

Energy Without Borders:

The Architecture of Power Connectivity in Central Asia

October 2026



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Energy Without Borders: The Architecture of
Power Connectivity in Central Asia

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The new report takes the "middle path" strategy to the regional level

Two EDB reports form a single line of analysis: from modernising national systems to connecting them



REPORT 26/4 • EDB • 2026

Power Sector of Central Asia: Modernization and Energy Transition

- Sector diagnostics through the trilemma: reliability, affordability, sustainability
- "Middle path": modernised conventional generation + RES/BESS + digitalisation
- Regional integration is one of the key tools for reliability and efficiency



Focus: HOW to modernise the system



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Energy Without Borders: The Architecture of Power Connectivity in Central Asia

- Available and deliverable capacity, grid constraints and RES integration
- Economics of cooperation: trade, reserves and paid hydro flexibility
- Market architecture, priority grid/digital projects and financing mechanisms



Focus: HOW to connect the systems



The new report answers one question: how to turn the physical interconnection of power systems into a managed and bankable regional asset

Source: EDB (2026)



Eurasian Development Bank



Context

- Why integration in the power sector is special
- The isolated model is becoming ever more expensive
- Regional markets are built step by step



The isolated power system model is becoming ever more expensive

Three global drivers are intensifying simultaneously in Central Asia: demand growth, rapid deployment of variable generation and ageing infrastructure



+27%

electricity demand by 2030

Demand and electrification

Industry, transport, the digital economy and data centres are increasing load and changing its profile.



>35 GW

of solar + wind announced for commissioning by 2035

Variable generation

Solar and wind require reserves, flexibility, storage and the ability to export surplus to a neighbouring system.



up to 70%

of grids and TPPs need modernisation

Reliability requirements

Wear raises failure rates and the cost of outages: reliability cannot be secured by new generation alone.



Building more plants within national borders is no longer enough: exchanging energy, reserves and flexibility with neighbours is what creates value

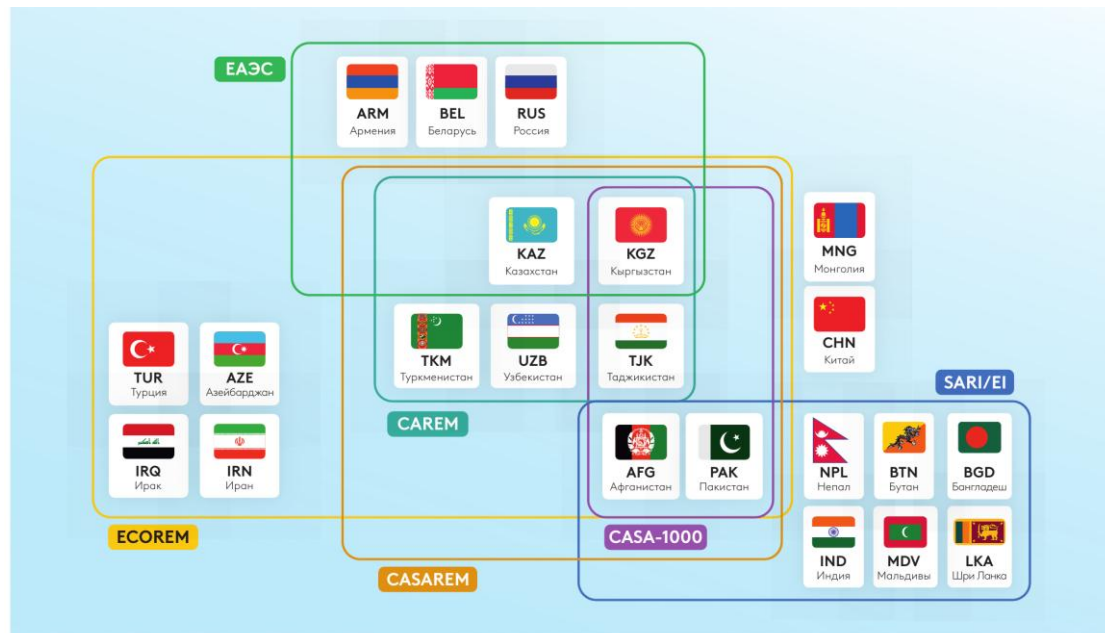
Source: EDB, "Power Sector of Central Asia: Modernization and Energy Transition" (2026)



Eurasian Development Bank

Regional electricity markets are emerging step by step — in Eurasia and around Central Asia

Central Asia is simultaneously part of the EAEU, CAREM/CASAREM and CASA-1000 frameworks; the World Bank's REMIT programme has become the practical anchor of regional trade



Regional power market frameworks and initiatives involving Central Asian countries



REMIT (World Bank, since 2026)

USD 1.018 bn

10-year programme

up to 16 GW

interconnection capacity

up to 9 GW

clean energy integration

up to 15 TWh

of mutual trade

Pilot regional market — hosted by CDC Energiya



Focus of the EDB report

- CAREC Energy Strategy 2030 sets the policy framework for 11 countries; REMIT finances infrastructure
- The report adds an operational framework: system constraints, the full cost of reliability, the value of hydro flexibility, prioritising projects by system effect



Integration advances across five building blocks at once: infrastructure, planning, operational coordination, market design, institutions

Source: IEA (2021); World Bank (2026)

Why integration in the power sector is special

Electricity cannot be stored in a warehouse: all participants operate in a single regime at the same time

THREE CONDITIONS FOR INTEGRATION



1. Synchronism

ONE RHYTHM

Generation equals consumption every second, and the frequency (50 Hz) is the same across the whole system. Electricity cannot be stored at system scale, so a failure in one country is felt by its neighbours.



2. Monitoring

SHARED VISIBILITY

Flows and grid status must be visible in real time: SCADA, AGC, WAMS/WACS, commercial metering (AMR). What is not measured cannot be controlled or paid for.

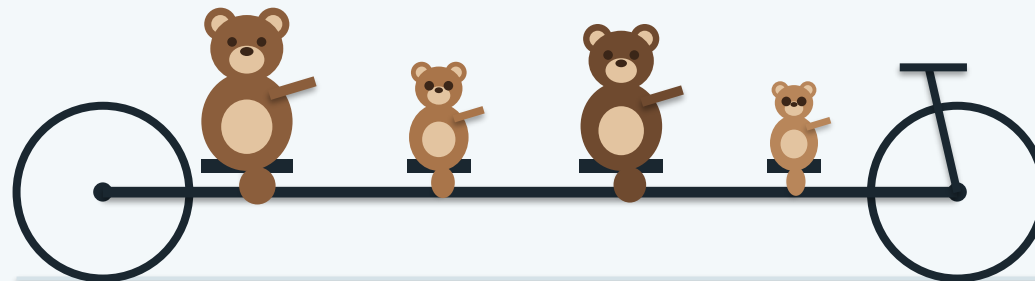


3. Trust

COMMON RULES

Agreed schedules, settlement of deviations, payment for balancing energy and hydro flexibility. Honest data and clear settlements are required.

