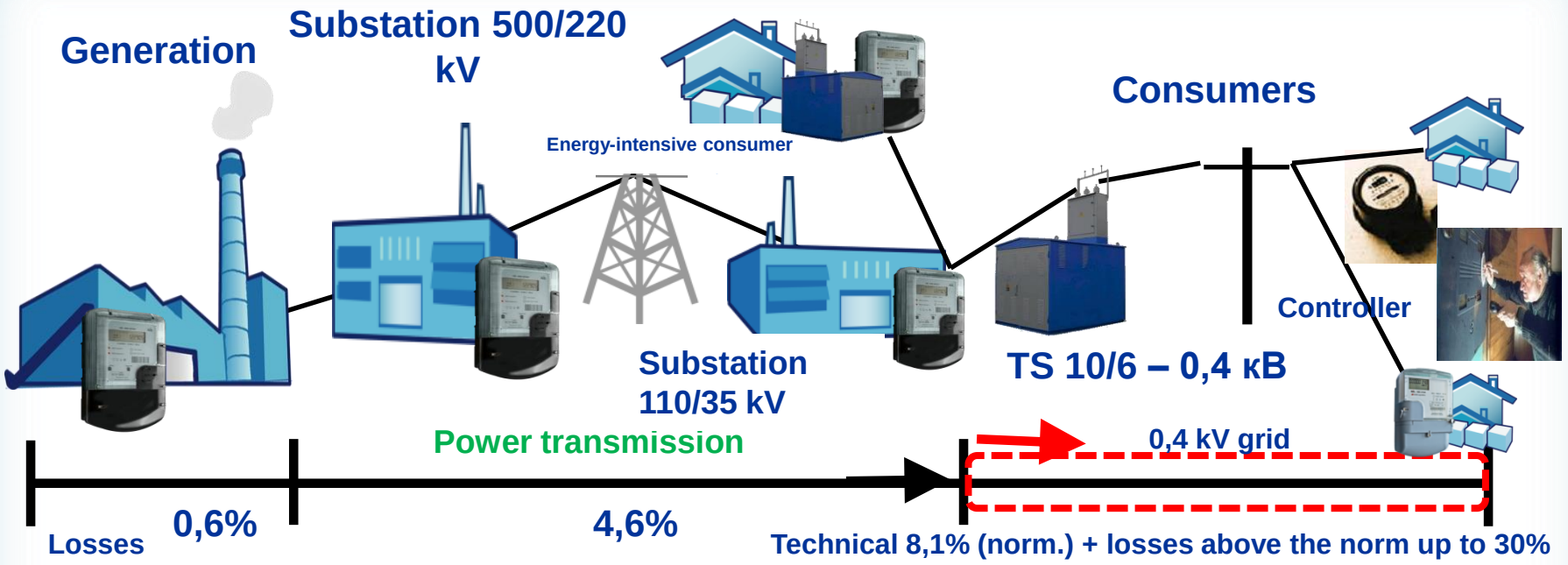
Project
"Implementation of an automated metering and control system for the electric power consumed by 0,4 kV consumers in the Republic of Uzbekistan"
with participation of International Financial Institutions

