Complex
Automation
Systems GmbH

BILIKI

Data Center

Technical Consultation

Data Center Design

Tier III+ Certification Scope

BASIS OF DESIGN

Document # GGE-CAS-DES-BOD-C02

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BASIS OF DESIGN (BoD)

Project: Biliki Data Center Unit (DCU)

Location: Isani-Samgori District, Tbilisi, Georgia (adjacent to Kura River)

Prepared by: CAS GmbH

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1. PROJECT DATA AND TARGETS

Total IT capacity: 5.635 MW / 407 racks

Functional mix:

Quantum (AI): 2.5 MW, 100 racks, direct-to-chip liquid cooling

Enterprise Suites A-C: 1.47 MW, 132 racks, in-row cooling

Hub: 0.665 MW, 95 racks, in-row cooling

VIP: 1.0 MW, 80 racks, in-row cooling

The project was structured in phases, and each phase was subdivided into specific groups.

Phase 1 comprises two implementation groups:

- **Group 1:** VIP (5 halls)
- **Group 2:** Enterprise Suite **A** and **Hub**

Phase 2 comprises also two implementation groups:

- **Group 1:** Quantum (AI)
- **Group 2:** Enterprise Suites B-C

Certification target: Uptime Institute Tier III Certified

Design objectives:

Concurrent maintainability (CM) on all systems

Annualized PUE ≤ 1.5

Energy source: 3.7 MW Mtkvari HPP (Archimedes screw + IRD dam), 100% renewable and City Utility service.

Sustainability: LEED Gold, Hydropower Sustainability Standard, CO_2 credit certification

2. CLIMATIC DESIGN CONDITIONS (TBILISI)

Elevation: 427 m AMSL

Max dry bulb: +40.2 °C

Min dry bulb: −11.2 °C

Summer design (0.4%): DB 35.2 °C / WB 22.8 °C

Winter design (99.6%): DB −4.7 °C

Average annual DB: 14.4 °C

Seismicity: Zone VIII, PGA 0.25-0.27 g

3. BUILDING PHYSICAL PARAMETERS

Elevation references

Basement −2 (Cooling Plant): −11.00 m

Basement −1 (Power/MEP): −5.55 m

Ground Floor (IT Halls): ±0.00 m

First Floor (Offices / NOC / VIP): +5.40 m

Roof (finish): +10.90 m

Satellite antenna: +16.00 m

Raised floor heights

IT halls: 450 mm

Corridors / MMRs: 450 mm

Clear heights

IT halls: ≥ 4.5 m

Offices / NOC: ≥ 3.5 m

Phase 1	Phase 2
Group 1: VIP (5 rooms): *IT load: 1,000 kW* *IT area: 385 m²* *80 racks – average 12.5 kW/rack*	**Group 1:** Quantum (AI) *IT load: 2,500 kW* *IT area: 471 m²* *100 racks – average 25 kW/rack*
Group 2: Enterprise Suite **A** and **Hub** *(2 rooms):* *IT load: 1,385 kW* *IT area: 671 m²* *167 racks – average 8.5 kW/rack*	**Group 2:** Enterprise Suites **B** and **C** *(2 rooms):* *IT load: 750 kW* *IT area: 194 m²* *60 racks – average 12.5 kW/rack*
Subtotal **7 rooms** ***IT load: 2,385 kW*** ***IT area: 1,056 m²*** ***247 racks*** ***Average density: 10.5 kW/rack***	**Subtotal** **3 rooms** ***IT load: 3250 kW*** ***IT area: 665 m²*** ***160 racks*** ***Average density: 18.75 kW/rack***

Total

10 rooms
IT load: 5,635 kW
IT area: 1,691 m²
407 racks
Average density: 13.4 kW/rack

4. ELECTRICAL POWER TOPOLOGY (Phase 1)

Sources and transformation

Dual independent utility + HPP feeds

Transformers: 4 total (2 per group)
- Each group includes 1 × 3000 kVA dry-type units
- A/B segregation, 2N configuration

Generators

4 × 2500 kVA total (2 per group)

UPS and batteries

Modular static UPS (N+1 per side)

$LiFePO_4$ battery banks, ≥10-15 min autonomy

Optional flywheel bridge prepared

Fuel system

Bulk + day tanks per Group

Dual transfer pumps (duty/standby) per line

Fuel storage tank: 20 t

Day tank: 1 m^3

Fuel consumption: 563.8 L/h.

Cross-feed with isolation valves
≥72 h autonomy

Distribution and switching philosophy

- Independent A/B buses from source to PDU
- Normal operation: incomers NC, bus ties NO
- Maintenance transfer: NO→NC→NO sequence ensures CM
- Generator incomers NC only when on generator supply

5. MECHANICAL COOLING SYSTEM

Hybrid system: direct-to-chip liquid for AI, in-row CRAH for enterprise/VIP/host

River air tunnels (<26 °C) for passive free cooling for Chiller, UPS and battery rooms

Chiller plant (N+1), dual segregated loops

River-water free cooling & ground-thermal (BILIKI DCU, Tbilisi)

A hybrid cooling strategy that leverages our river-adjacent site with a closed-loop, no-contact Kura River free-cooling system plus a complementary ground-thermal field. The approach materially cuts mechanical cooling energy, water use, and noise, supporting the OPR target with annualized PUE ≤ 1.5. The river system uses screened intake and plate-heat-exchanger (PHE) trains (no mixing with river water); metallurgy and concrete protection are selected for the site's chemistry (elevated sulfates/chlorides), ensuring longevity of assets and civil works. The ground-thermal provides a stable heat sink/source year-round, extending free-cooling hours and smoothing HPC direct-to-chip and chilled-water loads—while preserving concurrent maintainability and independent headers/pumps for Tier III topology. The scheme respects the waterfront planning context and permits framework for the Mtkvari corridor.

6. FIRE PROTECTION AND SAFETY

Detection: VESDA, zoned smoke/heat sensors

Suppression: Inergen/Novec in IT halls, pre-action water mist in plant areas

Compartments: 2-hour fire-rated walls between A/B paths

Life safety: dual staircases, 10 t freight elevators for chiller/genset transport

7. SECURITY AND ACCESS

Multi-layered access: perimeter → gate → building → mantrap → hall

Biometric + dual-factor for IT spaces

24/7 CCTV with SOC integration
NOC blast-resistant and acoustically insulated

8. NETWORK AND CONNECTIVITY

Dual fiber routes along Tbilisi railway corridor

Meet-Me Rooms: 2 × fully diverse (A/B)

Latency: < 30 ms to Istanbul, < 40 ms to Dubai

9. TIER III COMPLIANCE

Tier III - Concurrent Maintainability

All systems designed N+1 minimum

Maintenance of any single component without IT impact

Dual independent A/B paths with ties normally open

Availability targets

Tier III: 99.982% (~1.6 h downtime/year)

10. SUSTAINABILITY

100% renewable hydropower baseline (Phase 1)

Onsite PV array on roof (10-15% supplemental)

LEED Gold / HSS certification

Carbon credit monetization (Verra/JCM)

SUMMARY

The Biliki DCU is a 5.635 MW IT facility with a total gross building area of 16 000 m², designed for Tier III Certification. Its architecture, power and cooling topology, and operational concepts ensure concurrent maintainability, renewable energy integration, and PUE ≤ 1.5.