1.5 Technology Development for Advanced Reactor and non-electric applications

1.1.5.1 (1000166) Technology development for water-cooled reactors

1.1.5.2 (1000153) Technology Development for small & medium-sized and modular reactors and gas-cooled reactors

1.1.5.3 (1000154) Advanced technology for fast reactors

1.1.5.4 (1000155) Non-electric applications of nuclear power

Organizational structure:
Department of Nuclear Energy
Division of Nuclear Power
Nuclear Power Technology Development Section
Nuclear Power Engineering Section
The Section supports countries operating nuclear power plants or expanding their existing programmes to improve engineering, performance, management systems, human resource management, stakeholder involvement and technical infrastructure. It shares best engineering practices and innovations consistent with the global objectives of nuclear safety, security and non-proliferation. Read more →

Nuclear Power Technology Development Section
Fostering information exchange and collaborative research and development for advanced nuclear reactor technologies, this Section provides information to the IAEA’s Member States on technology status and development trends for advanced reactor systems and their applications. Read more →

Nuclear Infrastructure Development Section
This Section is responsible for coordinating IAEA assistance to Member States considering or embarking on nuclear power programmes. It supports capacity-building, conducts review missions and offers guidelines, standards and workshops on developing the infrastructure for a safe, secure and sustainable nuclear power programme. Read more →

International Project on Innovative Nuclear Reactors and Fuel Cycles Section
The Section coordinates the activities of the membership-based International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) to increase international cooperation on global nuclear energy sustainability, long term strategies and institutional and technical innovations for nuclear energy development and deployment. Read more →
SMR activities across NENP

NIDS: Milestones approach for SMRs
- TM on the Application of the IAEA Integrated Nuclear Infrastructure Review Methodology for SMRs, 27-20 Nov 2020
- Plan to develop specific considerations on the application of the milestone approach to SMR

INPRO:
- **Transportable Nuclear Power Plants:**
  - NES NG-T-3.5 Legal and Institutional Issues of TNPPs: A preliminary Study
  - TECDOC Case Study for the Deployment of a Factory Fuelled SMR
- **Dialogue Forum (DF) 17 on “Opportunities and Challenges in Small Modular Reactors”**
  - Ulsan, Republic of Korea, Jul 2019
  - Some 140 participants

NPES: SMR Instrumentation and Control (I&C) System
- NES NP-T-3.19 Instrumentation and Control Systems for Advanced Small Modular Reactors

NPTDS: Presentation to follow and details in next presentation
SMR activities across NEPK

PESS:
  - Aims at providing MS with a framework for the economic appraisal of SMR development and deployment;
  - Issues covered: SMR economic competitiveness vs non-nuclear; market research; cost-benefit analysis; financing key metrics and LCOE
  - Close cooperation in TC Europe RER2017 (see later)

NKMS:
- SMRs and Advanced reactors regularly part of NEM Schools

Jointly developed with NPTDS
SMR activities with NEFW

NEFW / Nuclear Fuel Cycle and Materials
- Added fields on fuel cycles and decommissioning plans in the Booklet
- Jointly implemented TC projects (HTGR fuel and waste)
- Advanced in designs and technology of nuclear fuels for integral-PWR type SMRs

CRP: HTGRs applications for energy neutral sustainable comprehensive extraction and mineral products development

Increased sustainability of ores and extraction processes while cleaning products and waste

CRP completed - TECDOC being finalized
Macro Areas for Each Reactor Line and Non-Electric Applications

Assist MSs with national nuclear programmes; Support innovations in nuclear power deployment; Facilitate and assist international R&D collaborations

Information Exchange

Modelling and Simulations

Development of Methodologies

Safety - Technology

Technology Support

Education and Training

Knowledge Preservation

Tool-kits
*IAEA Tools for delivery*

- Reference technical documents
- Technical meetings, thematic conferences, cooperation meetings, GC side events
- Peer Review, Advisory and Expert Missions
- Coordinated Research Projects (CRPs)
- Collaborating Centres (EPFL-Switzerland, PIAES-Pakistan, INSTN-France, Ontario Tech University-Canada)
- Training courses and Workshops
- Fellowships and Scientific Visits
- E-learning material, distant learning, topical and programmatic web-platforms
- Coalitions and networks, including web-based
- Databases and information systems (e.g. ARIS)
- Procurement of products and services
Webinar Series on Nuclear Technology
Breakthroughs for the 21st Century

