Building the Digital Backbone for the Power Sector in Kyrgyz Republic

Smart Metering and Data-Driven Operations

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"Improving the National Energy System of the Kyrgyz Republic through Centralized AMI System Construction"

The Problem: Managing a Grid Without Data

~90%	13–17%	Manual
Share of hydropower in total generation	System loss rate in Ak-Ordo district (2023–2024, feeder data)	Metering still predominant — monthly estimates, not real data

- **No real-time visibility** — operators respond to last month's data, not today's. Grid management is reactive, not adaptive.
- **Non-technical losses are invisible** — theft, billing errors, and unregistered meters cannot be detected without granular data.
- **Climate stress compounds the problem** — hydropower variability and temperature extremes demand responsive, data-driven grid management.

> *"You cannot manage what you cannot measure.*
> *This project gives Kyrgyzstan's grid operators the ability to measure,* ***for the first time****."*

Climate Change Is Making This Worse

Driver	Mechanism	Grid Impact
Glacial retreat	Reduced river flows	Hydropower instability → Supply shortfalls
Temperature extremes	Peak demand spikes	Grid stress → Blackout risk
Erratic precipitation	Unpredictable inflows	Planning failure → Investment uncertainty

- Climate risks shift both **supply** (hydropower variability) and **demand** (temperature-driven peaks), increasing operational uncertainty.
- Without **high-frequency consumption data**, utilities cannot forecast peaks, target loss reduction, or evaluate demand response policies credibly.

Smart metering *is not just a billing upgrade.*
It is foundational climate infrastructure — enabling demand forecasting, loss detection, renewable integration, and evidence-based tariff design.

The Korea–Kyrgyz AMI Partnership

Project Overview

Item	Details
Project	Improving the National Energy System of the Kyrgyz Republic through Centralized AMI System Construction
Funding	Korean Government / KOICA KRW 13.3 billion (approx. USD 10M)
Period	November 2023 – December 2026
Location	Bishkek, Kyrgyz Republic
Partners	KEEI · KOICA · KT (C&U Global) · Ministry of Energy (MOE) · NEGK

Scope

1. **CAS* Operations Center** — server room, network, UPS, security systems
   * the central data collection system

2. **CAS System** — 1.5 million meter capacity; integration with 17 legacy systems

3. **Smart Meters** — 10,799 units (incl. DCU); installation and commissioning

4. **Capacity Building** — operator training, O&M support, policy consulting

Implementation platform for centralized metering, system integration, and policy evidence.

What We Have Built — Delivered Results (Early 2026)

CAS Operations Center — 100% Complete

- Inaugurated May 2025
- Guarantee Test passed June 2025
- Warranty active through May 2027
- Monthly inspections running
- NEGK engineers assigned and operating

CAS System — For the first time, operators can see what is happening on the grid

- Real-time dashboard operational
- 181 DCUs in operation
- 17 legacy systems under integration
- GIS, Billing, CRM: 1st-stage integration complete
- MDMS optimized for 1.5M meter capacity

