1 Rationale

Artificial intelligence (AI) is being deployed at increasing scale across sectors, leading to growing demand for computing resources, electricity, water, and materials. At the same time, AI technologies offer opportunities to improve the environmental efficiency, reliability, and sustainability of energy systems.

The increasing interdependence between AI and energy systems creates both opportunities and challenges. The Focus Group on Environmental Efficiency for Artificial Intelligence and Emerging Technologies which concluded in 2022, produced deliverables addressing the environmental efficiency of AI. Since then, the continued growth of AI has increased the importance of access to reliable, affordable and increasingly sustainable energy resources, while AI can support the optimization of energy generation, transmission, distribution and consumption. This duality is defined as AI-Energy and includes emerging approaches for coordinating computing power and electric power systems, aimed at improving energy efficiency, facilitating renewable energy integration, and supporting environmentally sustainable AI deployment.

Despite growing interest in this area, activities related to AI and energy remain fragmented across different sectors and stakeholders. Existing initiatives address specific aspects of AI sustainability, energy systems, digital infrastructure and renewable energy integration. However, there is a need to better understand the interaction between AI computing demand and energy systems, with a focus on environmental aspects of AI,, and to identify implementation challenges and opportunities for reducing the environmental impacts associated with AI and its application in the energy sector.

These considerations highlight the need for coordinated pre-standardization activities bringing together experts from the AI, ICT and energy communities to support sustainable AI-energy systems, encourage collaboration, and identify areas where future standardization work may be beneficial.

2 Scope

The scope of this Focus Group, within the mandate of ITU-T SG5, covers the energy supply and environmental sustainability of AI computing infrastructure, including data centres and computing facilities, its interaction with the electric power grid and the use of AI to improve the environmental sustainability of electric power systems:

- Approaches and implementation pathways for increasing the use of renewable and low-carbon energy to support AI computing infrastructure to become more environmental efficient.
- Study on the adoption of solution to increase utilization of green energy for backup power and energy storage in data centre and computing facilities.
- Study scenarios for environmentally sustainable AI computing infrastructure and energy efficiency improvements that leverage renewable-energy resources and support sustainable regional development, including in developing countries;
- Study the influence of AI computing load to the electric grid especially the failure happened in AI data centre;
- Coordination between AI computing demand and energy resources covering whole lifecycle which includes design, construction, operation etc. to improve energy efficiency, support the deployment and operation of environmentally sustainable AI;
- Identification of implementation challenges, data needs and opportunities for applying existing methodologies and standards related to sustainable AI-energy deployment.
- Implementation pathways and enabling conditions for sustainable AI-energy deployment, including energy efficiency, renewable energy integration and investment considerations.

Technical requirements, reference architectures, specifications or deliverables related to AI-enabled energy management applications and services involving IoT, digital twins or smart sustainable cities and communities are out of the scope of the Focus Group.

The Focus Group does not develop deliverables on security, trust or identity. Such aspects arising from its work are referred to ITU-T SG17 and, for the trust and identity of humans and AI agents, to FG-TIDA.

The Focus Group will identify stakeholders with whom ITU-T could collaborate and enable the inclusion of non-members to contribute to the technical pre-standardization work. Potential collaboration can be built across academia, industry, administrations (governments), regulatory bodies in the telecom/ICT and energy sectors, telecom networks operators, telecom/ICT equipment manufacturers, data centre and cloud computing providers, energy utilities, financial institutions standards development organizations (SDOs) environmental organizations and relevant international organizations active in the energy domain,, to ensure inclusive and interoperable technical foundations.

Considering the dynamic nature of this emerging field, particular attention will be paid to the A.7 clause « The subject is not already addressed by work underway in ITU-T study groups or other focus groups, or cannot be currently handled by a study group. » FG Chair and SG5 Chair will resolve on a case by case basis.

3 Objectives

According to its scope (clause 2), the Focus Group aims to identify key technologies, conduct pre-standardization work, and facilitate future standard adoption for environmental sustainability of AI computing infrastructure and its interaction with the electric power grid including the application of AI to improve the environmental sustainability of electric power systems . It has the following objectives:

- To study and harmonize concepts, terminologies, working definitions, vision, and ecosystem relevant to AI- energy environmental efficiency deployments;
- To analyse implementation needs, use cases, technical enablers and potential standardization gaps related to sustainable development of AI including green and low carbon energy for AI, AI enablement effect on energy system. coordination between computing demand and energy resources especially in developing countries;
- To study and gather information to develop a pre-standardization roadmap for sustainable AI-energy deployments;
- To provide a platform to share findings and foster dialogue on technical and implementation aspects of AI-energy deployments;
- To identify and study enabling technologies, trends, and standardization needs relevant to AI-energy efficiency and renewable energy integration;
- To identify approaches and best practices for improving the environmental sustainability of AI systems;
- To identify technical and operational considerations supporting reliable and sustainable AI-energy deployment, including in resource-constrained environments;
- To identify approaches and best practices for leveraging AI to improve energy system efficiency and sustainability contributing to the achievement of SDGs 6, 7, 9, 12, 13,14 and 15[1] complementing existing ITU-T Recommendations.