ANALOGY: A LONG CIRCUS BICYCLE



✓ Pros

- **Shared capacity.** Pooled reserves and cheaper balancing
- **Faster together.** More trade, less curtailed RES output
- **If one tires,** the others take up the slack: emergency support

⚠ Cons

- **One pace for all.** Common regimes, schedules, frequency
- **One stumbles** — everyone falls: a fault spreads through the grid
- **Agree in advance.** Rules, metering and payments before launch



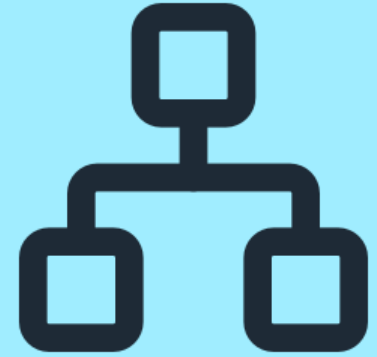
Riding together pays off when there are common rules, visibility and trust

Source: EDB (2026) "Energy Without Borders" — CAPS diagnostics, the role of monitoring and settlement discipline, the "architecture of trust"

II

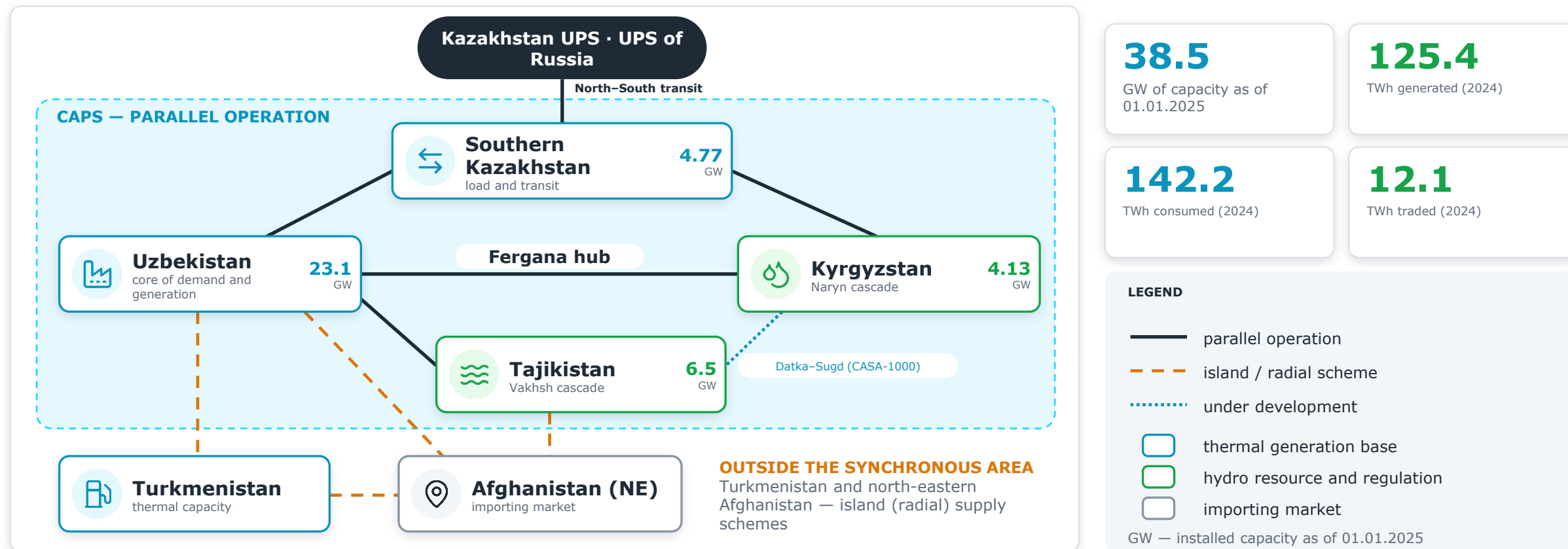
Diagnostics of the Central Asian Power System

- An interdependent technical perimeter
- Trade is recovering, but its potential is untapped
- Heterogeneous capacity mix and the system roles of countries



Central Asian Power System (CAPS): an interdependent technical perimeter

Uzbekistan, Kyrgyzstan, Tajikistan and southern Kazakhstan operate in parallel; Turkmenistan and north-eastern Afghanistan are connected via island schemes



Differences in resources and system roles form a shared portfolio of reliability and flexibility

Source: EDB; CDC Energiya



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The system roles of countries form a shared portfolio of reliability and flexibility

Some power systems concentrate demand, others hold hydro flexibility, others are transit hubs or external sources of thermal capacity

Country / perimeter	Core role	Main resource	Main constraint
 Southern Kazakhstan	Sensitive load and transit hub	Large demand, link to Kazakhstan UPS and UPS of Russia	North–South transit limits (~2,000 MW in an emergency outage)
 Kyrgyzstan	Hydro-regulating hub with a shrinking free resource	Naryn cascade, Toktogul, peak regulation	Growing domestic demand (14.6 → 19.3 TWh), water levels
 Uzbekistan	Core of demand, generation, transit and RES integration	Thermal base, CCGT/GT/gas engines, RES, BESS	Winter gas shortages (100–400 MW deficits), internal grid constraints
 Tajikistan	Supplier of summer hydropower and regulating capacity	Vakhsh cascade, Nurek, Rogun	Evacuation limits (220 kV grid) and seasonality
 Turkmenistan	External source of surplus thermal capacity	Gas-fired generation, 15–50% reserve	Island schemes and synchronisation
 Afghanistan	Importing market and prospective southern extension	Demand, southern corridor	Stability limits and island schemes

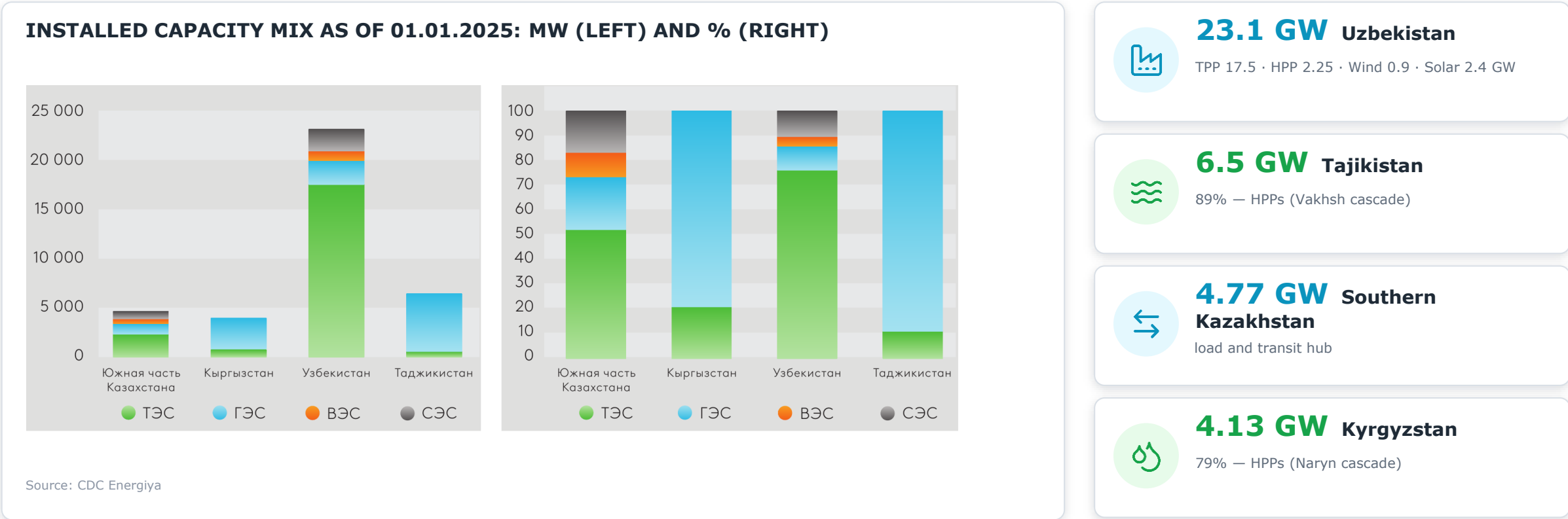


Cooperation makes it possible to use the strengths of each power system without replacing national strategies

Source: EDB assessment based on CDC Energiya data. The classification is an analytical framework, not an official allocation of functions

