Recommendations to the IAEA & Chairs' Summary

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The 26th INPRO Dialogue Forum on the Deployment of Nuclear Energy Systems for Applications beyond Electricity

26th INPRO Dialogue Forum on the Deployment of Nuclear Energy Systems for Applications beyond Electricity

- **Main Objectives:**
  - Discuss key economic, technological, and institutional factors influencing nuclear energy innovation for industrial applications
  - Review the status of ongoing activities related to the nuclear production of industrial heat and identify areas for further research, development and demonstration
  - Explore strategies to support regulatory alignment, coordinated infrastructure development, and effective market introduction of nuclear energy systems for industrial use
  - Develop recommendations for the IAEA Secretariat and Member States to facilitate the advancement of nuclear energy innovations for industrial applications
- **Participation**
  - 92 participants from 20 Member States and 1 International Organization

26th INPRO Dialogue Forum on the Deployment of Nuclear Energy Systems for Applications beyond Electricity

- **Structure:**
  - ➢ 5 plenary panel sessions on:
    - Scene Setting - Nuclear Energy for Industrial Process Heat
    - Industrial Heat Applications
    - Advanced High-Temperature Reactor Technologies
    - Nuclear Hydrogen
    - Policy & Infrastructure
  - ➢ Member States sessions and 2 Breakout group discussion sessions
  - ➢ Closing session
  - ➢ Technical Visit: Research Reactor and Radioactive Waste Management facilities

Highlights from the Opening session

IAEA INPRO overview (Frederik Reitsma, NPTDS)

- Established in 2000, INPRO provides a holistic methodology that reflects the UN’s environmental, social, economic, and institutional dimensions of sustainability. It evaluates nuclear energy systems across 6 areas: economics, safety, environment, waste management, proliferation resistance, and infrastructure
- As of 2025, INPRO’s membership has grown to 49 members (48 Member States plus the European Commission).

IAEA Non-Electric Applications (Alina Constantin, NPTDS)

- Decarbonization Potential: While grid decarbonization is critical, other sectors (like industry, transport, and buildings) generate 60% of global emissions. Nuclear power offers highly efficient low-carbon heat, yet currently only 1% of nuclear heat is utilized globally for non-electric applications.
- Cogeneration Versatility and SMR Suitability: Cogeneration improves efficiency by using heat that would otherwise be rejected.

Thailand (Thawatchai Onjun, TINT Executive Director)

- Power Development Plan (PDP2026 draft) plans for 8 or more SMRs in Thailand as its first Nuclear Power Plants
- Hub of Talents (HOTNET) - network of nuclear energy technology personnel and organizations

Highlights from Plenary 1: Scene Setting - Nuclear Energy for Industrial Process Heat – Chair: Mr. Yujie Dong [1/2]

1. "**Economic and policy requirements for wider applications of SMR in newcomer countries**" by Mr. Kampanart Silva, NSTDA

- SMRs offer safety, flexibility, and potential cost benefits, but newcomer countries may face higher LCOE due to infrastructure and FOAK costs.
- Growing carbon policies, AI-driven data centers, and industrial heat demand are accelerating commercialization.
- FOAK delays and infrastructure requirements increase costs.
- CBAM (Carbon Border Adjustment Mechanism) and carbon pricing strengthen demand for clean energy.
- Successful deployment requires suitable markets, infrastructure readiness, and supportive policies

2. "Nuclear Energy Beyond Electricity: Opportunities for Industrial Heat and Hydrogen Production in Türkiye" by Ms. Hilal Gumuslu, TENMAK, Türkiye

- Türkiye targets 7.2 GW nuclear capacity by 2035 and 20 GW by 2050, including 5 GW of SMRs, to support net zero.
- Nuclear energy could provide district heating, desalination, and 500–800°C industrial heat, while hydrogen capacity targets reach 70 GW by 2053.
- Nuclear heat could support refining, fertilizers, and steel.
- Green hydrogen cost targets are below \$2.4/kg by 2035 and \$1.2/kg by 2053.
- Recommends national coordination and pilot industrial projects.

Highlights from Plenary 1: Scene Setting - Nuclear Energy for Industrial Process Heat – Chair: Mr. Yujie Dong [2/2]

3. "Deployment of Nuclear Energy Systems for Applications Beyond Electricity in Pakistan" by Ms. Khizra Iqtidar, PAEC, Pakistan

- Pakistan operates six NPPs totaling about 3,530 MW and is assessing 35–100 MWe Gen III+ PWR SMRs for desalination, district heating, and remote industrial/mining sites.
- Hydrogen options include low-temperature electrolysis, HTSE, and thermochemical cycles.