[1] SDG6: Clean Water and Sanitation
SDG7: Affordable and clean energy
SDG9: Industry, Innovation and Infrastructure

- To identify and discuss potential impacts of AI computing loads to the electric grid stability, including potential failures in AI data centre that could significantly affect grid load;
- To identify the key elements which support the coordination between AI computing demand and energy resources in whole lifecycle phase;
- To identify opportunities for collaboration among relevant ITU-T Study Groups (SGs), external SDOs, regulators, telecom networks operators, data centre and cloud computing providers industrial entities, energy utilities, academic institutions, and relevant international organizations, including both ITU and non-ITU members, to leverage existing expertise, promote interoperability and avoid unnecessary duplication of effort;
- To facilitate community engagement and best practice, knowledge dissemination to accelerate consensus in the technical approaches, ensuring alignment with the evolving landscape of AI - energy deployment.

4 Specific tasks and deliverables

According to its scope (clause 2), the Focus Group aims to develop deliverables considering the following aspects related to environmental efficiency:

A. Foundational frameworks:

- Develop deliverables covering concepts, working definitions and terminologies relevant to AI-energy;
- Identify implementation needs, standardization gaps relevant to AI-energy;
- Study and gather information to develop a pre-standardization roadmap for sustainable AI-energy deployment, energy-efficient AI computing facilities, AI enabled environmental efficiency, computing power and electric power coordination, considering the deliverables developed in SG5, SG20 and other SGs on energy management and computing power and FG-AI4SSC TG5.2. “Sustainability aspects of AI-enabled cities and communities” where relevant.

B. Sustainable AI-energy deployment:

- Study implementation approaches, uses cases, deployment scenarios for increasing the use of renewable and low-carbon energy in AI computing infrastructure which support sustainable regional development;
- Identify use cases and implementation approaches for energy saving technologies and circularity to improve energy efficiency and support deployment in resource-constrained environments.
- Study the interaction between AI computing facilities and the electric power grid, including the impact of AI computing loads on grid stability and potential failures in AI data centres. Identify use cases and good practices for AI use for more environmental efficient energy systems across other sectors;
- Study use cases and implementation experiences of energy-supply and environmental aspects of AI computing infrastructure.
- The development of requirements, frameworks and architectures for coordination between computing and energy systems is outside the scope of the Focus Group.

SDG12: Responsible consumption and production
SDG13: Climate Action
SDG14: Life below water
SDG15: Life on land

C. Collaboration and dissemination:

- Support liaison with relevant ITU-T SGs, regulators, telecom networks operators, data centre and cloud computing providers, industrial entities, energy utilities, financial institutions, environmental organizations and external SDOs;
- Collaborate with related ITU-T study groups, other standards bodies, international organizations, academia and industry working on AI, energy, and sustainability;
- Promote the exchange of implementation experience, best practices and lessons learned related to AI-energy interaction;
- Organize workshops, seminars, forums, panels, and global challenges in coordination with major ITU events (e.g., AI for Good Global Summit) to collect knowledge and experience, foster innovation, and promote youth education.

Upon completion of its lifetime, the FG should provide the final report, including the complete set of deliverables to its parent group ITU-T SG5.

5 Relationships

The Focus Group will work through regular meetings with ITU-T SG5 when possible. Its pre-standardization work serves to support, complement, and inform the standardization activities of SG5, without duplicating ongoing efforts. Furthermore, it will liaise with other relevant ITU-T SGs as necessary to ensure coherence, promote synergy and avoid duplication.

The Focus Group will coordinate closely and share energy use cases of FG AI + Energy with ITU-T SG17, FG-TIDA, ITU-T SG20, and ITU-T FG-AI4SSC, through regular exchange of liaison statements, in order to avoid duplication of work.

The Focus Group will collaborate with other relevant entities and groups in accordance with Recommendation ITU-T A.7. These include governments, non-governmental organizations (NGOs), policy makers, SDOs, industry forums and consortia, companies, energy utilities and grid operators, academic institutions, and other relevant organizations, dealing with aspects of AI and energy from their own perspectives.

The Focus Group will organize thematic workshops and forums to promote the FG activities, encouraging both ITU members and non-ITU members to jointly contribute to this Focus Group and its objectives.

6 Structure

The Focus Group may establish a sub-group structure if needed.

7 Parent group

The parent group of the Focus Group is ITU-T SG5.

8 Leadership

See clause 2.3 of Recommendation ITU-T A.7.

9 Participation

See clause 3.1 of Recommendation ITU-T A.7.

A list of participants will be maintained for reference purposes and reported to the parent group.

10 Administrative support

See clause 5 of Recommendation ITU-T A.7.

11 FG Financing

See clauses 4 of Recommendation ITU-T A.7.

12 Meetings

The Focus Group will conduct regular meetings. The frequency and locations of meetings will be determined by the Focus Group management. The Focus Group will use remote collaboration tools to the maximum extent.

The meeting dates will be announced by electronic means (e.g., e-mail and website) at least four weeks in advance.

13 Deliverables

See clause 8 of Recommendation ITU-T A.7.

14 Working language

The working language is English.

15 Approval of deliverables

Approval shall be obtained by consensus according to clause 8.2 of Recommendation ITU-T A.7.

16 Working guidelines

Working procedures shall follow the procedures of Rapporteur meetings (ITU-T A.1). No additional working guidelines are defined.

17 Progress reports

See clause 3.6 of Recommendation ITU-T A.7.

18 Announcement of Focus Group formation

The formation of the Focus Group will be announced via TSB Circular to all ITU membership, via the ITU-T news log, press releases and other means, including communication with the other involved organizations.

19 Milestones and duration of the Focus Group

The Focus Group lifetime is set for one year from the first meeting with possibility of extension. Any extension beyond the above-mentioned date is subject to the decision by ITU-T SG5, in line with ITU-T A.7.

20 Intellectual Property Rights

See clause 7 of Recommendation ITU-T A.7.

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