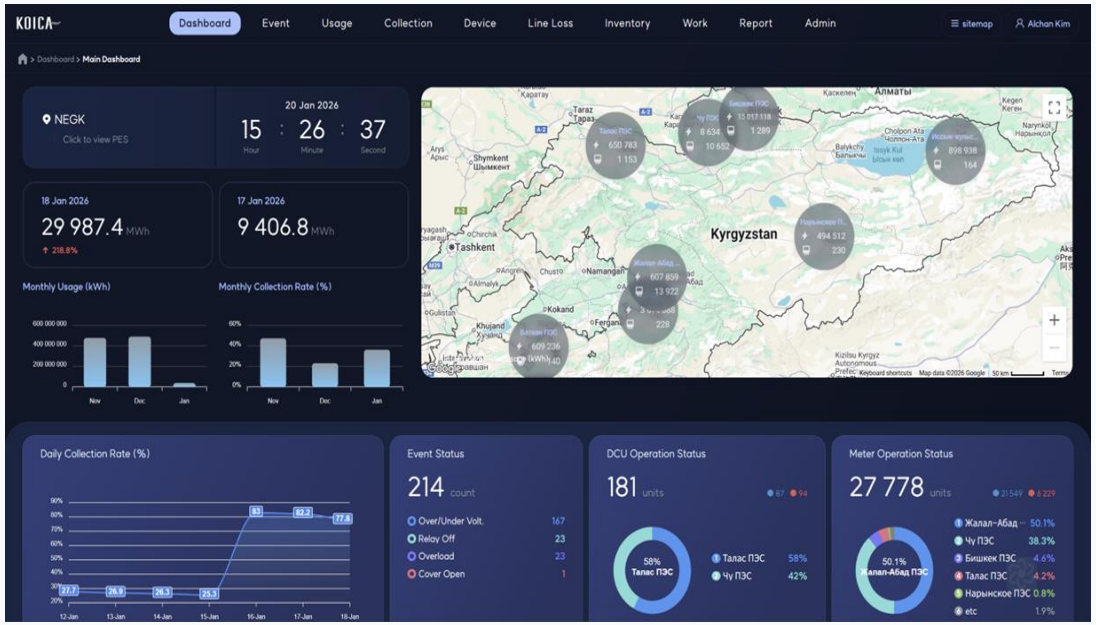
Smart Meters — 99% Installed

- Target: 10,799 units
- Installation expanding across districts

Capacity Building — 100% Pass Rate

- 26 operators trained and certified
- Competency test pass rate: 100%
- Average training satisfaction: 7.9 / 10
- OJT-based O&M program established

The CAS Dashboard — Real-Time Grid Visibility



The demo dashboard displays:

- 27,778 meters actively monitored
- 181 DCUs in real-time operation
- Daily collection rate tracking
- Geographic distribution across Bishkek substations
- Real-time alerts: Over/Under Voltage, Relay Off, Cover Open

Before vs. After CAS

	Before CAS	After CAS
Data frequency	Monthly manual reading	30-min interval (48/day)
Fault detection	Field visit required	Remote, real-time
Loss identification	Estimated	Feeder-level, verified
Grid visibility	None	Live dashboard

> *This dashboard is a demo. It is about to be operational.*

Loss Rate Baseline — The Evidence Is Already Emerging

Feeder	Loss Rate 2023	Loss Rate 2024	Signal
F-22 Ak-Ordo	0.18%	—	Low loss zone
f-16 Mambetova	11.27%	11.63%	Stable mid-loss
f-8 Ak-Ordo	14.37%	14.88%	Stable mid-loss
F-5 STP Peak	21.36%	10.12%	Formula change effect
F-7 Peak	**26.63%**	**18.09%**	**Persistently high**
f-16 Ak-Ordo	8.65%	12.80%	Increasing trend
F-17 Peak	22.47%	14.16%	Formula change effect
f-4 STP Peakovaya	13.79%	15.57%	Slight increase
Total / Average	**12.97%**	**14.40%**	**Consistent 13–17% range**

Caveat

Both years based on manual records.
Year-on-year comparison requires caution due to formula changes and feeder composition differences.

What this confirms

Loss rates consistently 13–17% / High-loss feeders (F-7 Peak) repeatedly identifiable /
AMI completion in 2026 enables the first meter-verified loss measurement.

From Infrastructure to Policy: The TOU Question

The Kyrgyz government is considering a **Time-of-Use (TOU) tariff reform**: charging more during peak hours (07:00–09:00, 18:00–21:00) to reduce grid stress and incentivize demand shifting. NEGK has already explored peak-hour load limitation features within the CAS system.

Does a price differential between peak and off-peak hours actually change when households use electricity — and by how much?

Without AMI data

The question cannot be answered

Without rigorous evaluation

Any answer cannot be trusted

“charging more during busy hours, less during quiet hours"
This project provides both — for the first time in Central Asia.

“This is where infrastructure becomes policy”

Experimental Design — Cluster-Randomized Controlled Trial

Ak-Ordo District, Bishkek

~80 Distribution Transformers · ~10,000 Households · AMI installed

Random Assignment

Control (C)	Treatment 1 (T1)	Treatment 2 (T2)	Treatment 1+2 (T1+T2)
~20 transformers	~20 transformers	~20 transformers	~20 transformers
250 households	250 households	250 households	250 households
No intervention	Subsidy on off-peak consumption (00:00–07:00)	Provision of Use of Electricity hourly basis	Both interventions: off-peak subsidy (00:00–07:00) + Information
Counterfactual baseline	Price signal	Information signal	Combined signal

Design rationale: We test two off-peak price signals (T1, T2) and their combined intervention (T1+T2) against a control group.
Pre-Analysis Plan registered before treatment assignment.