- SMRs could support desalination, heating, and mining.
- HTSE (High-Temperature Steam Electrolysis) and thermochemical hydrogen pathways are being explored.
- Key needs include public acceptance, regulatory frameworks, financing, and waste management.

Highlights from the Plenary 2: Industrial Heat Applications – Chair of the session Mr. Shiran Altaher

1. “Needs of Polish district heating networks and industrial sectors - possible application of the nuclear cogeneration” – Mr. Powel Gilski, ORLEN Synthos Green Energy, Poland

- Poland’s heating sector is heavily coal-dependent, while nuclear cogeneration could theoretically supply up to 55% of total heat production (~190 PJ).
- However, small district heating networks, declining heat demand, and EU rules that do not fully recognize nuclear cogeneration remain barriers.
- 50% of networks are below 50 MWth, limiting nuclear integration.Nuclear could significantly reduce coal dependence.
- EU EED (Energy Efficiency Directive) rules should recognize nuclear cogeneration alongside other clean technologies.

2. “Potential Areas of Nuclear Energy Applications in Mongolia” – Mr. Davaa Suren, Nuclear Energy Commission, Mongolia

- Mongolia relies on coal for 82% of its energy, with heating accounting for 60% of final energy use.
- SMRs are being considered for district heating, remote mining, and Southern Gobi hydrogen production under the government’s MEGA
- SMRs could reduce coal use and winter air pollution.
- RITM-200N and BWRX-300 are under evaluation. A government decision is targeted for 2028.

Highlights from the Plenary 2 (continued): Industrial Heat Applications – Chair: Mr. Pawel Gilski [1/2]

1. "SMRs for Sustainability: Jordan Case Study on Non-Electric Applications" – Mr. Shiran Altaher, JAEC, Jordan

- Jordan faces severe water scarcity and future energy supply risks.
- For the Aqaba-Amman water project, JAEC proposes an SMR-solar hybrid supplying 320 MW continuously, with a projected electricity cost of 6.4 cents/kWh and water cost of $1.633/m^3$.
- Hybrid SMR-solar power could support 300 MCM/year water supply.The model combines reliable nuclear baseload with low-cost solar.
- The project also supports uranium development and several UN SDGs.

2. "Feasibility of Integrating Nuclear Reactors with Seawater Desalination in Tripoli, Libya: An Assessment within the IAEA INPRO Framework Discussion" – Mr. Khaled Abdulsalam Hussain Alashtar, Libyan Atomic Energy Establishment, Libya

- Tripoli relies on groundwater for 97% of its water, while existing desalination operates at only about 28% capacity.
- A hybrid MED-RO system is considered suitable for nuclear-powered desalination, but political instability, regulatory gaps, workforce shortages, and long lead times remain major barriers.
- MED-RO could provide both heat and electricity.Nuclear SMRs could provide stable long-term power.
- A phased approach should begin with plant rehabilitation and IAEA Milestones.
- Collaboration remains fragmented.
- More economic analysis is needed for investment and policy decisions.

Highlights from the Plenary 2 (continued): Industrial Heat Applications – Chair: Mr. Pawel Gilski [2/2]

3. “Nuclear Energy and Cogeneration for Desalination: A Comparative Bibliometric Analysis of Global Research Trends” – Ms. Nur Hasanah, BRIN, Indonesia

- A review of 1,973 publications shows rapid growth in nuclear desalination research since 2019, but research remains concentrated in a few countries.
- Studies focus heavily on thermodynamics, with limited economic analysis of LCOE, LCOH, and LCOW.
- Major research gaps exist in Sub-Saharan Africa and Central America.

Highlights from the Plenary 3: Advanced High-Temperature Reactor Technologies – Chair: Mr. Topan Seitiadipura [1/2]

1. HECTAR – Mr. Chan Soo Kim, KAERI, South Korea

- KAERI is developing HECTAR, a 90 MWth, 750°C helium-cooled reactor using TRISO fuel and passive cooling.
- An intermediate steam loop separates industrial users from nuclear safety systems, with applications planned for hydrogen, petrochemicals, and green steel.
- Designed for high-temperature industrial heat.
- Supported by South Korea’s 2026 SMR Special Act.
- Targets hydrogen, petrochemical processing, and green steel.