Conducted:
- **400 participants**
  - 50 countries

Small Modular Reactors in Integrated Energy Systems
Webinar Series on Nuclear Technology Breakthroughs for the 21st Century

**09 July 2020**
18:00-16:00 CET (Berlin, GMT +02:00)

**Speakers:**
- Muhammad Aamir
  - Manager, SMR Design
  - Ontario Power Generation
  - Canada
- Giorgio Locatelli
  - Chair in Project Business Strategy
  - School of Civil Engineering
  - University of Leeds, UK
- Frederik Reitsma
  - Team Leader, SMR
  - International Atomic Energy Agency

**Moderator:**

Conducted:
- **254 registrants**
  - 55 countries

Cogeneration: Nuclear Energy Beyond Electricity Production
Webinar Series on Nuclear Technology Breakthroughs for the 21st Century

**22 July 2020**
10:00-10:00 CET (Berlin, GMT +02:00)

**Speakers:**
- Dr. Gina Strati
  - Director, Energy Program
  - Research & Development
  - Canadian Nuclear Laboratories
- Dr. Yan Xinglong
  - Deputy Director, Nuclear Energy Research Institute
  - Japan Atomic Energy Agency
- Dr. Ibrahim Khabis
  - Deputy Director, Research & Development
  - Jordan Atomic Energy Commission

**Moderator:**

Conducted:
- **333 registrants**
  - 44 countries

Molten Salt Reactors: A Game Changer in the Nuclear Industry
Webinar Series on Nuclear Technology Breakthroughs for the 21st Century

**27 August 2020**
14:00-16:00 CET (Berlin, GMT +02:00)

**Speakers:**
- Elsa Merle
  - Cernobbio Institute of Technology
  - CRNS-SISE-PARC, France
- David Holcomb
  - Oak Ridge National Laboratory (ORNL)
  - USA
- Gerardo Martinez-Guridi
  - Nuclear Power Technology Development
  - IAEA

**Moderator:**

Conducted:
- **530 registrants**
  - 67 countries

Visit www.iaea.org/nptd-webinars for more information.
Small Modular Reactors in integrated Systems

Webinar in Numbers

- Canada: 19%
- USA: 16%
- South Africa: 13%
- UK: 12%
- Indonesia: 10%
- Russia: 9%
- Saudi Arabia: 9%
- Austria: 9%
- France: 7%
- Kenya: 7%
- China: 7%
- Ghana: 7%
- Turkey: 7%
- Armenia: 7%
- India: 7%
- Japan: 7%
- UAE: 7%
- Spain: 7%
- Africa: 6%
- North America: 5%
- Asia & the Pacific: 5%
- Europe: 5%
- Latin America & the Caribbean: 1%
- <25: 6%
- 25-30: 19%
- 31-35: 16%
- 36-40: 13%
- 41-45: 8%
- 46-50: 9%
- 51-55: 9%
- 56-60: 7%
- >60: 7%

Gender

- Female: 17%
- Male: 83%

530 Registrants
67 Countries
Coordination with the other Technical Departments:

- NE-NS Coordination Group on SMR:
  - Joint meetings and conferences (*Topical Issues in Nuclear Installation Safety*)
  - Joint CRPs (e.g. EPZ)
  - Joint technical support to TC projects
  - Cross review of technical documents
  - The case of TNPPs (joint briefing to MS)

- Participation to the Safeguard-by-Design WG of the Department of Safeguard

- TCEU regional project on SMR: to become interregional in 2022-23

Coordination with Other International Organizations:

- OECD-NEA
- EC/JRC
- IFNEC
- Generation IV International Forum
- NICE Initiative
IAEA NPTDS Activities

- The NPTDS SMR team
- Main products
- Coordinated research projects
- Publications
- Planned activities
NPTDS – Nuclear Power Technology Development Section

SMR team:
2 Regular Staff
1 CFE US
1 JPO France
1 Intern
International Technical Working Group on SMR

• To advice and support IAEA programmatic planning and implementation in areas related to technology development, design, deployment and economics of SMRs

