

CIGRE Study committee C4

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG C4/D2.80

NAME OF THE CONVENOR

Yifan Zhou (UNITED STATES OF AMERICA)

TITLE

Quantum Information Science and Technology (QIST) for Reliable and Secure Power Systems

THE WG APPLIES TO DISTRIBUTION NETWORKS: YES

ENERGY TRANSITION

3 / Digitalization
5 / Grids and Flexibility

POTENTIAL BENEFIT OF WG WORK

1 / commercial, business, social, economic benefits
2 / potential interest from a wide range of stakeholders
3 / likely to contribute to new or revised industry standards
4 / state-of-the-art or innovative solutions or directions
6 / work likely to contribute to improve safety

STRATEGIC DIRECTION

1 / The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-of-the-art technological advances
2 / Making the best use of the existing systems

SUSTAINABLE DEVELOPMENT GOAL

9 / Industry, innovation and infrastructure

BACKGROUND :

Recent developments in Quantum Information Science and Technology (QIST) have significantly advanced quantum computing, simulation, and communication capabilities, collectively presenting transformative opportunities for the power and energy sector. This highlights the importance of creating a “quantum sandbox” which connects quantum technologies with energy infrastructure and exploiting potential applications in grid modelling, forecasting optimization, reliability, security, and new material development.

However, there is currently no dedicated CIGRE Working Group (WG) exploring the integration of quantum technologies within power systems, nor establishing standards, use cases, and frameworks that can guide utilities, manufacturers, and research institutions. Furthermore, while other WGs address adjacent topics like cyber-security, advanced computing, and grid communication, none explicitly address the quantum frontier.

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

The proposed JWG will fill this gap by advancing quantum-enabled solutions for power and energy sectors. Our purposes and objectives include:

- Identify critical application areas of QIST in power systems.
- Assess innovation pathways and utility-scale solutions, identifying both near-term demonstrations and longer-term transformative opportunities for the energy sector.
- Evaluate the benefits, readiness and feasibility for practical adoption of QIST in the energy domain.
- Engage the ecosystem (utilities, researchers, technology vendors, regulators, and policymakers) that outlines strategies for phased adoption QIST in energy sectors.

This JWG will position CIGRE at the forefront of integrating quantum innovation into power engineering, enabling its members to anticipate opportunities, overcome adoption barriers, and guide the sector toward practical deployment of quantum-enabled solutions.

SCOPE :

The Working Group will pursue the following topics:

1. Application and technology identification:

- Engage utilities, vendors, and researchers to catalog high-value use cases of QIST in power and energy systems, including but not limited to modeling, forecasting, optimization, communication, and security.
- Review the state of quantum-enabled technologies, including quantum computing, communication, and sensing technologies, with emphasis on their relevance to power and energy system applications.
- Review the state of quantum security technologies, including quantum-resistant cryptography and related secure communication and data-protection mechanisms, with emphasis on their capabilities for protecting energy infrastructure against quantum threats.
- Document promising demonstrations, simulation results, and pilot initiatives already exploring QIST in the energy domain.

2. Technology readiness and benefits evaluation:

- Evaluate the associated benefits, technical challenges, risks, and Technology Readiness Levels (TRLs).
- Analyze hardware and software requirements for quantum-enabled key use cases, including qubit counts, error thresholds, and integration interfaces with existing power system operation platforms.
- Analyze hardware and software requirements for quantum security technologies, including protocol performance, key sizes, computational overhead, interoperability, and deployment constraints in energy communication and data infrastructures.
- Assess short-term (3-5 years) and longer-term (>5 years) deployment potential.

3. Roadmap development:

- Build dialogue among academia, utilities, technology providers, regulators, and policymakers.
- Explore a staged approach to integrating QIST into power systems, from laboratory validation to pilot deployment and eventual large-scale adoption.
- Identify areas requiring standards, interoperability guidelines, or regulatory engagement.
- Support CIGRE's role as a global convenor by producing technical guidance documents, best practices, and awareness material for the broader power engineering community.

DELIVERABLES AND EVENTS

Deliverables Types

Annual progress and activity report to Study Committee

Electra report

Future connections

Tutorial

Webinar

Time schedule

Q3	2026	Recruit members
Q1	2027	Develop final work plan
Q4	2028	Draft TB for Study Committee review
Q1	2029	Final TB
Q2	2029	Tutorial
Q2	2029	Webinar

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:

Rannveig S. J. Loken

March 18th, 2026