CAPS capacity mix: high system heterogeneity is the basis of complementarity

Installed capacity as of 01.01.2025 — 38.5 GW: the thermal base of Uzbekistan and southern Kazakhstan versus the hydropower of Kyrgyzstan and Tajikistan

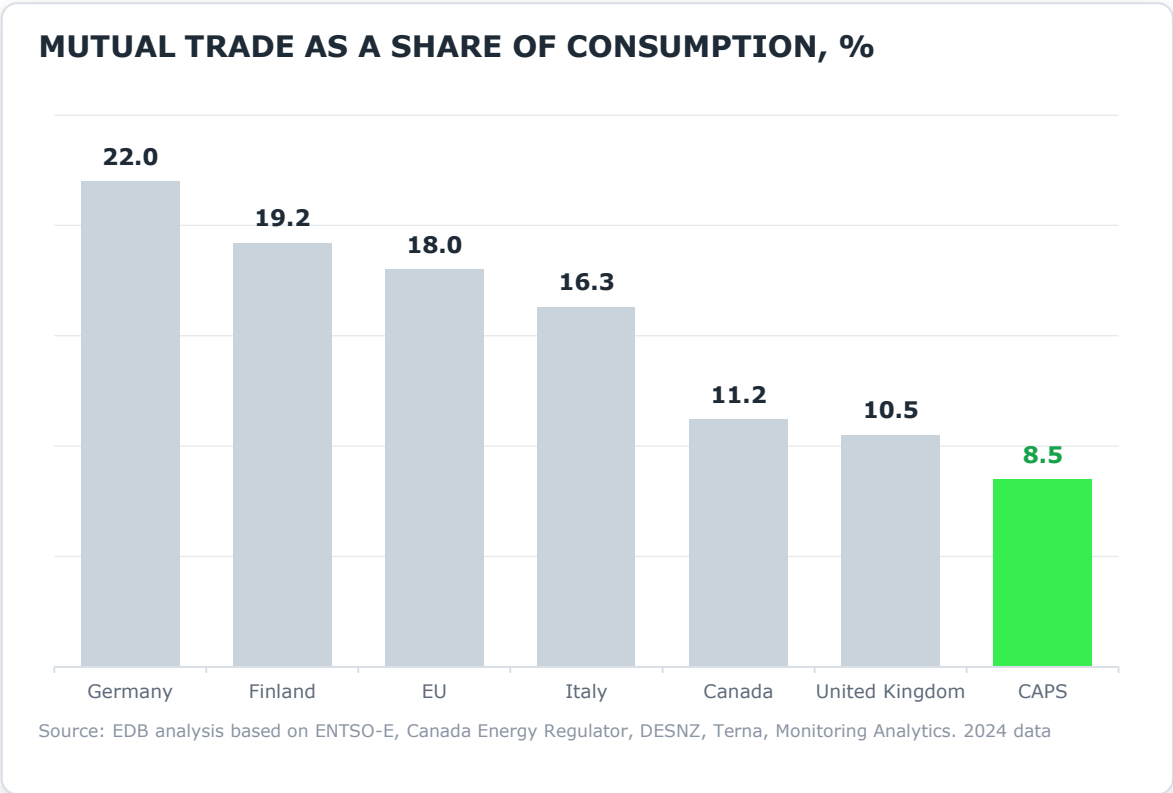
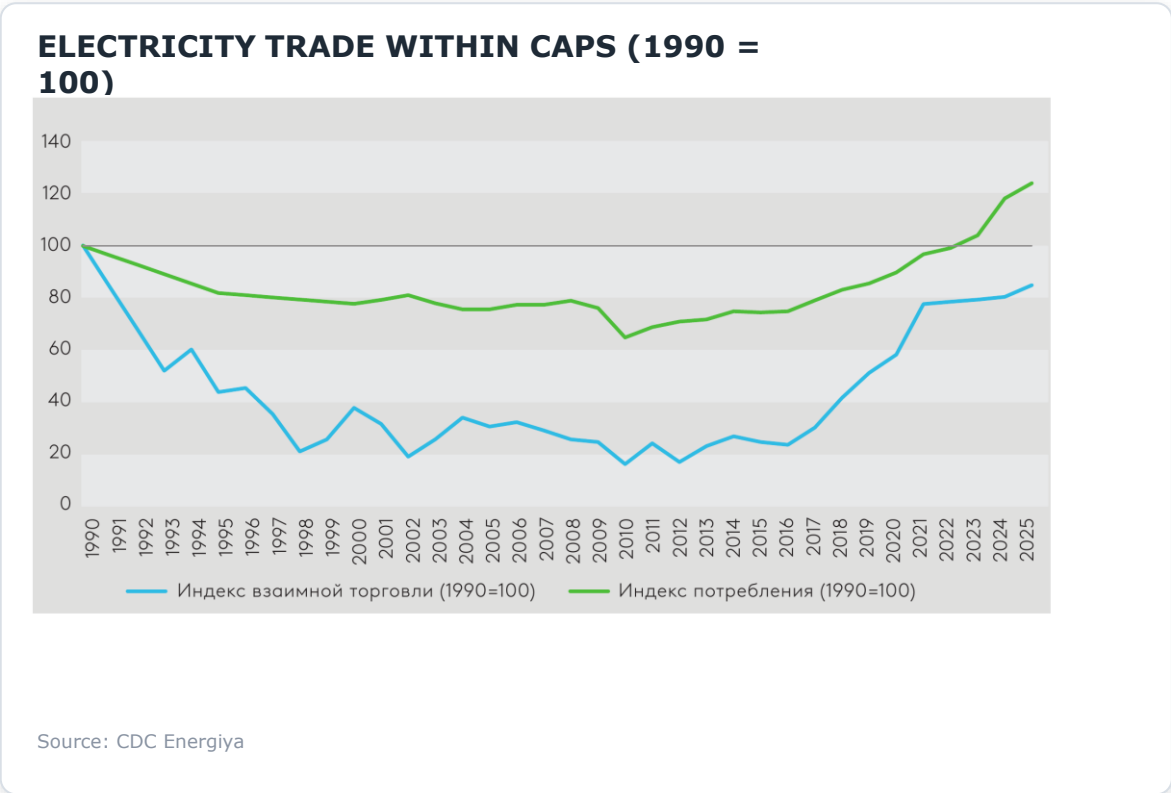


 **The value of integration is measured by the ability to deliver capacity to the right node at the right hour**

Source: CDC Energiya

Regional trade is recovering, but the potential of connectivity remains untapped

Mutual trade within CAPS has grown fivefold since its 2010 low, but its share of consumption is 2–2.5 times lower than in the EU, Germany and Finland



 In 2024 trade was already five times above its 2010 low, but remains below its technical potential

III

Four system challenges

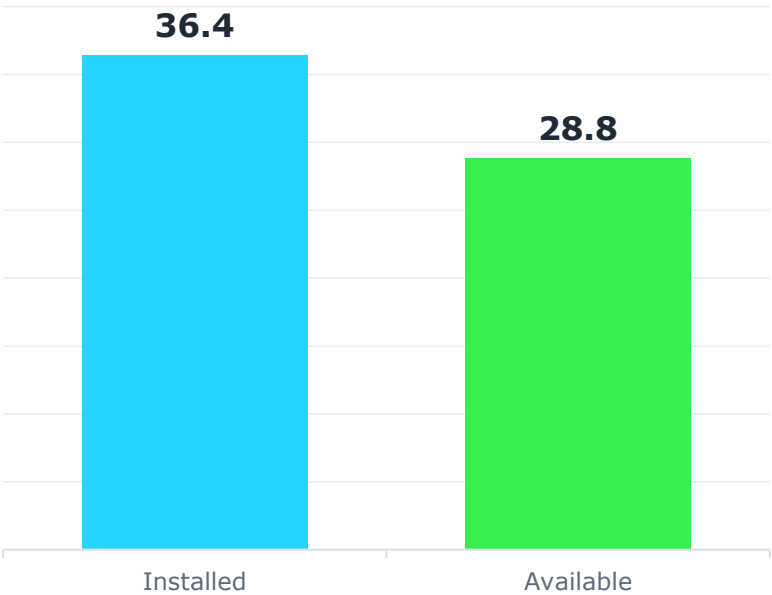
- Capacity unavailable at the annual peak hour
- Resource constraints on available capacity
- Growing RES curtailment and congested sections
- Digital architecture