• 1st meeting in 2018 with 14 Member States

• **Now 21 Member States** and two International Organizations: European Commission and OECD-NEA as invited observers:

  ![Flag icons](image-url)

• Recent additions: Finland and Morocco (observer)

• Three technical subgroups established in 2018:
  - **SG-1**: Development of Generic Users Requirements and Criteria (GURC)
  - **SG-2**: Research, Technology Development and Innovation; Codes and Standards
  - **SG-3**: Industrialization, design engineering, testing, manufacturing, supply chain, and construction technology

• TWG will also address SMR for Non-Electric Applications and coupling with renewables
  - 1st TWG Meeting for SMR held on 23 - 26 April 2018 in Vienna
  - 2nd Meeting: 8 – 11 July 2019 in Vienna

• 3rd meeting, Scheduled for 31 August – 2 September 2020 in Vienna – POSTPONED to September 2021

• This WebEx session for information sharing

• [https://nucleus.iaea.org/sites/htgr-kb/twg-smr/SitePages/Home.aspx](https://nucleus.iaea.org/sites/htgr-kb/twg-smr/SitePages/Home.aspx)
• The IAEA offers two publications providing guidance and information for performing non-radiological and radiological EIAs, and assist in developing an effective assessment process for large nuclear power plants (NPPs):

• IAEA-TECDOC-1915, published in June 2020, currently may be used in addition to these two IAEA publications to support early SMR deployment.

IAEA ARIS database include SMR designs

Advanced Reactors Information System

Submissions made by vendors / design organizations, often small startup companies

11 SMR design updated in ARIS in JULY 2020
Updating IAEA SMR Booklet 2020 and ARIS

- The booklet contains information provided by vendors and designers on their SMRs
- Main Features
  - Design description and main features of 72 SMR designs being updated (we had 56 in 2018)
  - Also requested information on fuel cycle, decommissioning and final disposal (for the first time)
  - SMRs are categorized in types based on coolant type/neutron spectrum:
    - Land Based WCRs
    - Marine Based WCRs
    - HTGRs
    - Fast Reactors
    - MSRs
    - Micro reactors
    - Test reactors (to be included with the types above as applicable)
  - MANY designs not included / not submitted and thus not included in IAEA reporting
  - Content to be finalized this week
  - Printing date 3 September
In response to Member States need on **Rational Roadmap** of global development and deployment pathways of SMR design and technology.

Technology Roadmap for SMR Deployment

**Owner/Licensee Roadmap for Near-Term Deployable SMR**

1. **PROJECT CREATION**
   - Site Selection
   - Site Application Submitted
   - Site License Application Completed

2. **PLANNING, FINANCING, CONTRACTING & SITING**
   - Site Permit Approved
   - Construction License Issued

3. **SITE SPECIFIC DESIGN & ENGINEERING SUPPORT**
   - Site Specific Design Completed
   - Site Specific License Issued

4. ** LICENSING & REGULATORY OVERSIGHT**
   - License Application for Construction License

5. **CONSTRUCTION**
   - First Concrete
   - Fuel Loading

6. **OPERATIONS, SPENT FUEL & WASTE MANAGEMENT, DECOMMISSIONING**
   - Spent Fuel Storage Site Approved

7. **TRAINING & INITIAL STARTUP**
   - Commercial Operation (COD)

**Designer/Vendor Roadmap for Near-Term Deployable SMR**

1. **PROJECT CREATION, CONCEPTUAL DESIGN, FUNDING & ECONOMIC STUDIES**
   - Project Charter
   - Conceptual Design & Econ Studies
   - Establish QM Programme
   - Test Plan Finalised

2. **BASIC DESIGN & ENGINEERING DEVELOPMENT**
   - Preliminary Licensing Package
   - Detailed Design, Testing & Validation (Owner Participation in D&M)

3. **FUEL DESIGN ASSESSMENT & QUALIFICATION**
   - Fuel Design Assessment
   - Fuel Qualification Plan
   - Final Design Data

4. **SUPPLIER DEVELOPMENT & QUALIFICATION**
   - Supplier Qualification Plan
   - Qualified Suppliers List