Tashkent - 2016

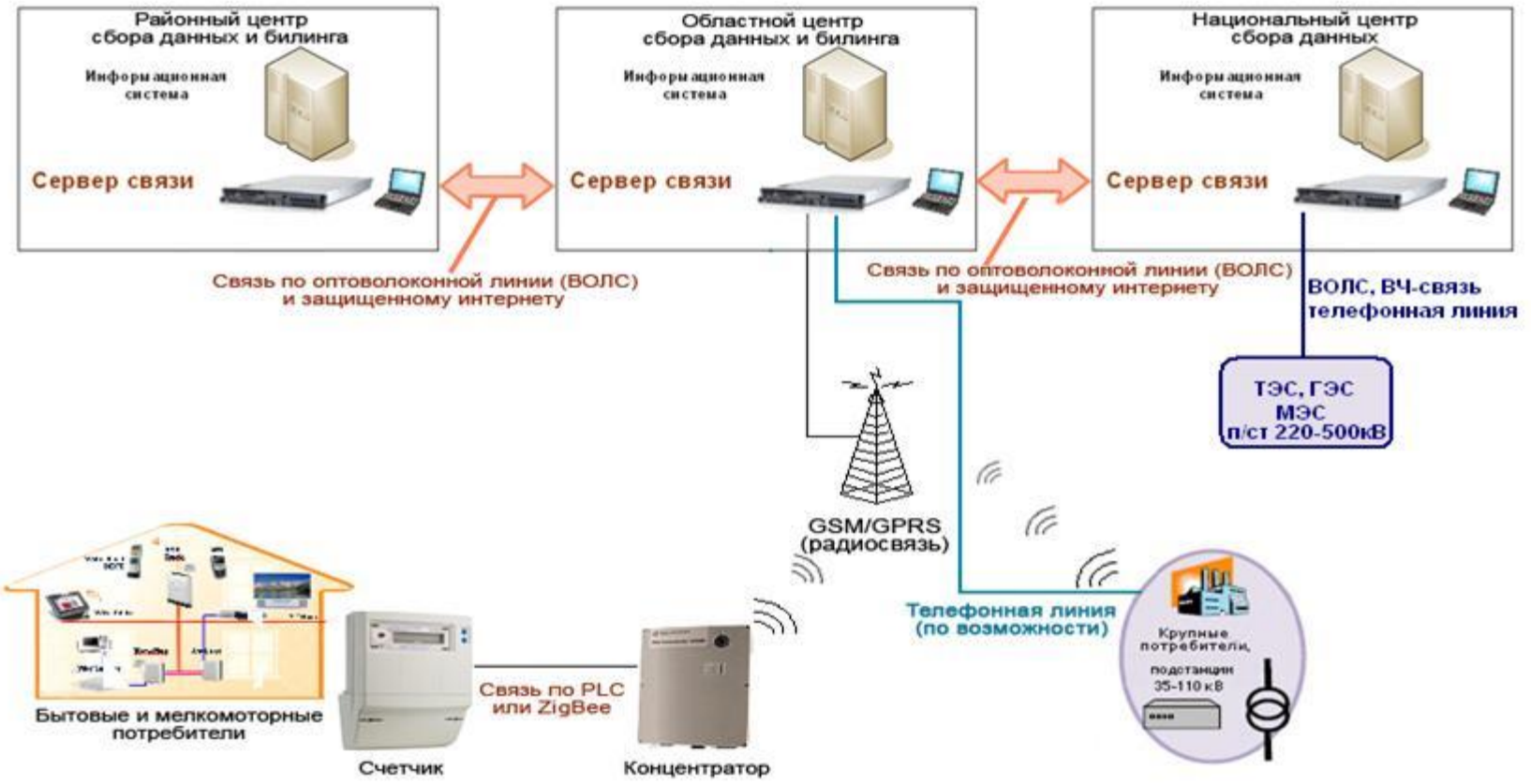
The existing system of electric power metering in the Republic



On the boundaries between 0.4 kV power transmission lines there are electronic balance meters; daily power balance is calculated including taking the readings and their registration in the control log.

- **Untimely gathering of meter readings and incorrect billing;**
- **Untimely payment for consumed electricity (growth of receivables);**
- **No capacity for remote connection/disconnection;**
- **Untimely detection of unauthorized connections and tampering with meters;**
- **Illegal power consumption including distortion of data;**
- **No valid data for balance calculation.**

Overall AEMCS architecture



AEMCS architecture

Data collection and processing and billing center (AMM/MDM)