Data Collection and Estimation Strategy

Data sources

AMI Administrative Data

- 30-minute interval consumption (48 obs./household/day)
- Pre-treatment period: March 2026 (minimum 1 month)
- Treatment period: April–October 2026
- Governed by formal data agreement with NEGK; de-identified

Baseline Household Survey (April 2026)

- Covers: sociodemographics, appliance ownership, TOU awareness, billing behavior
- Endline survey planned: October 2026

Estimation

Primary Outcome

Share of daily consumption in off-peak hours (00:00–07:00)
→ Measures load-shifting effect

Specification: ANCOVA

$$Y_{post} = \alpha + \beta \cdot Treatment + \gamma \cdot Y_{pre} + \delta \cdot Strata\ FE + \varepsilon$$

- Standard errors: clustered at transformer level
- Comparisons: T1 vs. C / T2 vs. C / T1 vs. T2 (dose-response)
- Heterogeneity analysis: income, appliance ownership, TOU awareness

High-frequency AMI data + a pre-registered experimental design enables credible, policy-relevant impact estimates for TOU reform.

Honest Assessment — Challenges and How We Addressed Them

Challenge	What Happened	Our Response
Construction delay (4 months)	HVAC installation by counterpart delayed → server setup, CAS software, meter integration all shifted downstream	Warranty period adjusted (Jun 2025 → May 2027) with KOICA approval. Monthly facility inspections regularized. NEGK engineers now operating center independently.
Legacy system integration complexity	Of 31 target systems: 17 confirmed for direct integration. World Bank AMI declined API support. Vendor API errors (Sanxing, Hexing, Sunrise) required iterative resolution.	Integration completion extended to June 2026. NEGK Deputy CEO engaged directly. Stepwise UAT for each completed integration.
Meter registration and data quality gaps	~2,000 meters unregistered in CRM at launch. Billing system upload errors. Meter ID mismatches between field installations and CAS records.	On-site CRM registration supported. Billing data structure redesigned. Troubleshooting guide created; field team technical capacity strengthened.

These are real-world implementation challenges in a complex institutional environment. Addressing them transparently is part of what makes the evidence we generate credible.

Three Takeaways for the CAREC Region

#	Takeaway	Implication
1	**AMI data is climate infrastructure**	30-minute consumption data is the shared foundation for renewable integration, demand response, loss detection, and carbon accounting. Without this data layer, climate-adaptive grid management is impossible.
2	**Rigorous evaluation turns pilots into policy**	The RCT launching this month produces the first causal evidence on household demand response in Central Asia. “We believe TOU works” → “We have proven it works, at this scale, in this context.” That difference determines whether a pilot becomes national policy.
3	**The hardware is the easy part**	MDMS operations, data governance, tariff design, CRM integration, operator training — these institutional capabilities determine whether hardware delivers lasting impact. Technology transfer must include the software of institutions.

From Bishkek to the CAREC Region

Comparison

Feature	Kyrgyz Rep.	Regional relevance
Hydropower dependency (~90%)	Yes	Tajikistan, Georgia
Aging metering / manual reading	Yes	Kazakhstan, Uzbekistan, Mongolia
TOU reform under discussion	Yes	Uzbekistan, Kazakhstan
AMI deployment underway	Yes	Kazakhstan (partial), Uzbekistan
Loss rates 13–17%	Yes	Common across CAREC

Cooperation opportunities

1. Harmonize AMI data standards across CAREC for cross-border grid optimization

2. Share the RCT evidence base — TOU findings applicable to tariff design across the region

3. Replicate the model: CAS + AMI + rigorous evaluation = transferable template

4. Connect K-Hub innovators to real AMI deployment contexts for testing and scaling

Evidence + standards + operations capacity can scale across CAREC.

Conclusion

Category	Summary
What we built	A centralized AMI system for Bishkek — 1.5 million meter capacity, real-time grid visibility, and the region's first high-frequency household electricity dataset. CAS Operations Center opened May 2025. 8,968 meters installed and live.
What we are proving	Through a cluster RCT launching this month, we generate the first causal evidence in Central Asia on whether price signals shift household electricity demand — directly informing Kyrgyzstan's TOU tariff reform.
Why it matters beyond Kyrgyzstan	Loss rates of 13–17%, aging metering, and TOU reform discussions are shared realities across CAREC. The evidence and the model are both transferable.

**"The infrastructure is built. The data is flowing. The experiment begins today.
What we learn here can change how this region manages its energy future in the face of climate change."**

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Thank you — Questions & Discussion