5. **PRE-LICENSING DISCUSSIONS and/or DESIGN CERTIFICATION ACTIVITIES**
   - Preliminary Regulatory Response
   - Obtain Regulatory Acceptance

6. **OWNER/LICENSEE AND INTERNATIONAL INTERACTIONS**
   - IAEA Safeguards Reserve
   - IAEA Economics Reserve
   - IAEA Final Acceptance of Design QA Programme

7. **OPERATIVE SAFETY ASSESSMENT**
   -运营商安全评估
   - Agreement of Cooperatives (POA/K)

*To be published in 2020*
TECDOC: Role of SMRs in Climate Change
SMR Renewables Hybrid Energy System to Reduce GHG Emission

Modules:
- Electricity production
- Process heat
  - Petro-chemical industry
  - Desalination plant
  - Oil and gas reforming
  - Hydrogen production
  - Ammonia production
  - District heating / cooling
  - Waste reforming
- Energy storage
- Load follow capabilities
  - Switch between applications

Example of load follow with renewables

TECDOC: Options to Enhance Energy Supply Security using Hybrid Energy Systems based on SMR; being finalised in 2020
Forthcoming HTGR Publications

- TECDOC: Description of benchmark experiments at the ASTRA facility on the definition of the spatial distribution of 235U fission reaction rates
- TECDOC: Improving the Understanding of Irradiation Creep Behaviour in Nuclear Graphite Part 1: Models and Mechanisms (Final report of a coordinated research project)
- TECDOC: Discussion of Nuclear-Grade Graphite Oxidation in Modular High Temperature Gas-Cooled Reactors
- To be combined again after agreement with NSNI (CRP outcome):
  - NES: Modular High Temperature Gas-cooled Reactor Safety Design Criteria
  - TECDOC: Modular High Temperature Gas-cooled Reactor Safety Design Methodology and Implementation Examples (Final report of a coordinated research project)

2021:
- TECDOC: High Temperature Gas Cooled Reactor Physics, Thermal-Hydraulics and Depletion Uncertainty Analysis (Final report of a coordinated research project)
- TECDOC: Performance Evaluation of German Mixed Thorium-Uranium and Uranium Oxide TRISO Fuels
TECDOC on the Status of Molten Salt Reactor (MSR) Technology

- It summarises the state-of-the-art knowledge on the status of research, technological developments, and reactor concepts in the area of molten-salt-fuelled and molten-salt-cooled advanced reactors.
- A draft is being developed, and there will be a virtual meeting on this document in July, including members from the GIF Provisional System Steering Committee (pSSC) on MSRs.
- It is expected that it will be published in the next 6 to 12 months.
CRP I32010 Passive Engineered Safety Features in iPWRs

- Develop an approach for
  - designing passive engineered safety features for water-cooled SMRs and
  - offering good practices for assessing their performance and reliability
  - verification & validation methodologies

- Focus groups:
  - Passive Safety System Design and Technology Development
  - Approaches and Methods for Functional Reliability Assessment of Passive Systems
  - Experiments, Analysis and V&V

- 3 Year project from July 2017 until July 2020
  - Argentina, Canada, China, Egypt, India, Indonesia, Italy, Republic of Korea, Lithuania, Pakistan

- RCMs:
  - RCM1: 30 Oct – 3 Nov 2017
  - RCM2: 7 – 10 May 2018
  - RCM3: 3 - 6 September 2019, KAERI
  - RCM-4 delayed to 2021

- TECDOC draft under development
CRP I31029 Development of Approaches, Methodologies and Criteria for Determining the Technical Basis for Emergency Planning Zone for Small Modular Reactor Deployment

- Definition of consistent approaches, methodologies, criteria to determine need for off-site EPR, including EPZ/D size, for SMR deployment
- Includes identification of technology specific factors for different SMRs that may influence source term and timing of release possible sequences to be considered for emergency classification system

- Focus groups:
  - Passive Safety System Design and Technology Development
  - Approaches and Methods for Functional Reliability Assessment of Passive Systems
  - Experiments, Analysis and V&V

- 3 Year project from May 2018 until May 2021 (CIVID-19 delays possible)
  - 20 participants from 14 MS
  - Argentina, Canada, China, Finland, Indonesia, Israel, Japan, Korea, Pakistan, Saudi Arabia, Tunisia, UK, USA, and EC

- RCMs:
  - RCM-1 took place May 14-17 2018
  - RCM-2 took place May 27-31 2019 in Beijing, China
  - VIRTUAL RCM-3 took place
  - Final RCM for

- TECDOC draft under development

- JOINT project with IEC and NSNI
ICTP-Trieste-2019

- The workshop covers several aspects related to High Temperature Reactors with focus on the state-of-the-art in technology, design concepts, cogeneration and nuclear heat applications. It includes scientific aspects such as reactor physics, thermal-fluids, analyses and simulation.