2. Advanced Reactor Technologies – Mr. Rauf Bikmurzin, ROSATOM Science JSC, Russia

- Russian facilities including SM-3, BOR-60, and VK-50 demonstrate experience with high-temperature fuel testing, site heating, and nuclear cogeneration.
- Their operational experience highlights the importance of plant-scale testing for validating coupled nuclear-industrial systems.
- SM-3 supports TRISO and molten-salt testing.BOR-60 demonstrates long-term cogeneration.
- VK-50 demonstrated direct steam-cycle operation and improved cogeneration.

Highlights from the Plenary 3: Advanced High-Temperature Reactor Technologies – Chair: Mr. Topan Seitiadipura [2/2]

3. HTR-PM Development – Mr. Yujie Dong, Tsinghua University, China

- China's 200 MWe HTR-PM entered commercial operation in 2023 following extensive TRISO testing and safety demonstrations.
- The technology is being scaled through the 650 MWe HTR-PM600, with industrial steam applications planned at Jiangsu Xuwei.
- HTR-PM achieved commercial operation in December 2023.
- TRISO fuel demonstrated strong high-temperature performance.HTR-PM600S will supply clean industrial steam to a chemical park.

Highlights from the Plenary 4: Nuclear Hydrogen - Chair: Mr. Hossam Gaber [1/2]

1. "Deploying a Licensed SMR for Industrial Hydrogen: Cost Conditions for SMART100 Pink Hydrogen in the Republic of Korea" – Mr. Joo Hyung Moon, KAERI, South Korea

- SMART100, a 110 MWe/365 MWth PWR, received design approval in 2024. Coupling it with SOEC reduces energy consumption to 40.6 kWh/kg H_2 and could lower hydrogen costs by \$0.97–\$2.74/kg compared with low-temperature electrolysis.
- SMART100 is approved for deployment.
- SOEC improves hydrogen production efficiency.
- Competitiveness depends on low financing costs, serial SMR deployment, and electrolyzer scale.

2. Opportunity and Strategy of Nuclear Energy Implementation for Hydrogen and Ammonia Production – Mr. Topan Seitiadipura, BRIN, Indonesia

- Indonesia targets 500 MWe nuclear capacity by 2032 and 35 GW by 2060.
- The PeLUIt-40 reactor could provide electricity, heat, desalination, and 1.3 kt/year of hydrogen below \$5/kg, while an 8 MWth portable reactor is designed for remote islands.
- Nuclear could support Indonesia's de-dieselization strategy.
- PeLUIt-40 integrates power, heat, desalination, and hydrogen.
- Portable microreactors could serve remote communities and islands.

Highlights from the Plenary 4: Nuclear Hydrogen – Chair: Mr. Hossam Gaber [2/2]

3. "Status of Clean Hydrogen Production Demonstration" – Mr. Taewon Kim, Korea Hydro & Nuclear Power (KHNP), South Korea

- **Lo**w-carbon hydrogen can be produced using nuclear electricity, supporting Korea's clean-hydrogen certification, grid stability, energy security, and commercialization of nuclear-based hydrogen. KHNP is developing a 10 MW low-temperature electrolysis demonstration plant, integrated with nuclear power and renewable-energy systems, under a 2024–2028 project with a budget of KRW 94.7 billion.
- The project covered plant design and construction, integrated operation and optimization, hydrogen transport, safety and regulatory licensing, and the development of a commercialization framework.
- Particular attention is given to hydrogen hazard analysis, including explosion scenarios, safe separation distances, and siting requirements, with the demonstration intended to establish practical experience and a foundation for future larger-scale nuclear hydrogen production.

4. "Recent developments in Nuclear Hydrogen Production" – Mr. Shripad Revankar, Purdue University, USA

- The presentation reviewed recent developments in nuclear hydrogen production, covering conventional electrolysis, high-temperature steam electrolysis, thermochemical water-splitting cycles, and high-temperature reactor technologies.
- The presentation highlighted growing real-world demonstrations at U.S. nuclear plants, including PEM, alkaline, and high-temperature electrolyzers, alongside research into SOEC systems, advanced materials, thermochemical cycles such as Cu-Cl and sulfur–iodine, and HTGR-based hydrogen production.
- Reducing hydrogen costs, improving high-temperature materials and system efficiency, and expanding public–private demonstrations are key to commercial deployment, supported by U.S. DOE clean-hydrogen initiatives and regional hydrogen hubs

Highlights from the Plenary 4: Nuclear Hydrogen (continued) - Chair: Mr. Shripad Revankar [1/2]

1. SMRs in Integrated Energy Systems – Ms. Yulia Chernyakhovskaya, STAR-NET

- An INPRO FRAMES study selected 1.79 GW of LWR-SMRs for Hungary’s 2040 energy system, reducing CO_2 emissions by 60% and hydrogen costs to $2.08/kg.
- A three-layer financing model combines regulated infrastructure assets, hydrogen CfDs, and industrial off-takers.
- SMRs could reduce emissions and hydrogen costs.
- Flexible operation supports electricity and renewable integration.
- Regulatory coordination is essential for deployment.