Major consumers

TCP/IP data transmission network GSM/GPRS/3G/…

Data concentrator

radio communication

PLC

Mbus/ ZigBee

Thermal power

Gas

Water

Display

Mbus/ ZigBee

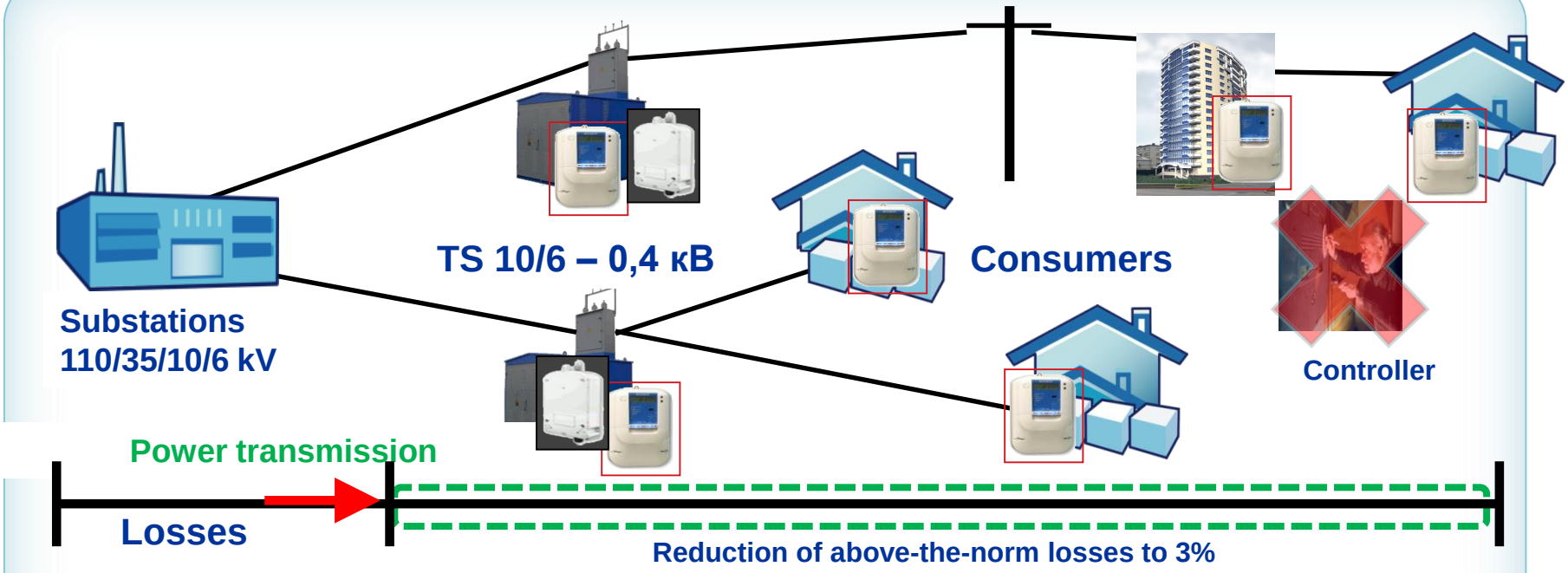
Thermal power

Gas

Water

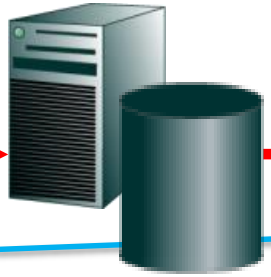
Display

Expected outcomes from AEMCS implementation in 0,4 kV grids



- automatic remote disconnection (in case of debt) and connection of consumers with a capacity to impose limitations on power consumption in line with the contract between the energy supplying enterprise and the consumer *(timely prepayment and putting an end to the growth of receivables);*
- automated hourly collection and daily balance calculation of the distributed and consumed electric power, analysis of physical and financial energy balances, enabling to detect unauthorized consumption of electric power *(timely taking of readings, balance calculation and absence of the controller);*
- collection, processing, storage and provision of objective and valid information on electric power distribution and consumption *(timely and accurate billing).*

Advantages of the "intelligent" metering device:



Data collection and processing center

Operator

Operations group

The meter is able to detect and send an alarm to the "CENTER" for the following main interventions into its operation:

Deliberate external tampering:

- Switching the power supply on and off • Changing the meter's parameters • Setting date and time
- Removal of the terminal's cover • Opening of the meter's housing
- Detection of static magnetic field • Reverse connection of wires • Current without voltage • Internal errors • Communication problems • Configuration problems • Switching off the power supply • Phase errors • Excessive voltage • Voltage drop

Deliberate technical tampering:

The consumer bus will be "READ ONLY" i.e. it will be impossible to reprogram the meter using this bus.

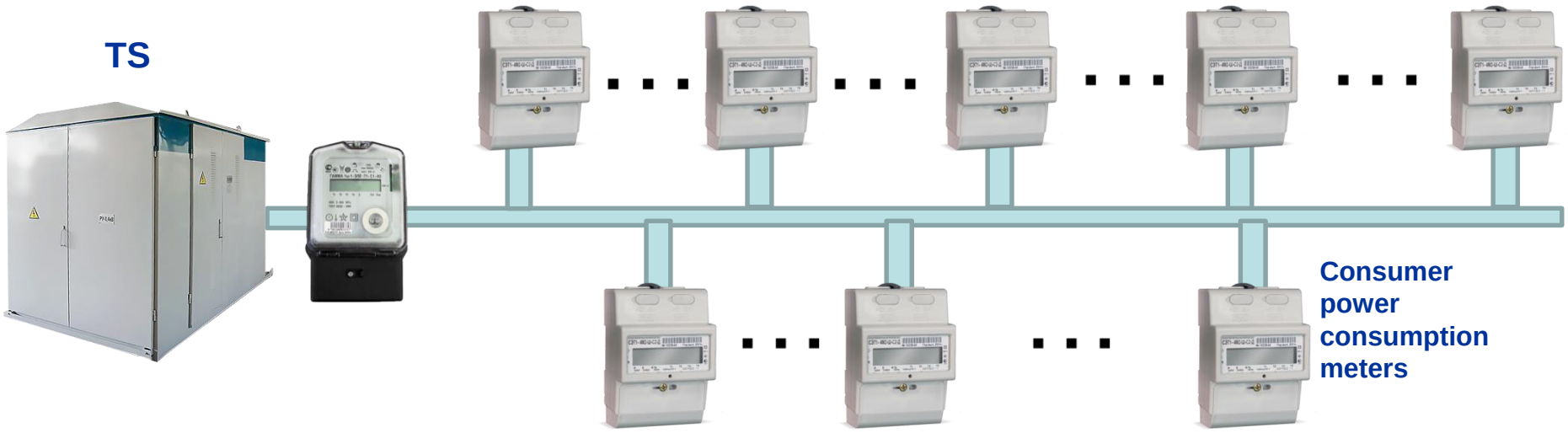
Main technical parameters:

Temperature range (extreme operating temperatures): from -45°C to +75°C;
Extended range of operating voltages: from 70% to 120%
Service period: ≥ 25 years; Inter-verification interval: ≥ 4 years;
Metering active energy: class 1
Metering reactive energy: class 2
Tariffs for import and export metering: ≥ 4
Load profile storage capacity: ≥ 4 months with a sample every 30 minutes;
Battery to maintain operations of the clock, calendar and functions
tampering protection: Service period ≥ 10 years
International standards of electromagnetic and other compatibility parameters

Comparison of the assumed type of the "intelligent" AECMS metering device with the available units:

Main features	Proposed unit	Available (installed) units:		
		AECMS	electronic	induction
Meter accuracy class	1	1	1	2
Measured parameters, in standard and remote directions etc.	Available	Available	Available (only for excessive voltage)	Unavailable
Battery to maintain operations of the clock, calendar and tampering protection functions	Available, service period 10 years	Available, service period 1.5 years	Unavailable	Unavailable
Electric power quality analysis	Available	Available	Unavailable	Unavailable
Alarm transmission functions:	Available	Available	Unavailable	Unavailable
• Switching the energy supply on and off	Available	Available	Unavailable	Unavailable
• Changing the meter's parameters	Available	Available	Unavailable	Unavailable
• Setting the date and time	Available	Available	Unavailable	Unavailable
• Removing the terminal's cover (terminal block)	Available	Unavailable	Unavailable	Unavailable
• Opening the meter's housing	Available	Unavailable	Unavailable	Unavailable
• Detection of static magnetic field	Available	Unavailable	Unavailable	Unavailable
• Reverse connection of wires	Available	Available	Unavailable	Unavailable
• Current without voltage	Available	Available	Unavailable	Unavailable
• Internal errors	Available	Available	Unavailable	Unavailable
• Communication problems	Available	Available	Unavailable	Unavailable
• Configuration problems	Available	Available	Unavailable	Unavailable
• Switching off power supply	Available	Available	Unavailable	Unavailable
• Phase errors	Available	Available	Unavailable	Unavailable
• Voltage overload	Available	Unavailable	Unavailable	Unavailable
• Voltage drop	Available	Available	Unavailable	Unavailable

Current power balance
using the example of TS 39 SS Pakhtaobod 35 kV



Power supply to the consumers from the TS: 256 kW/h
Based on the consumer meters: 156 kW/h
Difference (imbalance): Δ = 100 kW/h or 39,06%

Causes of the TS-30 power imbalance

Indicators	Total length of overhead 0,4 kV power line (km)	Number of broken isolators	Number of lay-ups	Number of sagging sections	Number of sections with contacts with trees	Measurement of load and voltage at the beginning of the 0,4 kV line						Measurement of load and voltage at the end of the 0,4 kV line			ΔU %
						Phase A		Phase B		Phase C		Phase A	Phase B	Phase C	
						Volts	Amperes	Volts	Amperes	Volts	Amperes	Volts			
1	2	3	4	5	6	7						8			9
Current situation	3,4	132	142	6	7	242	21	250	0,05	235	37	200	213	204	15,1
Norm	0,6 - 0,8	-	-	-	-	230	21	230	21	230	21	220	220	220	4,3

Also:

- 60% of power meters are not located on the borders *(there are opportunities for theft of electric power by connecting to the grid bypassing the meter)*;

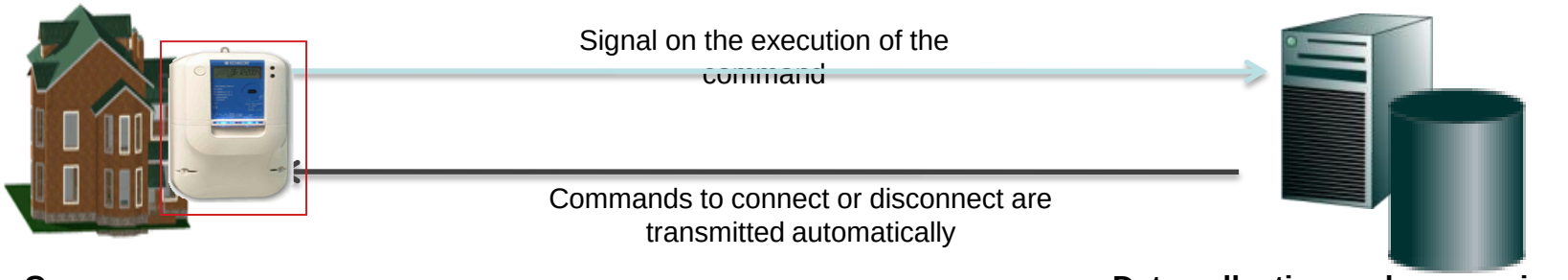
- After the placement of power meters on the borders and addressing problems in columns 3, 4, 5, 6, the losses went down from 39,06% to 8,18 %.