- Global scenarios for nuclear energy;
- Advances of SMRs and overview and status of HTR technologies;
- Non-electrical applications of nuclear energy;
- Safety characteristics and design philosophy;
- Core neutronics and thermal-fluid design features;
- Status of fuel development for HTRs for normal and accident conditions;
- Innovative primary components and availability of high temperature materials (graphite, structural materials, coolants, molten salt, and for hydrogen production facilities);
- Source terms evaluation, chemical form and transport phenomena;
- Uncertainties in analysis including uncertainties in cross section libraries;
# SMR E-Learning Courses

E-Learning planned and under development

| SMR | 1 Introduction + history of LWRs  
2 Safety design Approach  
3 LWR Licensing  
4 Fuel  
5 Reactor design  
6 Reactor systems  
7 Material performance  
8 I&C  
9 Fission products behavior  
10 LWR Accidents  
11 Accident analysis tools |
|---|---|
| HTR | 1 Introduction + history of HTGRs  
2 Safety design Approach  
3 HTGR Licensing  
4 Graphite  
5 TRISO Fuel  
6 Prismatic HTGR  
7 Pebble bed HTGR  
8 Reactor systems  
9 HT material performance  
10 I&C  
11 Fission products behavior  
12 HTGR Accidents  
13 Accident analysis tool |
2020, 2021 Meeting plans &
P&B 2022/23 main topics
**2020 Meeting plan**

<table>
<thead>
<tr>
<th>Event Number</th>
<th>Event Quarter</th>
<th>Event Title</th>
<th>Event Owner</th>
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</thead>
<tbody>
<tr>
<td>EVT1904139</td>
<td>5-6 Nov</td>
<td>Technical Meeting on the IAEA Nuclear Graphite Knowledge Base</td>
<td>Reitsma, Frederik</td>
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<tr>
<td>EVT1907033</td>
<td>11-13 Nov</td>
<td>(Virtual Event) Consultancy Meeting on Development of Generic User Requirements and Criteria (GURC) on Small Modular Reactor Technology</td>
<td>Reitsma, Frederik</td>
</tr>
</tbody>
</table>

- Many unknowns:
  - Meetings was postponed, again postponed, made virtual and cancelled…
  - The Agency had to put new procedures in place for virtual meetings
  - Unfortunately some meetings got changed / approved opr postponed on very short notice
- Webinars was introduded as new way to communicate with MS.
- Focus on publications and e-learning should bear fruit in foreseeable future
# 2021 Meeting plan

(Not official)

(Only to be approved in October, subject to requested reductions from DG office)

