Energy Demand/Supply Balances and Infrastructure Constraints Limiting Trade

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Presented
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- **Description of Issue**
- Current Activities
- Objectives of Action Plan
- Core Action Items

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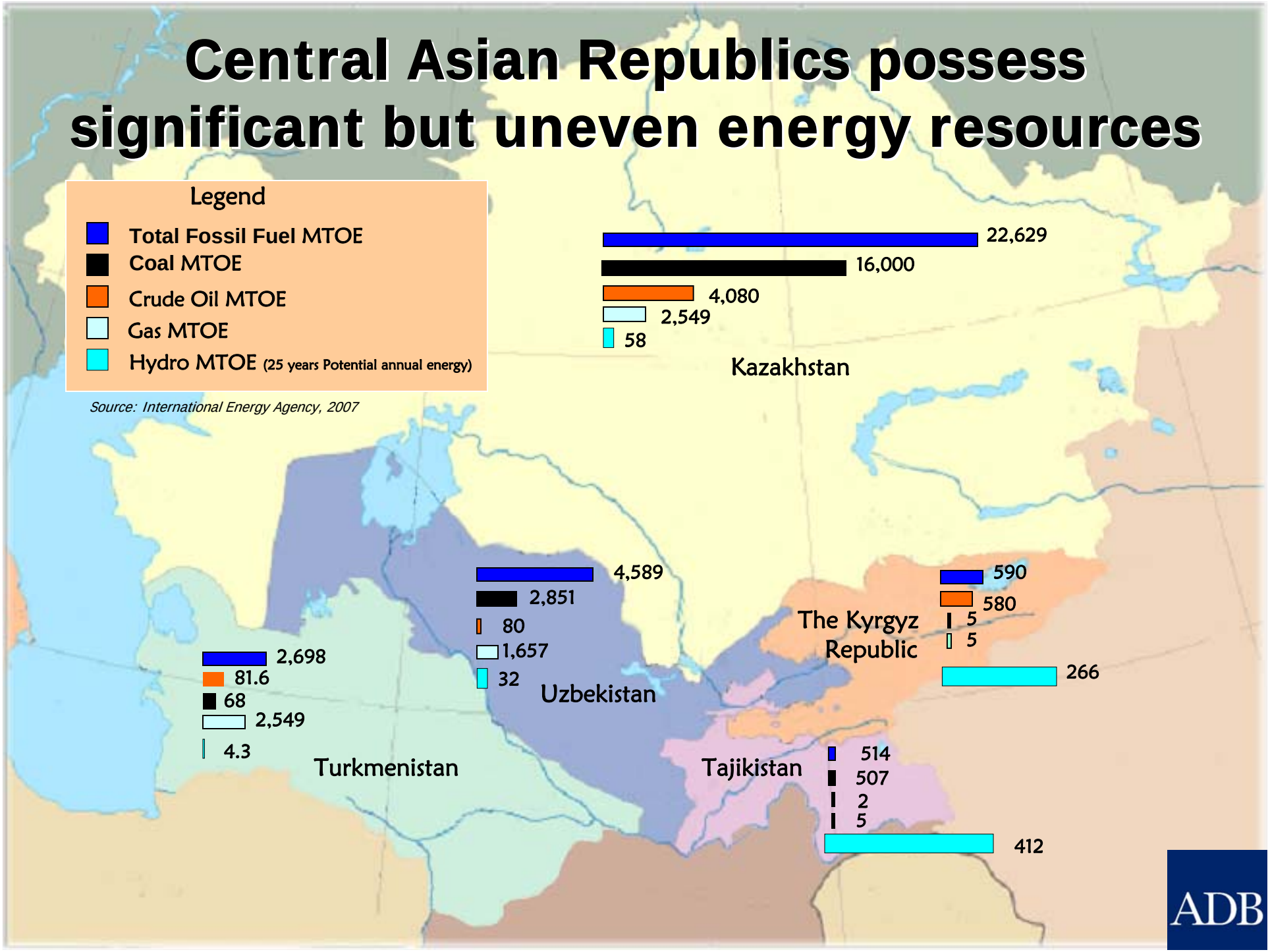
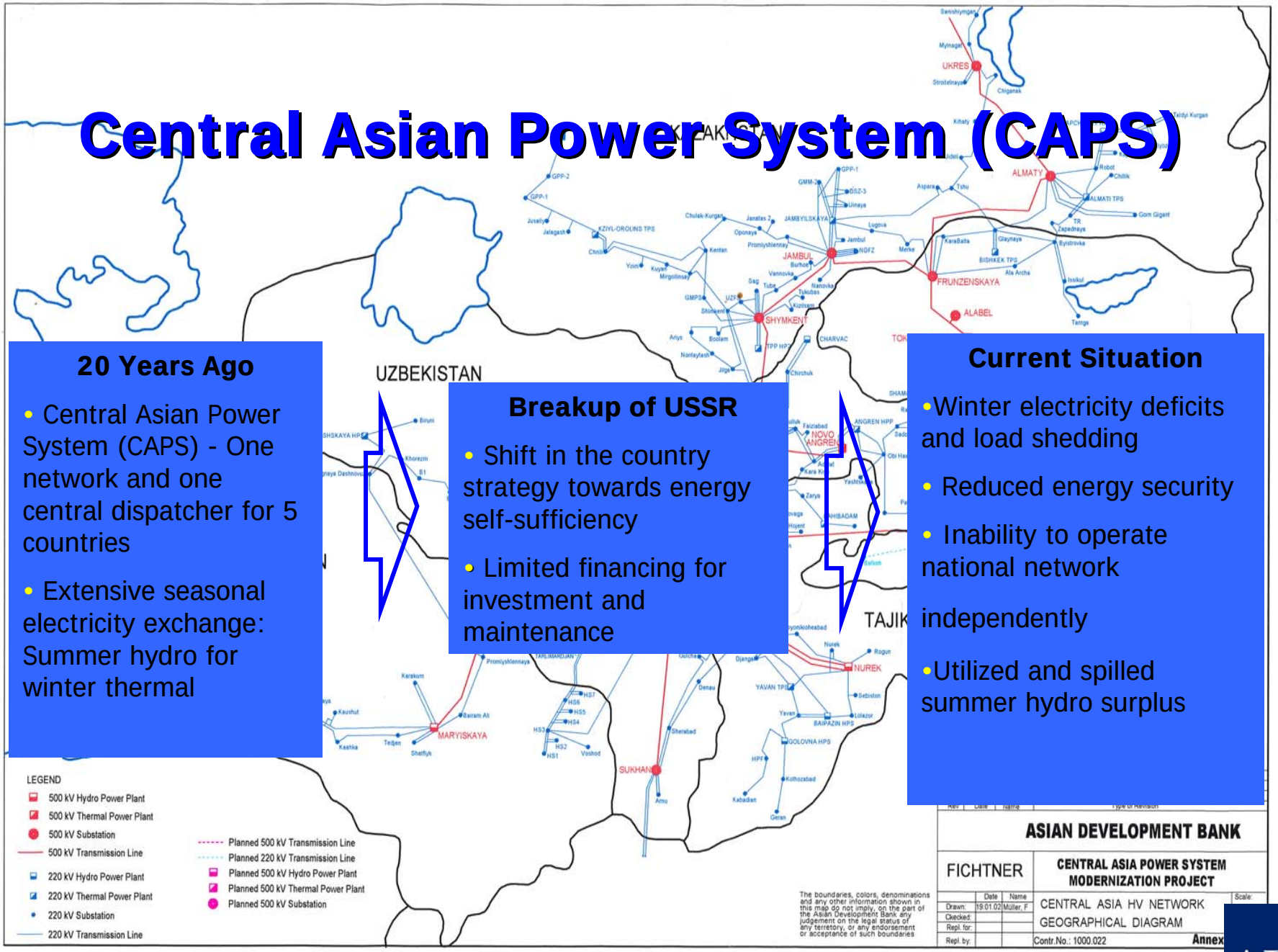
Central Asian Republics possess significant but uneven energy resources