2. Nuclear-Renewable Hybrid Systems – Mr. Hossam Gaber, UOIT, Canada

- The LORPA framework and Nuclear Reactor-in-the-Loop simulator were developed to optimize resilient SMR microgrids.
- A Canadian case study found an SMR-wind-solar-hydrogen system with 88.5% SMR capacity and an LCOE of $0.5148/kWh.
- LORPA supports resilient microgrid planning.
- SMR-based hybrid systems can serve remote communities.
- RE-LLaMA was developed for renewable and hydrogen research.

Highlights from the Plenary 4: Nuclear Hydrogen (continued) - Chair: Mr. Shripad Revankar [2/2]

3. Hydrogen-Nuclear Synergy – Mr. Visarn Lilavivat, NSTDA, Thailand

- Thailand’s net-zero roadmap identifies hydrogen and SMRs as important decarbonization technologies.
- SMRs can provide reliable 24/7 electricity and heat for hydrogen production, while nuclear hydrogen could support SAF, green diesel, bio-methanol, and green steel.
- SMRs address renewable intermittency through reliable baseload power.
- SOEC and thermochemical pathways offer higher-temperature options.
- Nuclear hydrogen could support multiple hard-to-abate industries.

Highlights from the Plenary 5: Policy & Infrastructure – Chair: Mr. Chan Soo Kim

1. Exploring Malaysia's Potential Contributions and Capabilities in Nuclear Power Plant Cogeneration – Mr. Phongsakorn Prak Tom, Malaysian Nuclear Agency

- Malaysia's planned coal phase-out by 2044–2045 could create a 12 GW baseload gap.
- SMRs could provide reliable power while supporting industrial heat, hydrogen, desalination, and district cooling for hyperscale data centers.
- Nuclear is reintroduced under the 13th Malaysia Plan.
- Key applications include petrochemicals, hydrogen, and data centers.Major requirements are updated nuclear legislation and secure HALEU.

2. Licensing process of future SMRs in Thailand – Ms. Pantip Ampornrat, OAP, Thailand

- Thailand's PDP 2024 introduced 2 × 300 MWe SMRs in 2037, while PDP 2026 expanded the target to 2,400–9,000 MWe from 2037 to support clean energy and growing data center demand.
- SMR licensing involves five stages: Siting, Construction, Commissioning, Operation, and Decommissioning.
- The process requires coordination among OAP, ERC, ONEP, and local authorities.
- OAP and ERC are developing a joint "one-stop service" center to streamline regulatory approvals.

Highlights from Member States session – Chair: Mr. Kampanart Silva [1/2]

1. The Role of TINT in Supporting the 19 IAEA Nuclear Infrastructure Issues: A Technical Support Organization (TSO) Perspective – Ms. Saensuk Wetchagarun, TINT, Thailand

- Thailand is considering nuclear power and SMRs under draft PDP2024 to support its 2050 net-zero goals and provide electricity, industrial heat, and hydrogen.

- SMR readiness requires coordination among Government, OAP, EGAT, TINT, and Industry/Academia.

- Key gaps remain in regulation, financing, waste management, and site evaluation, while TINT will provide technical support through R&D and safety assessment.

- Priorities include streamlined licensing, digital technologies, and strengthening TINT as a regional technical support center.

2. Sudan Nuclear Power Programme: Status, Challenges and Future Opportunities for Nuclear Energy Applications Beyond Electricity – Mr. Ammar Ahmed, Nuclear Power Directorate, Sudan

- Sudan faces rapidly growing electricity demand and limited conventional energy resources, making nuclear power a potential option for long-term energy security.
- Sudan has completed INIR Phase 1 and identified nine potential sites.
- Major challenges include political instability, financing, human resources, and regulatory capacity.
- SMRs could support electricity and desalination, particularly around Port Sudan.

