



Q-SMEC USE CASES

DOC QSMEC-EP-TS · NAICS 2211 · ELECTRIC POWER SECTOR

Consolidated technical specification sheet — notional specifications across all Q-SMEC electric power sector use cases.

NIKET Q-SMEC – VALIDATED TRL/MRL LEVEL 3 APPLICABILITY TO ELECTRIC POWER SECTOR USE CASES

01 1–100 MW Q-SMEC MODULAR SOLID-STATE BESS

High-density, ultra-safe solid-state energy storage enabling low-cost substation buffering and microgrid resilience.

Targets \$55–\$68/kWh installed cost, undercutting conventional utility-scale lithium-ion chemistry. Delivers 450–600 Wh/L volumetric and 225–250 Wh/kg specific energy density; 250 kW modules weigh 18–20 kg at 55 × 35 × 20 cm for rapid field deployment.

NOTIONAL SPECIFICATIONS

TARGET INSTALLED COST	\$55–68 per kWh	DISSIPATION RATE	> 10,000 W/cm ²
250 KW MODULE WEIGHT	18–20 kg	VOLUMETRIC HEAT STORAGE DENSITY	> 200 MJ/m ³
MODULE SIZE	55 × 35 × 20 cm	VOLUMETRIC ENERGY DENSITY	450–600 Wh/L
SYSTEM CONFIGURABILITY	Variable – 1 hr · 2 hr · 4 hr · 8 hr	SPECIFIC ENERGY DENSITY	225–250 Wh/kg
OPERATING TEMPERATURE	25 °C (±1 °C); designed –35 to +50 °C	THERMAL CONDUCTIVITY	> 10 W/mK
OPERATING LIFE	> 20,000 hrs	SAFETY STANDARD	NFPA 855

KEY SPECS \$55–\$68/kWh installed · 1h / 2h / 4h / 8h configurations · >10,000 W/cm² dissipation · NFPA 855



02 Q-SMEC ALTERNATIVE TO GOES FOR TRANSFORMERS

Next-generation soft magnetic material replacing grain-oriented electrical steel to eliminate lamination losses and reduce mass.

Applicable to wound-core and stacked-core builds across current, power and distribution transformers. A >97% stacking factor reduces or eliminates interlaminar insulation coatings and minimizes winding material and winding losses.

NOTIONAL SPECIFICATIONS

CORE TYPES	Wound core · stacked core	HEAT CAPACITY	> 0.2 cal/g/°C
TRANSFORMER CLASSES	Current · power · distribution	THERMAL EXPANSION	< 100 nm/cm/°C
THICKNESSES	0.18 mm/7-mil · 0.23/9 · 0.27/11 · 0.30/12 · 0.35/14	DENSITY	> 9 g/cm ³
CORE LOSS	0.6–0.7 W/kg at B ₈ ≥ 1.9 T (50/60 Hz)	SATURATION INDUCTION B _{SAT}	> 2.5 Tesla
MAGNETIC PERMEABILITY	1–20 T saturation; peak > 14,000	CURIE TEMPERATURE	770–800 °C
ELECTRICAL RESISTIVITY	> 55 μΩ·cm at 20 °C	TENSILE STRENGTH	320–400 MPa
THERMAL COEFF. OF RESISTIVITY	> 0.06 μΩ·cm/°C (20–145 °C)	MODULUS OF ELASTICITY	Variable
THERMAL CONDUCTIVITY	> 0.08 cal/cm ² ·s·°C/cm (20–700 °C)	STACKING FACTOR / LAMINATION	> 97% of theoretical maximum

KEY SPECS 0.18–0.35 mm thicknesses · B_{sat} >2.5 T · >97% stacking factor · current / power / distribution

03 Q-SMEC SUBSTATION, SCADA & DATA CENTER SENSOR SUITE

Multi-modal quantum sensor network for direct electromagnetic field measurement and switchgear prognostics.