Power balance of TS 39 SS Pakhtaobod 35 kV after the impelentation of technical activities

Power supply to the consumers from the TS: 210 kW/h
Based on the consumer meters: 193 kW/h
Difference (imbalance): Δ = 17 kW/h or 8,18 %
Causes:

- **The length of the overhead power line was reduced from 3,4 km to 0,8 km thanks to the relocation of the TS;**
- **All consumer meters were relocated to the boundaries;**
- **Loads across branching TS feeders were split proportionally.**

The mechanism for disconnecting consumers in case of receivables and/or overconsumption of the load



The system's operation is based on prepayment.

When the prepaid amount is exhausted the program automatically sends a signal to the consumer's power meter. Upon receipt of the signal a relay is engaged in the meter stopping the supply of power until a signal to reconnect is received.

When the consumer consumes capacity above the contractual amount a computer program sends a signal to the consumer's meter. Upon receipt of the signal a relay is engaged in the meter stopping the supply of power to the consumer.

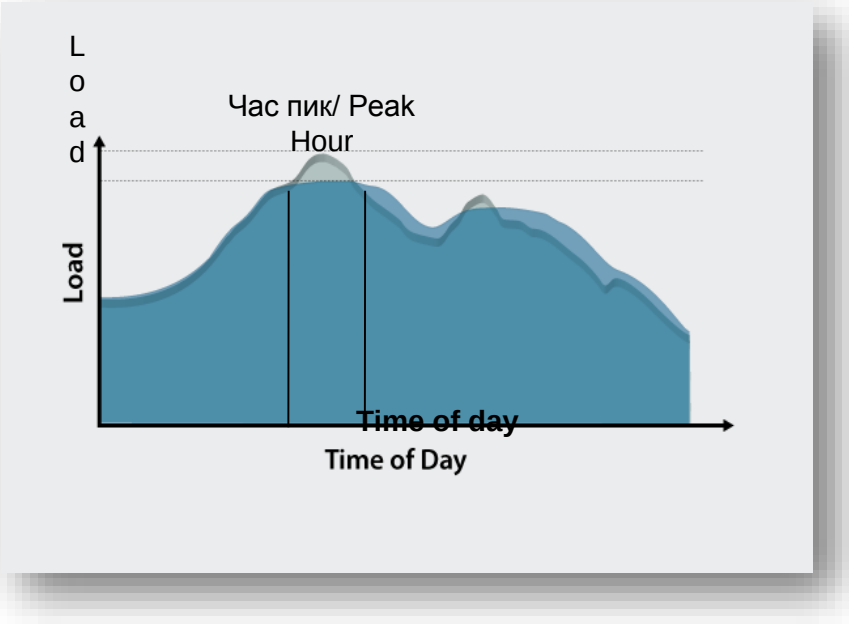
Capacity to record maximum power consumption load

Project execution will make it possible to introduce multi-tariff payment system for the electricity.