Highlights from Member States session – Chair: Mr. Kampanart Silva [2/2]

3. Thailand's Nuclear Energy System Assessment: KIND-ET and CENESO – Ms. Piyatida Kaewchinda, KMUTT, Thailand

- Thailand adapted the IAEA INPRO KIND and CENESO frameworks to assess nuclear energy based on four key objectives: Economics, National Security, Public Acceptance, and Infrastructure.
- KIND-ET analysis initially favored coal over nuclear because of lower costs and mature infrastructure, although greater emphasis on public acceptance significantly narrowed the gap.
- CENESO similarly ranked nuclear low for immediate deployment due to gaps in legal frameworks and human resources, while a 20-year deployment scenario significantly improved its position as infrastructure, skills, and institutional capacity mature.
- The findings highlight the importance of long-term planning and capacity building for Thailand's future nuclear development.

Highlights from Breakout session-1 Building the Ecosystem (Identifying Opportunities and Barriers) [1/2]

Group 1 – Applications, Markets and Demand

- Opportunities: Nuclear applications beyond electricity driven by decarbonization, renewable integration, and growing demand from AI/data centers
- Applications: Desalination, cogeneration, industrial heat/steam, district cooling/heating, hydrogen, ammonia, and mining
- Country examples: **Thailand** – district cooling and desalination; **South Korea** – industrial heat; **Indonesia** – desalination and hydrogen/ammonia; **Pakistan** – desalination; **Mongolia** – district heating and mining
- Key barriers: Regulatory gaps, financing challenges, high costs, low carbon prices, and technology limitations

Group 2 – Economics, Business Models and Investment Risks

- Technology: SMR design maturity and supply-chain constraints remain challenges
- Investment: High upfront costs, limited financing, and project bankability are major barriers
- Regulation: Gaps in frameworks for non-electric applications, including Contracts for Difference and integration of generation and distribution
- Market: Uncertainty over customer demand and long-term product offtake increases investment risk
- Recommendations: Further research, improved INPRO tools, and technology-neutral information sharing

Highlights from Breakout session-1 Building the Ecosystem (Identifying Opportunities and Barriers) [2/2]

Group 3 – Regulatory, Governance and Infrastructure Readiness

- Opportunities: Greater end-user involvement, collaboration, integrated regulation, and risk-management approaches
- Applications: Industrial heat, hydrogen, desalination, district heating, marine applications, and renewable integration
- Key barriers: Limited expertise and workforce, unclear regulations, environmental and safety assessment challenges, and complex approvals
- Other challenges: Funding constraints, uncertain returns, waste management, and mismatched nuclear and industrial project timelines
- Recommendations: IAEA guidance, technical documents, training, capacity building, and knowledge-sharing platforms

Group 4 – International Cooperation and Capacity Gaps

- Pre-project gaps: National policies, public communication, regulatory capacity, skilled workforce, technical codes/tools, SMR knowledge, and project management
- Implementation gaps: Workforce, technical expertise, material supply chains, and manufacturing capacity
- Key focus: Strengthening national capabilities to move from demonstration to deployment
- Cooperation: Collaboration with the IAEA and technology providers is identified as important for addressing capacity gaps and supporting deployment

Highlights from Breakout session-2 Solutions and Strategies for Deployment [1/2]

Group 1 – Market Development and Demand Creation

- Focus: creating demand and an ecosystem for nuclear energy beyond electricity
- Applications include desalination, hydrogen, process heat, and data centers
- Key actions: supportive policies, pilot projects, financing, capacity building, and public acceptance
- Requires cooperation among government, industry, regulators, universities, and the IAEA
- Build the right market, policy, infrastructure, and skills to enable deployment
- Start with feasibility studies and pilot projects, then move toward large-scale applications

Group 2 – Business Models, Financing and Risk Sharing

- Focus: making non-electric nuclear projects financially viable and reducing investment risk
- Key approaches: government support, PPPs, long-term contracts, appropriate tariffs, and early industry engagement
- Use risk-sharing mechanisms across construction and the full project lifecycle
- Develop human resources and competencies for non-electric nuclear applications
- Develop bankable business models and fair risk-sharing mechanisms
- Government, industry, investors, regulators, and technology providers need to work together

Highlights from Breakout session-2 Solutions and Strategies for Deployment [2/2]

Group 3 – Regulatory Frameworks, Infrastructure and Project Development

- Opportunities: industrial heat, hydrogen, desalination, district heating, marine applications, and renewable-energy integration
- Barriers: unclear regulations, limited expertise, complex approvals, safety-assessment challenges, funding issues, mismatched project timelines
- Proposed: integrated regulatory frameworks, demonstration sites, simulation tools, cross-sector cooperation, training for regulators and operators
- Recommendation: IAEA support through guidance, technical documents, training, capacity building, and workshops on integrated regulation and environmental impacts
- Required for deployment: hydrogen interface
- To deploy the project, the contributions of international technical support agencies and community are also required.