VOLTAGE / CURRENT / POWER	DIRECT E-FIELD	B-FIELD & dB/dT	FLOW
PRESSURE	TEMPERATURE	FAULT DETECTION	GRID ASSET MONITORING
GRID LOAD MONITORING	SOLAR / WIND MONITORING	VIBRATION	HVAC CONTROLS
SWITCHGEAR PHM			

- **Direct field sensing:** direct E-field, B-field and rate of change (dB/dT).
- **Grid telemetry:** voltage, current, power, flow, pressure, temperature, vibration, fault detection, grid asset and load monitoring, solar/wind.
- **Switchgear PHM:** prognostics & health management developed with Data Thermal / The Sensor Group.

KEY SPECS substation · SCADA · data center · advanced metering infrastructure



04 Q-SMEC OPTIMIZED SMART METER

Utility-grade metering platform with ten embedded sensors, Q-SMEC storage power and post-quantum encryption.

Captures 5–15 kHz V/I waveform samples across up to 256 channels for non-intrusive load monitoring (NILM). Powered by a self-contained Q-SMEC storage system with autoranging 120–480 V supply. Fully ANSI C12.20 compliant and inherently anti-tamper.

NOTIONAL SPECIFICATIONS

FREQUENCY	50 or 60 Hz	LOAD DISAGGREGATION	NILM
OPERATING VOLTAGE	120–480 V $\pm 0.1\%$, autoranging	OUTAGE REPORTING	Real time
POWER SUPPLY	Self-contained Q-SMEC storage system	EMBEDDED Q-SMEC SENSORS	Temperature (2) · voltage (2) · power (2) · pressure (2) · arc (1) · tilt (1)
VOLTAGE BURDEN	< 5 W max	STREAMING SENSOR DATA	5–15 kHz samples, V/I waveform
OPERATING TEMPERATURE	–40 to 85 °C under cover	TWO-WAY COMMUNICATIONS	5G · 75 Mbps · ISM 902–928 MHz · 2.4 GHz
HUMIDITY	Up to 95% relative humidity	ENCRYPTION	Post-quantum cryptography
STARTING LOAD	80 mA	TAMPER POSTURE	Inherently anti-tamper
DESIGN LIFE	10,000 operations	COMPLIANCE	ANSI C12.20
DATA RECORDERS	4 – active/reactive metrics, energy, demand, power quality, time of use	DOMAINS	Front · mid-level · backhaul
CHANNELS	Up to 256		

KEY SPECS ANSI C12.20 · 120–480 V $\pm 0.1\%$ · front / mid-level / backhaul · –40 to 85 °C · <5 W burden



05 DEPARTMENT OF WAR-GRADE PQC OT / NERC CIP CYBERSECURITY

Quantum-resistant operational technology cybersecurity engineered to protect critical grid infrastructure (NERC CIP).

- **Post-quantum cryptography** deployed across OT assets, SCADA control systems and substation networks.
- **Pilot basis:** TEP and SRP Cyber Resilience Pilot Proposals (34 pages each), available on request.
- **Co-developed with** Blue Ridge Networks Inc, High Entropy Security Inc and Black Fur Inc.

IN COORDINATION WITH:

BLUE RIDGE NETWORKS INC

HIGH ENTROPY SECURITY INC

BLACK FUR INC

06 WARGA-DESIGN FIRE-TUBE STEAM / HOT-WATER BOILER

Patented thermal boiler technology delivering 50% heating-surface reduction and optimized flue-gas exchange.

- **Proven history:** 25+ year track record of operational reliability at Tucson Medical Center.
- **Efficiency:** eliminates the drawbacks of 2/3/4-pass wetback and dryback boilers via pressurized-door furnace optimization.
- **Cost savings:** 50% reduction in heating surface area cuts acquisition, installation, operation and maintenance costs.

KEY SPECS fire-tube steam / hot-water · pressurized-door furnace · optimized tube configuration · partial-load efficiency

ENGAGEMENT MODEL – NIKET ENGAGES USE-CASE BY USE-CASE UNDER NDA, DEVELOPING JOINT IP ON THE SPECIFIC SOLUTION WHILE RETAINING CORE PLATFORM IP. MATURATION FROM TRL 3–5 (INTERNAL) TO TRL 6–9 (END USER CO-DEVELOPMENT).

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