Energy Innovation Basecamp 2026
Problem Statement EIPEIP160

Evaluating RTDS GTSOC vs RTDS Replica for Advanced Control System Simulation

The following problem statement has been developed by the innovation teams within the UK's Gas and Electricity Networks for the 2026 Energy Innovation Basecamp.

Theme: Flexibility and Forecasting

Network Areas: Electricity Distribution, Electricity Transmission, Electricity System Operator,

What is the problem?

Current control system validation relies heavily on RTDS Replica setups, which can be resource-intensive and may not fully capture the complexity of modern converter-based systems. With the introduction of GTSOC offering FPGA-based high-speed processing and secure integration of vendor-specific controls, there is uncertainty about whether this technology can replace or complement RTDS Replica for real-time simulation and testing.

The energy system is evolving with increased penetration of HVDC, FACTS, and renewable generation, requiring advanced simulation tools for stability and protection studies. Traditional RTDS Replica systems have limitations in scalability, cost, and integration complexity. GTSOC promises enhanced fidelity and black-box vendor model integration, but its comparative performance and operational benefits remain unclear. Key question: Can GTSOC V2 deliver a more efficient, secure, and scalable solution for control system validation compared to RTDS Replica?

What are we looking for?

- A clear benchmarking framework comparing RTDS GTSOC and RTDS Replica in terms of:
  - Real-time performance and fidelity
  - Integration complexity
  - Cost-effectiveness and scalability
  - Cybersecurity and IP protection
- Technology Readiness Level (TRL): Minimum TRL 7 (validated in lab environment, ready for pilot testing), reflecting that prototype testing is expected, especially given prior system-level testing.
- Practical Plan:
  1. Complete system-level testing of the replica solution.
  2. Update and adapt the base code for new applications or requirements as they arise.
  3. Compare performance and integration through Factory Acceptance Testing (FAT) or equivalent processes.
  4. Where possible, leverage earlier tested versions for benchmarking and code updates.
  5. Ensure sufficient hardware resources are available and include any additional licensing or infrastructure costs as needed.
- Solutions should be scalable and adaptable across transmission and system operator environments.

What are the constraints?

- Should integrate with existing RTDS hardware/software.
- Deployment within Energy Innovation Basecamp timelines (2026).

Who are the key players?

- Stakeholders: Electricity Transmission Operators, System Operators, RTDS Technologies, OEMs for converter controls.
- Beneficiaries: Network operators, system planners, and protection engineers.
- Innovators sought: Simulation technology developers, academic research teams, OEMs.

Does this problem statement build on existing or anticipated infrastructure, policy decisions, or previous innovation projects?

Yes:
Builds on RTDS-based simulation environments already deployed in UK networks.
GTSOC V2 documentation: https://knowledge.rtds.com/hc/en-us/articles/7817390306199-GTSOC-V2-Multi-Function-Auxiliary-Simulation-Hardware

What else do you need to know?

- Should consider IP protection mechanisms for vendor-specific models.
- Solutions should address future scalability

Innovator submissions to this problem statement will be open on the Smarter Networks Portal from 4th February to the 13th March, but we encourage you to submit your response as early as possible, as networks will be able to review submissions as soon as they come in.

You can also use the virtual Q&A on the Smarter Networks Portal to ask for more information about this problem statement. Questions may be answered online or at the ENA Problem Statement Launch on 4th February 2026. More information on last year's Basecamp programme can be found on the Smarter Networks Portal.