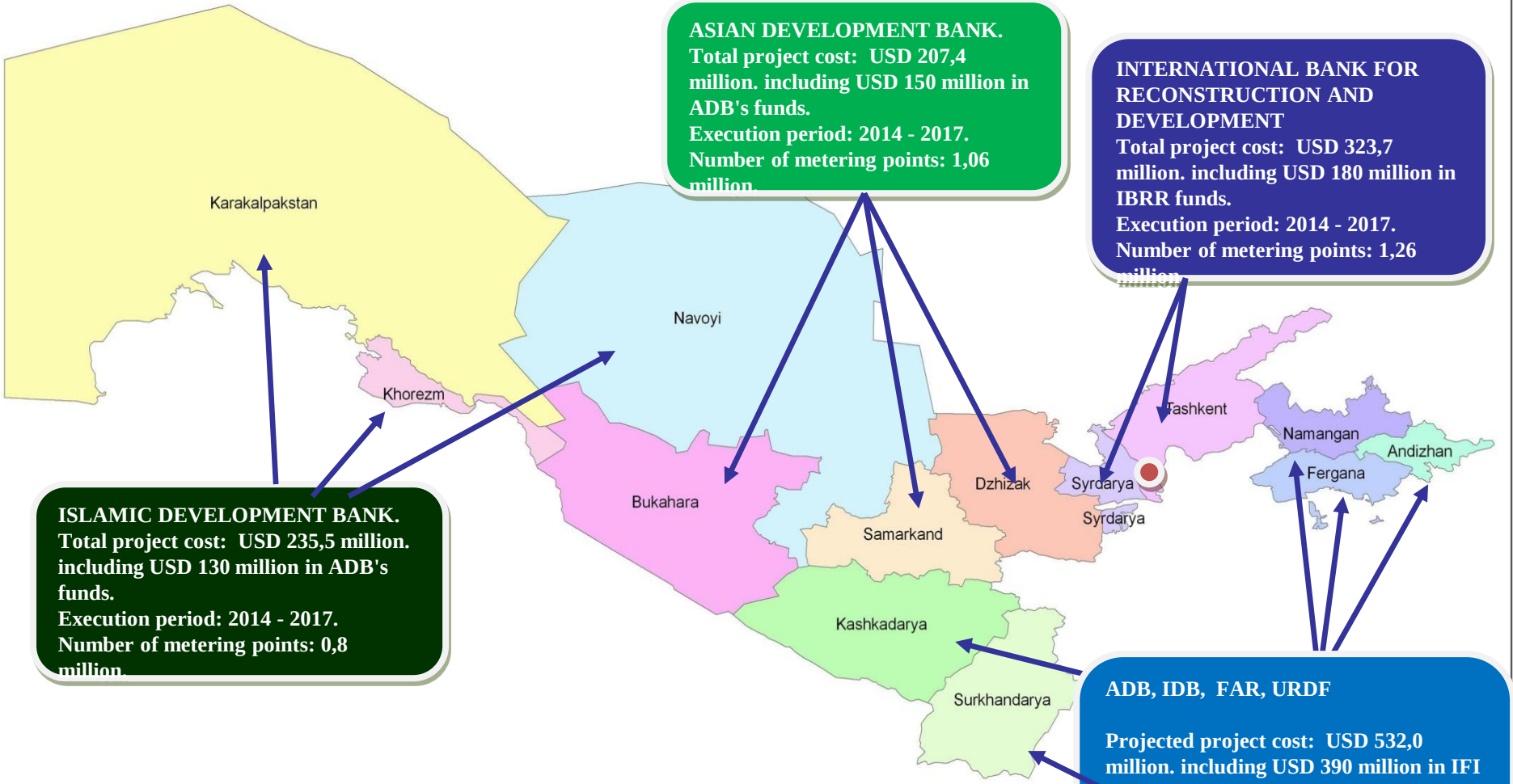
•Advantages of the multi-tariff system:

–Consumers are motivated to reduce power consumption in peak periods when power is more expensive.

–Consumers are motivated to increase power consumption during periods of low loads because the power is cheaper then.



The map of project zones on AECMS consumption



ASIAN DEVELOPMENT BANK.
Total project cost: USD 207,4 million. including USD 150 million in ADB's funds.
Execution period: 2014 - 2017.
Number of metering points: 1,06 million.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
Total project cost: USD 323,7 million. including USD 180 million in IBRR funds.
Execution period: 2014 - 2017.
Number of metering points: 1,26 million.

ISLAMIC DEVELOPMENT BANK.
Total project cost: USD 235,5 million. including USD 130 million in ADB's funds.
Execution period: 2014 - 2017.
Number of metering points: 0,8 million.

ADB, IDB, FAR, URDF

Projected project cost: USD 532,0 million. including USD 390 million in IFI and URDF funds.
Execution period: 2015 - 2018.
Execution period: 2014 - 2017.
Number of metering points: 2,6 million.

THANK YOU
FOR YOUR ATTENTION