<table>
<thead>
<tr>
<th>Event Number</th>
<th>Event Quarter</th>
<th>Event Title</th>
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</thead>
<tbody>
<tr>
<td>EVT1903994</td>
<td>1</td>
<td>Postponed due to COVID-19: Fourth Research Coordination Meeting on Design and Performance Assessment of Passive Engineered Safety Features in Advanced Small Modular Reactors</td>
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<tr>
<td>EVT1904099</td>
<td>2</td>
<td>Postponed due to COVID-19: Technical Meeting on Generic User Requirements for Near Term Deployment of Small Modular Reactors</td>
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<tr>
<td>EVT2000098</td>
<td>2</td>
<td>Postponed due to COVID-19: Technical Meeting on the Status, Design Features, Technology Challenges and Deployment Models of Microreactors</td>
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<tr>
<td>EVT1904019</td>
<td>2</td>
<td>Fourth Research Coordination Meeting on Development of Approaches, Methodologies and Criteria for Determining the Technical Basis for Emergency Planning Zone for Small Modular Reactor Deployment</td>
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<tr>
<td>EVT1904023</td>
<td>3</td>
<td>Postponed due to COVID-19: Workshop on High Temperature Gas Cooled Reactor Technology (<strong>if meeting is to be reduced – to be cancelled (ICTP event to address topic in future)</strong>)</td>
</tr>
<tr>
<td>EVT1904101</td>
<td>3</td>
<td>Postponed due to COVID-19: First Research Coordination Meeting on Technologies to Enhance the Competitiveness and Early Deployment of Small Modular Reactors and High Temperature Reactors</td>
</tr>
<tr>
<td>EVT1904034</td>
<td>3</td>
<td>Meeting of the Technical Working Group on Gas Cooled Reactors (TWG-GCR)</td>
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<tr>
<td>EVT1904016</td>
<td>3</td>
<td>Postponed due to COVID-19: Third Meeting of the Technical Working Group on Small and Medium Sized or Modular Reactors</td>
</tr>
<tr>
<td>EVT1904029</td>
<td>3</td>
<td>Technical Meeting on the Status of the IAEA Nuclear Graphite Knowledge Base</td>
</tr>
<tr>
<td>EVT1904514</td>
<td>4</td>
<td>Postponed due to COVID-19: Second Joint IAEA–GIF Technical Meeting on the Safety of High Temperature Gas Cooled Reactors (<strong>alternatively to be organised by NSNI</strong>).</td>
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New CRP: Technologies to enhance the competitiveness and early deployment of SMRs and HTRs

**CRP-I3 2231** Technologies to Enhance the Competitiveness and Early Deployment of SMRs & HTRs *(Q2/2021 – 2024)*;

Provides a forum for R&D with the objective to facilitate MS with the formulation of innovative solutions to make SMRs / HTRs more attractive viable option to diverse markets

The Coordinated Research Project will study **technologies related to reactor design and innovative power conversion of SMRs and HTRs to enhance the competitiveness and possibilities for deployment**

- This includes aspects such as reactor core and NPP designs for novel applications
Generic User Requirements and Criteria (GURC)

- Member States requested IAEA to provide support, guidance and capacity building on the development of their national generic user requirements and criteria (GURC) for SMR technology.
- The GURC is to present:
  - expectations of user/owner/operator in Member States for their potential SMR nuclear plants;
  - a set of key policy, technical and economic requirements that will facilitate the embarking countries in conducting reactor technology assessment and eventually developing a tender document; and
  - a basis for designers and technology developers to come up with a certified reactor product that incorporates specific needs of embarking countries.
- Identify specific issues associated with the need of SMRs for cogeneration of electricity and industrial process heat.
- Consider key technology attributes of SMRs, including: plant outputs, design simplification, plant footprint, operational flexibility, incremental capacity, reliability, constructability, standardization, safety performance, creditworthiness and cost competitiveness;
- Discuss roadmap of national nuclear energy programmes in the Member States by highlighting electric utility requirements on SMRs design;
- Identify key differences between design requirements of reactor technology for regulatory/licensing purposes and generic requirements from users/owners’ perspectives.
- The first year to focus on top-tier fundamental technology requirements, then will incorporate others such as safety, security and safeguards aspects in following years.
Other highlights for P&B 2022/23

All still to be approved:

• New CRP on Microreactors (on PCF).
• NE Series report on General User Requirements of Developing Countries for Small and Medium-sized Reactors and their application
• Address specific Technology Aspects of SMR such as Design, Manufacturing Process and Technology Qualification of Novel Components for SMRs.
• ONCORE – Open source HTGR and SMR software (built on German FZJ transfer of code systems to IAEA)
Concluding Summary

- IAEA is engaged to support Member States in SMR Technology Development and Deployment
- SMR is an attractive option to enhance energy supply security
  - In newcomer countries with smaller grids and less-developed infrastructure
  - In advanced countries for power supplies in remote areas and/or specific applications
- Innovative SMR concepts have common technology development challenges, including regulatory and licensing frameworks
- Studies needed to evaluate the potential benefits of deploying SMRs in grid systems that contain large percentages of renewable energy.
- Studies needed to assess Generic User Requirements, Technology Readiness, Experimental Facility needs and Manufacturing aspects (codes and standards)
Thank you!