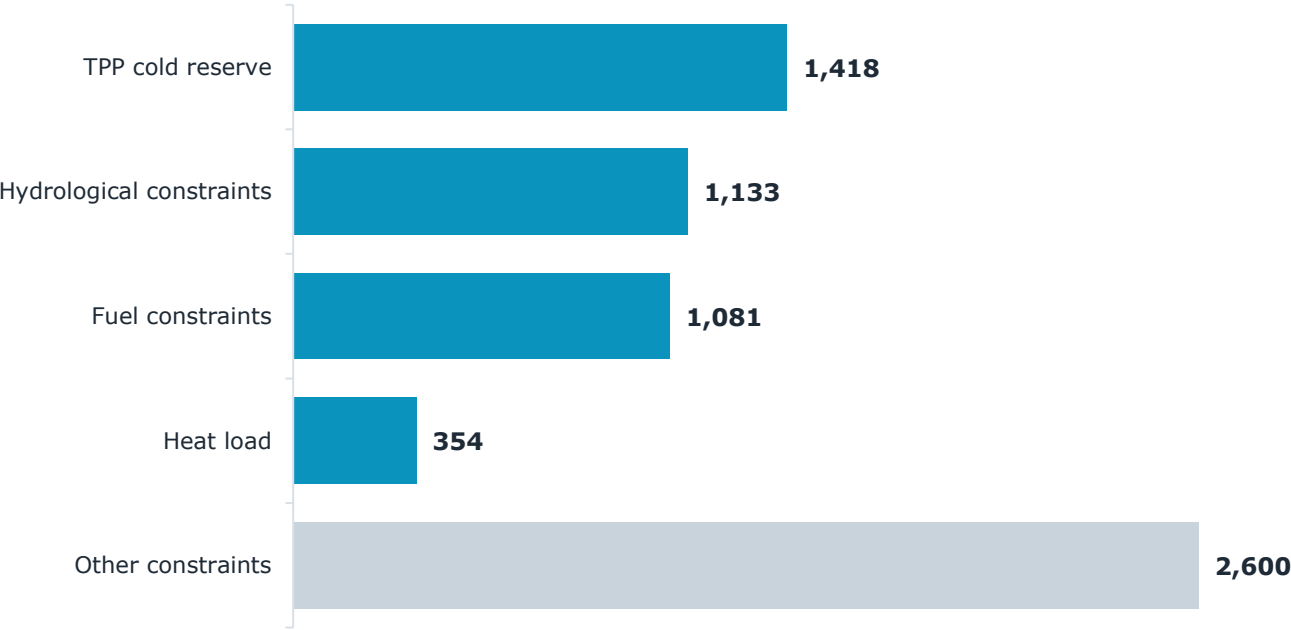
Challenge 1 – unavailable capacity

At the annual peak hour installed capacity substantially exceeds available capacity. The gap is a direct result of poor coordination, not a shortage of plants

CAPS CAPACITY AT THE ANNUAL PEAK HOUR, GW



REASONS FOR UNAVAILABLE CAPACITY, MW

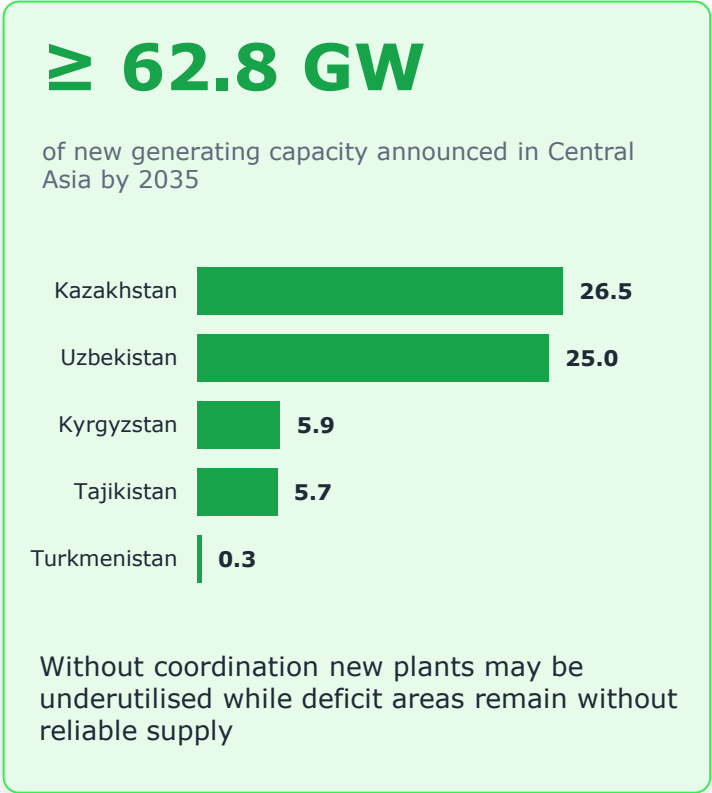


 Cooperation is valuable exactly to the extent that a resource is confirmed as available and deliverable, not merely existing on paper

Source: CDC Energiya; EDB assessment

Causes of constraints on available capacity

Constraint	Where it appears	Impact on integration	Possible solutions
Fuel shortage	Uzbekistan, some TPPs in winter	A formal capacity surplus does not translate into an available reserve at the critical hour	Fuel planning, flexible GT/gas engines, emergency support, BESS
Hydrological constraints	Kyrgyzstan, Toktogul, Naryn cascade	Free hydro flexibility shrinks when reservoir levels are low	Water-energy regimes, Kambarata-1 HPP, payment for flexibility
Grid constraints	Tajikistan, 220 kV grid, Surkhandarya node	Summer hydropower is not fully used	Tajikistan–Uzbekistan links, Datka–Sugd, Syrdarya/ACWA–Sugd
TPP cold reserve	Thermal systems of the region	Capacity exists, but rapid use is limited	Reserve mechanisms, ancillary services, upgraded start-up regimes
Technical condition	TPPs, HPPs, grids	Reduces resource readiness, increases failure rates	Repair programme, digital monitoring, prioritisation of nodes