Group 4 – International Cooperation, Capacity Building and Supply Chains

- Gaps: workforce, technical knowledge, project management, regulations, SMR technology, supply chains, and manufacturing capacity
- Recommendation: training programs, stronger policies and regulations, technology-provider cooperation, development of qualified supply chains
- Focus: international cooperation, joint education and training, knowledge/resource sharing, and regional projects
- Recommendation: continued IAEA support through schools, workshops, modeling tools, technology connections, and research programs for non-electric applications
- Financial support (e.g. from the World Bank) is important for running the nuclear power plant, including SMR, construction and related projects – the World Bank is now funding some projects, and would appreciate getting the process for further support
- International cooperation is need to help managing the risk related to construction.

Chairs' Summary – 1 (Overview and Context)

- **Emissions Beyond Electricity**: Grid decarbonization is only 40%; the other **60% of global emissions** (industry, heat, transport) require clean thermal energy.
- **Market Scale Mismatch**: 99% of global industrial heat users require 1 to 300 MWth—making modular SMRs the ideal, right-sized solution.
- **Diverse SMR Cogeneration**: Advanced SMRs can deliver clean district heating, high-temperature industrial steam, seawater desalination, and clean hydrogen.
- **Bangkok Milestone**: DF26 hosted by TINT brought together technology holders and new users to align on regulatory, economic, and deployment roadmaps.

Chairs’ Summary – 2 (Technical & Economic)

- **Proven Design Maturity**: Commercial operation of high-temperature gas-cooled reactor systems confirms the inherent passive safety of advanced designs.
- **Efficient Hydrogen Production**: SMR-HTSE (High-Temperature Steam Electrolysis) offers the highest efficiency, avoiding PWR superheating penalties.
- **Cogeneration Synergy**: Feedwater thermal preheating boosts RO seawater desalination output without electrical penalties.
- **Hybrid Energy Systems**: Balancing variable solar/wind with continuous, zero-emission SMR baseload is vital to guarantee 24/7 clean industrial supply.

Chairs' Summary – 3 (Challenges)

- **Regulatory Gaps**: Newcomer nations lack established licensing pathways and safety rules to govern co-located nuclear-industrial facilities.
- **Bankability & Financing**: High upfront capital costs and long payback periods require stable revenue models (such as Contracts for Difference).
- **Siting & Public Acceptance**: Locating SMRs close to factories and demand centers requires early, proactive public engagement.
- **Supply Chain & Skills**: Critical global shortages in local nuclear-grade manufacturing and specialized operators or engineers.

Chairs' Summary - 4

Recommendations to the IAEA (standardization)

- **Coupling Safety Guidelines**: Develop international safety standards for physical, thermal, and chemical interfaces in coupled systems.
- **Co-Located Hazard Rules**: Establish regulatory criteria for shared-site hazards, explosion overpressure zones, and tritium transport.
- **TSO Capacity Building**: Support newcomer nations with templates and frameworks to build independent Technical Support Organizations.
- **Policy & Commercial Alignment**: Harmonize licensing with low-carbon certification, offtake guarantees, and financing frameworks.

Chairs’ Summary – 5

Recommendations to the IAEA (expansion and enhancement)

•**Update INPRO Tools**: Integrate non-electric economic metrics natively (LCOH, LCOW, LCOH) into KIND-ET and CENESO.

•**SMR-Renewable Modeling**: Strengthen technical modeling support for SMR-renewable hybrid microgrids and demand mapping.

•**Operational Database**: Establish a technology-neutral database of safety and cost data from demonstration plants to de-risk investment.

•**Targeted Strategic Training**: Expand IAEA INPRO strategic planning schools to build workforce capabilities in nuclear-industrial integration.

Chairs' Summary - 6

Conclusions

- **Thermal Decarbonization**: Heavy industry cannot be decarbonized by electricity alone; nuclear cogeneration is a near-term strategic mandate.
- **SMR Flexibility**: SMRs bypass grid and cooling limitations of large nuclear plants, putting clean heat exactly where it is needed.
- **National Readiness**: Since reactor designs are already commercially proven, our primary focus must shift to local laws, TSOs, and training.
- **Shared Global Cooperation**: Technology holders and newcomers must co-develop safe, economically sound, and integrated clean energy networks.

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THANK YOU