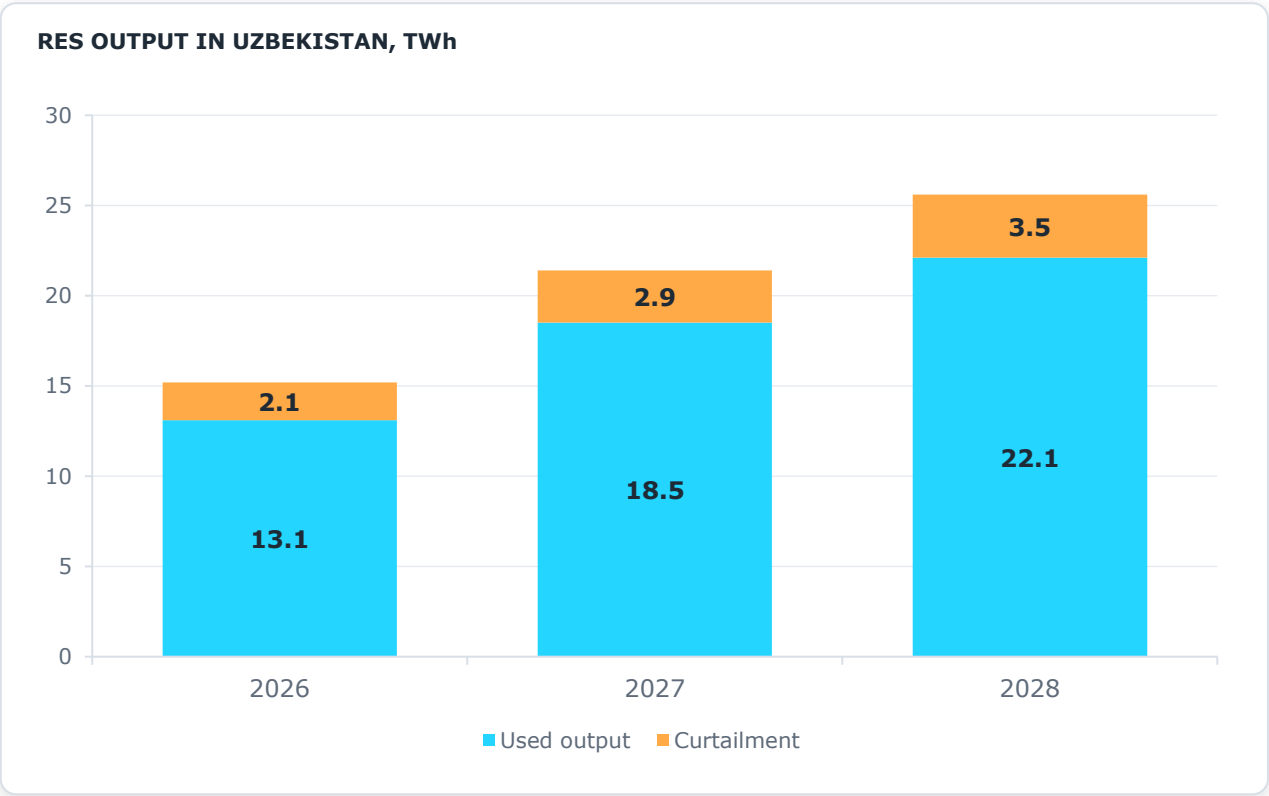


The region risks a formal surplus of installed capacity alongside a persistent deficit of available capacity at critical hours

Source: adapted by EDB experts from CDC Energiya; EDB assessment based on strategic plans

Challenge 2 — growing RES curtailment

By conservative estimates, RES capacity in Uzbekistan may reach 11.4 GW by 2028 and storage 4.3 GW. Forced curtailment of output will grow at the same time



**Curtailment** — energy that could have been produced but was not used by the system

 lower useful output

 weaker economics of RES projects

 payment risk under long-term contracts

 higher reserve requirements

CURTAILMENT PEAKS IN SHOULDER MONTHS

up to 45.7%

September (estimate)

up to 37.5%

May (estimate)



The estimate is conservative: a higher RES build-out target means more curtailment. Regional coordination is a key tool for reducing this risk

Source: CDC Energiya

Challenge 3 – key lines already operate at their limits

When internal grids are congested, trade, hydropower flows, RES evacuation and emergency support to neighbours are all constrained



↔

Internal constraints affect regional trade

🛡️

A shortage of available transfer capacity limits not only trade but also emergency assistance

⚠️

Congested sections undermine reliability when large units trip and/or demand spikes

 **New grid projects should increase NTC/ATC, relieve line congestion, reduce RES curtailment, improve reliability and market readiness**

Source: EDB; CDC Energiya. For sections with two permissible flow values, the percentage is calculated against the higher value

Challenge 4 — digital architecture: the region sees part of the operating state but does not manage it as a single system

Without observability, AGC, commercial metering and secure data exchange, the market is limited to manual coordination and conservative limits

CURRENT STATE



SCADA

National systems were chosen independently; CDC Energiya was not designed as a coordinating SCADA for regional control



AGC

Fully operational only at KEGOC; design documentation for a central AGC system at CDC is ready and will cover all cross-border sections and regulating plants in UZ, KG, TJ



WAMS / WACS

WAMS at CDC uses a limited set of PMUs (North–South transit); KEGOC's WACS added +250 MW of transfer capacity



AMR

The regional system has been procured and installed; commissioning, integration with national AMR systems and secure channels are under way



Relay protection, \ and cybersecurity

Protection was designed for synchronous generation; needs harmonised settings, inverter-based resource models (IEEE 2800), IEC 62443/62351 standards

TOOLS AND MEASURABLE EFFECT

Tool	System effect	KPI
CDC central AGC system	Fewer uncompensated imbalances; basis for an ancillary services market	Number of connected plants, reduction in deviations
WAMS / PMU	Early detection of dangerous regimes, justification of permissible flows	Coverage of critical sections
WACS	Increase in useful transfer capacity	Increase in permissible flows
Regional AMR	Financial settlements, deviation charges, accounting for emergency energy	Share of metering points covered
Secure channels	Trust and cyber resilience of the regional architecture	Channel availability, number of incidents
RES forecasting	Fewer "just in case" reserves and less RES curtailment	Forecast error, curtailment volume



Digital solutions are cheaper and faster than new lines and deliver a measurable increase in the useful transfer capacity of the existing grid

Source: CDC Energiya (2026); systematised by EDB experts

IV

Economics of cooperation

- Benefit channels: integration lowers the full cost of reliability
- Scenario assessment of three levels of integration
- International experience of regional markets



Economics of cooperation: integration lowers the full cost of reliability

Benefits come not only from trade but also from shared reserves, lower emergency costs and less RES curtailment

Benefit channel	How it works	Result
 Trade and arbitrage	seasonal and daily exchanges, cheaper resource in the neighbouring node	→ lower operating costs
 Shared reserves	a common reserve pool instead of full duplication in every country	→ lower cost of reliability
 Less curtailment	exporting surplus RES and BESS output to a wider demand area	→ more useful output
 Emergency support	rules and payment for deviations during sudden deficits	→ less damage from undersupply

Cooperation reduces not only the price of energy but also the cost of reliability: less emergency undersupply, less RES curtailment, a lower need for excess national reserves



640 mn USD

per year — gross benefit
developed architecture (central case)



120 mn USD

per year — net benefit
partial and deepened integration (central case)



Economic benefits can be shared through rules: trade/transit volumes, provision of flexibility/reserves, compensation for deviations

Source: EDB expert calculations

Scenario assessment: three levels of integration — from using existing grids to a developed architecture

Preliminary screening estimate of the annual system effect, USD mn/year: central case, range in brackets. Not a forecast or a project appraisal

Indicator	Partial integration	Deepened integration	Developed architecture
Main measures	Better use of existing grids	Priority reinforcements + pilot market	Comprehensive reinforcement, DAM, RTM, ancillary services
Added capacity for exchanges, GW	0.7–1.2	1.5–2.2	2.2–3.3
Additional trade, TWh/year	3.5–6.0	7–11	10.5–16
Avoided RES curtailment, TWh/year	0.6–1.2	1.5–2.8	2.8–4.5
Operating savings and arbitrage	65 (20–110)	118 (35–200)	170 (50–290)
Deferred capacity investment	78 (25–130)	153 (55–250)	250 (100–400)
Lower RES curtailment	25 (10–40)	63 (25–100)	100 (40–160)
Reliability and emergency support	25 (10–40)	65 (30–100)	120 (60–180)
Gross system benefit	193 (65–320)	398 (145–650)	640 (250–1,030)
Annualised costs	75 (50–100)	275 (200–350)	600 (450–750)
Net benefit, central case	118	123	40
Benefit / cost	2.6	1.4	1.1



Benefits without major construction

Digitalisation, NTC/ATC calculation and coordinated operation can deliver results before grid projects are completed



Partial integration is the most robust first step

USD 2.6 of benefit per USD 1 of cost; breaks even at just 39% of expected benefits. Deepened integration offers upside of up to USD 450 mn/year



Developed architecture — only once readiness is proven

The largest gross benefit, but a marginal return of USD 0.7 per USD 1; breaks even only at 94% of benefits



A positive effect for the region does not mean benefits are shared equally — the mechanism for sharing them must be agreed in advance



Flexibility and regional market architecture

- Hydro flexibility as a paid system service
- Flexibility portfolio: different horizons — different technologies
- Phased market development, allocation of functions, roadmap



The region has two unique HPP cascades

Water is a multi-purpose resource: energy, irrigation, environmental releases and interstate commitments. Hydro flexibility is a system service, not a free reserve



Naryn-Syrdarya cascade

Kyrgyzstan — Uzbekistan — Kazakhstan

Reservoir	Country	Capacity, bn m ³	Regulation
Toktogul	Kyrgyzstan	19.5	Multi-year
Charvak	Uzbekistan	2.0	Seasonal
Andijan	Uzbekistan	1.9	Seasonal
Kairakkum	Tajikistan	4.03	Seasonal
Shardara	Kazakhstan	5.7	Seasonal

- Toktogul HPP (1,440 MW): meeting Kyrgyz demand, releases for downstream countries and regulation for CAPS — these tasks do not coincide in time
- Kyrgyz consumption grew from 14.6 to 19.3 TWh (2014–2025); Toktogul levels do not recover even as imports rise
- Kambarata-1 HPP is a winter resilience project that preserves Toktogul's regulating function



Vakhsh cascade

Tajikistan

Facility	Parameter	Regulation
Nurek reservoir	10.5 bn m ³ (4.5 live storage)	Seasonal
Nurek HPP	Main power producer	Daily / seasonal
Rogun reservoir	13.3 bn m ³	Multi-year
Rogun HPP	3,780 MW (design)	Regulating HPP of the cascade

- Tajikistan returned to parallel operation on 7 June 2024; summer supplies to Uzbekistan are 2–3 times higher than winter supplies
- Tajik HPPs already act as counter-regulators for Uzbek solar plants, but part of the output is lost due to the 220 kV grid
- Rogun: supplies on an uneven daily schedule during peak deficit hours — hydropower sells not only energy but the shape of the load curve



Balancing energy export potential by 2032: Kyrgyzstan up to 0.8 TWh, Tajikistan up to 1.02 TWh

Source: CDC Energiya; USAID (2024)



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HPPs are a universal technology that needs adequate monetisation of its services

Hydropower plants can provide almost the full range of grid services, but flexible operation comes at a cost

● service provided ● not provided

Grid service	Direction	Run-of-river	Reservoir	PSPP
Electricity generation		●	●	●
Balancing	Upward	●	●	●
	Downward	●	●	●
Frequency control: primary	Upward	●	●	●
	Downward	●	●	●
Frequency control: secondary	Upward	●	●	●
	Downward	●	●	●
Frequency control: tertiary	Upward	●	●	●
	Downward	●	●	●
Voltage support		●	●	●
Active power loss compensation		●	●	●
Black start		●	●	●

HPPs can:

-  change output quickly
-  cover the peak and mid-peak parts of the load curve
-  serve as emergency and load-following reserves
-  participate in frequency control and supply reactive power



However, flexible operation of HPPs has a cost. Moving from baseload operation to a grid-stabilisation regime reduces the fatigue life of the whole unit by roughly an order of magnitude.

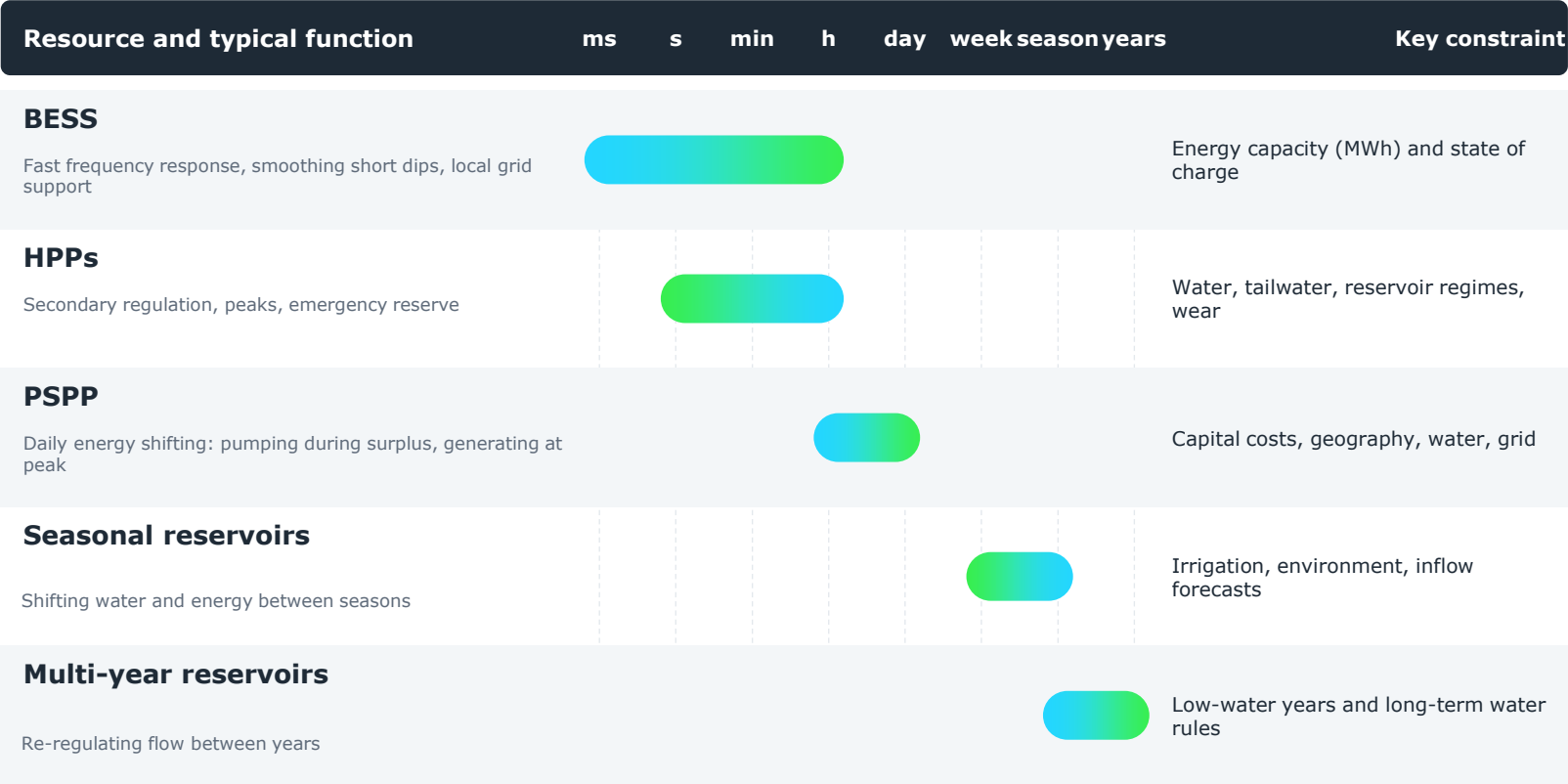


HPP flexibility is a valuable system service: for it to be provided, its wear-and-tear costs must be recognised and paid for

Source: IRENA (2019)

Flexibility portfolio: different horizons — different technologies

BESS, HPPs, PSPPs and reservoirs perform complementary functions; developed regional links combine them into a shared portfolio



PSPPs IN UZBEKISTAN

5,030 MW

assessed potential — 16 sites in 7 regions; 46% in Tashkent region (2.3 GW)

Project	MW	USD mn
Upper Pskem	600	1,020
Khodjikent	200	320
Karateren	500	477
Aydarkul	300	350
Total	1,600	2,167

Up to 2.8 TWh of output per year; value needs to be confirmed by system studies

A robust portfolio matters: BESS for fast tasks, HPPs for regulation and seasonal flexibility, PSPPs for shifting daytime RES surpluses, gas units for stress conditions

Source: adapted by EDB experts from CDC Energiya; Uzbekhydroenergo JSC; N. Akchabaev (2024)

International experience: markets follow technical, institutional and settlement readiness

Regional markets rarely emerge as unified from the start — they evolve from emergency support and metering to short-term trade, balancing and ancillary services

Region	Economic effect	Estimated effect
 Latin America	More efficient use of existing generation and cross-border trade	Up to USD 2 bn per year in potential savings without additional generation
 Pan-Arab Electricity Market (PAEM)	Lower total system costs through trade and interconnections	USD 107–196 bn in cumulative savings in 2018–2035; USD 35 bn in benefits from USD 7.5 bn invested in transmission lines
 Southern African Power Pool (SAPP)	Lower investment and operating costs through coordination	By 2040, CAPEX lower by USD 36 bn and OPEX by USD 3 bn versus the sum of national plans
 Europe	Lower generation costs through higher transfer capacity	Investment of EUR 2 bn per year after 2025 and generation cost savings of up to EUR 5 bn per year by 2030

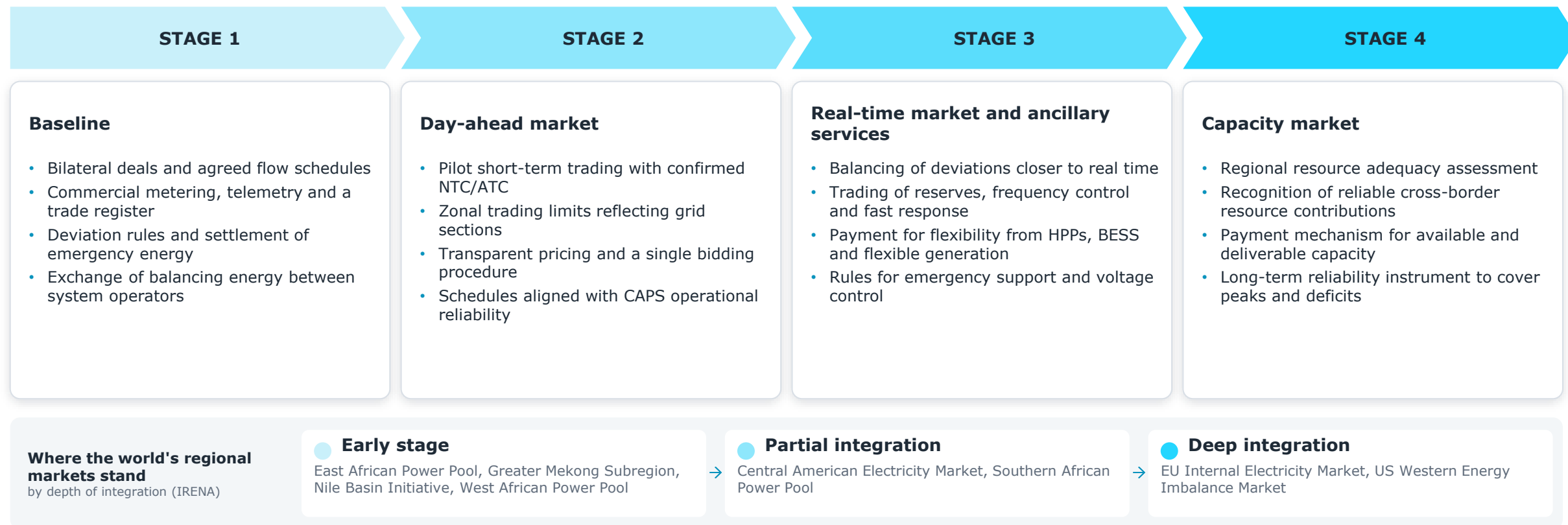


Lesson for Central Asia: post-Soviet market reform without settlement and institutional readiness guarantees neither competition nor reliability

Source: ESMAP (2025). Estimates refer to markets of different scale and institutional maturity and are not a quantitative benchmark for CAPS

Gradual, step-by-step development of the regional market

Sequencing reduces the risk of premature decisions and links trade to the stability of the power system



Before actively trading electricity and services, flows and deviations must be measured and settled accurately and reliably

Source: IRENA; EDB



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Allocation of functions: regional coordination without loss of national control

CDC Energiya can become the regional coordinator, platform operator and settlement centre; market monitoring and dispute resolution are kept organisationally separate

Institution	Possible functions	Principle preserved
 CDC Energiya / regional coordinator	Coordination of regimes, calculation of interconnection schedules, central AGC, market platform, settlement coordination, data centre	 Supports national dispatch control
 National system operators	Internal regime, reliability, grid access, balancing, operational commands	 Control over the security of national power systems
 National regulators	Tariffs, grid access, licensing, consumer protection	 National regulatory responsibility
 Market platform operator	Bid intake, DAM and real-time market clearing, publication of results	 A transparent operational function that does not replace policy decisions
 Financial settlement coordinator	Settlement of trades, deviations, emergency energy and ancillary services	 Financial discipline and payment security
 Market monitoring and dispute resolution	Monitoring of market power and manipulation, handling of disputes	 Participant trust, lower risk of politicised settlements
 Three monitoring models: a supervisory body under the CA Electric Power Council, an independent market monitor, or national regulators coordinating under a single set of rules		

Source: proposals by EDB experts based on CDC Energiya data, World Bank (2026a), ESMAP (2026) and the REMIT logic. The CA Electric Power Council is the forum for agreeing cross-system rules

VI

Investment, financing and risks

- Priority grid projects and external corridors
- Risk register
- Grid financing models and an ITP pilot



Investment priorities: "one constraint — one system effect — one project"

Indicative expert prioritisation of grid projects

	Project / package	Interface and system effect	Status / main KPI
P1	Kristall–Yulduz: reconstruction and second 220 kV circuit	Uzbekistan–Kyrgyzstan, Fergana hub; higher transfer capacity	REMIT phase 1; higher ATC, fewer constraints on L-Kr-Yu
P1	Second 500 kV line Shymkent–Tashkent TPP (alternative: Shymkent–Khalka SS)	Uzbekistan–Kazakhstan; stronger interface and support for trade with southern Kazakhstan	REMIT phase 2; less congestion on L-501/L-2-Ch/L-2-D
P1	Central AGC + AMR + secure channels	Controllable net flows, financial settlements, basis for the REMIT pilot	Design documentation / commissioning at CDC; fewer deviations, metering point coverage
P1	Frunze–Kemin / Bishkek-500	Internal reliability of Kyrgyzstan, reliable evacuation of hydro output	REMIT phase 3; fewer internal constraints
P2	Kemin–Almaty	Kazakhstan–Kyrgyzstan; seasonal exchanges and hydro flexibility	CDC proposal; relief of L-514, higher ATC
P2	Datka–Sugd in transit mode + tie-in at Lochin SS / Uzbekistan	Fergana hub, CASA-1000, northern Tajikistan	CDC proposal; higher transfers into the Fergana hub
P2	Syrdarya/ACWA–Sugd	Uzbekistan–Tajikistan; reliability of Sughd region	Financed by ADB; fewer constraints in northern Tajikistan
P2	Muruntau–Shymkent	South-west Uzbekistan → Shymkent hub; rerouting of flows	Proposal by NDC/NEGU of Uzbekistan; relief of south-western sections
P3	Atamyrat–Guzar; Dashoguz–Muruntau–Kyzylorda	Turkmenistan–CAPS / southern Kazakhstan; evacuation of Turkmen capacity	Options subject to Turkmenistan's parallel operation
P3	HVDC back-to-back at the CAPS–Kazakhstan UPS boundary	Controllable northern interface; fewer power surges on the North–South transit	Subject to a separate feasibility study



P1 — quick effect and institutional link to REMIT; P2 — high effect, needs alignment with feasibility studies and adjacent solutions; P3 — strategic options

Source: systematised by EDB experts based on CDC Energiya, REMIT

External corridors can unlock their potential only once the internal CAPS core is ready

Central Asia could become an energy hub between several systems, but external connectivity rests on internal controllability



Vector	Opportunities	Risks
Northern Russia / EAEU	Balancing and emergency support	Transit readiness and regulatory conditions
Southern CASA-1000	Channel for seasonal hydro exports	River flows, Afghan section
Eastern China	Large potential market	Confirmed demand and a contractual model
Trans-Caspian Europe	Long-term green exports to Europe	Early stage of feasibility work
Turkmenistan – Iran south-west	Depends on the synchronisation scheme	Use of a DC link

Developing external corridors continues the internal modernisation of CAPS rather than replacing regional integration

Source: IEA; EDB

The spectrum of grid financing models

From a fully public model to privatisation: moving right, the share of private capital, ownership and responsibility for the asset increases

	100% public	the share of private capital, ownership and responsibility for the asset increases			100% private capital
	1 Public / IFI	2 Hybrid / JV / SPV	3 ITP / BOOT	4 Grid concession	5 Privatisation
 CAPITAL	Budget, sovereign debt, IFIs or TSO debt	Public and private equity in a utility or project SPV	Private SPV: equity + project debt backed by TSA/RAP	Private concessionaire + debt backed by regulated revenue	Private owner finances through equity and debt
 OWNERSHIP	State / public TSO	Joint; the public side may retain control	With the SPV for the contract term; BOOT provides for transfer back	Assets usually remain state-owned	Company/assets sold with no obligation to transfer back
 CONSTRUCTION AND O&M	TSO; private sector usually as EPC/O&M contractor	With the TSO/JV or allocated by contract	SPV responsible for construction, commissioning, O&M and availability	Concessionaire operates, upgrades and expands the grid	Private owner / regulated TSO
 PLANNING / OPERATION	Fully with the state and the system operator	Remain with the public TSO / ISO	TSO retains planning, switching and dispatch	By contract; regulator oversight, a separate ISO is possible	Regulator + TSO/ISO; the system function may be separated
 CASES	REMIT I: IDA/CAWEP → state TSOs KG/TJ/UZ; RTE: tariff + debt/bonds	KEGOC: Samruk-Kazyna ≥85%, free float 8.1%; 50Hertz: Elia 80% / KfW 20%	Brazil: 30-year auctioned concessions / RAP; KZ: Batys Transit, 500 kV (EDB)	Philippines / NGCP: 25 years; TransCo assets remain state-owned	UK / National Grid: listed in 1995; NESO: public system operator since 2024

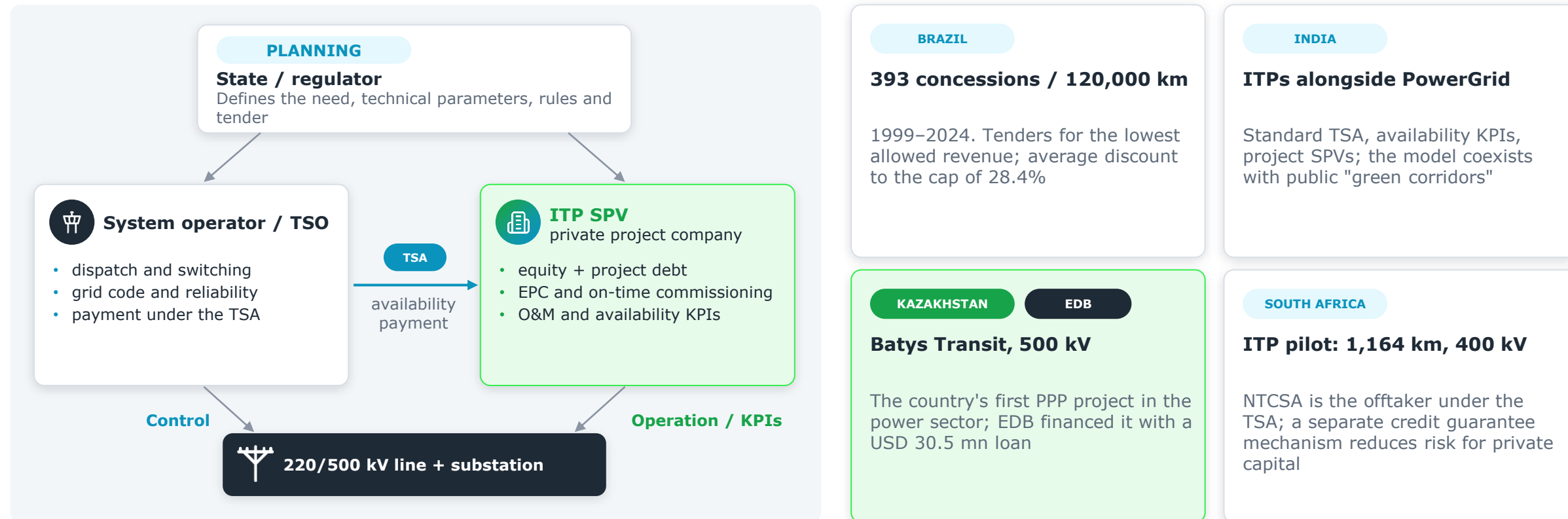


The hybrid model shares capital; an ITP transfers the life cycle of a single asset; a concession transfers operation and grid development; privatisation transfers ownership

Sources: OECD (2026); World Bank REMIT; KEGOC; 50Hertz; ANEEL/MME Brazil; NGCP; National Grid / UK Government

ITP: private capital in a single grid asset without handing over system control

The investor takes on financing, construction and technical availability risks; the state and the system operator retain planning, dispatch and security



An ITP does not mean privatising the power system: the project asset becomes private, while planning and operational control stay with the state and the system operator

Source: OECD (2026); National Treasury South Africa (2025); World Bank (2026); EDB, Batys Transit (2008/2013)

Conclusion: from inherited connectivity to a managed regional asset

Central Asia already has the wires. What it lacks is an "architecture of trust" between countries, operators and investors



01

Controllability matters more than scale

- the value of a connected system depends on the quality of data, metering, AGC and rules
- a resource is valuable exactly to the extent that it is confirmed as available and deliverable



02

The full cost of reliability

- four benefit channels: arbitrage, shared reserves, less curtailment, lower emergency costs
- net benefit of about USD 120 mn per year; returns diminish — deepen step by step



03

Hydro flexibility is a paid service

- water is a multi-purpose resource for upstream and downstream countries
- an explicit compensation mechanism is needed, not declarations of mutual benefit



04

Phasing instead of a supranational regulator

- four maturity levels built on existing mechanisms
- national operators retain control over internal regimes



EDB's role

- 1 Regional cooperation creates a new class of investment projects whose effect extends beyond a single country
- 2 The Bank is not only a source of finance but an institution that links technical diagnostics, economic assessment, benefit- and cost-sharing mechanisms and interstate dialogue
- 3 Priority goes to projects with a measurable regional effect: more available transfer capacity and reliability, less RES curtailment, more trade and shared use of flexibility



Managed connectivity is the precondition for the next stage of Central Asia's power sector development

Source: EDB (2026) "Energy Without Borders"