Central Asian Power System (CAPS)



20 Years Ago

- Central Asian Power System (CAPS) - One network and one central dispatcher for 5 countries
- Extensive seasonal electricity exchange: Summer hydro for winter thermal

Breakup of USSR

- Shift in the country strategy towards energy self-sufficiency
- Limited financing for investment and maintenance

Current Situation

- Winter electricity deficits and load shedding
- Reduced energy security
- Inability to operate national network independently
- Utilized and spilled summer hydro surplus

Electricity Trade in Central Asian Power System 1990-2008

Electricity Trade in 1990 (GWh)

Imports

Exports	KAZ	KGZ	TAJ	TKM	UZB	Non CAPS*	Total Exports
KAZ	X	277.0	-	-	310.0	-	**587.0**
KGZ	697.0	X	-	-	2,383.0	-	**3,080.0**
TAJ	-	324.0	X	-	2,344.0	-	**2,668.0**
TKM	-	-	-	X	6,066.0	-	**6,066.0**
UZB	8,139.0	-	3,927.0	946.0	X	-	**13,012.0**
Non CAPS*	-	-	-	-	-	X	**-**
Total Imports	**8,836.0**	**601.0**	**3,927.0**	**946.0**	**11,103.2**	**-**	**25,413.0**

Electricity Trade in 2000 (GWh)

Imports

Exports	KAZ	KGZ	TAJ	TKM	UZB	Non CAPS*	Total Exports
KAZ	X	-	-	-	-	-	**-**
KGZ	1,253.0	X	154.0	-	1,926.0	-	**3,333.0**
TAJ	-	126.0	X	-	244.0	-	**370.0**
TKM	35.0	-	819.0	X	68.0	-	**921.0**
UZB	-	195.0	729.0	32.0	X	-	**956.0**
Non CAPS*	2,224.0	-	-	-	-	X	**2,224.0**
Total Imports	**3,512.0**	**320.0**	**1,702.0**	**32.0**	**2,237.0**	**-**	**7,804.0**

Electricity Trade in 2005 (GWh)

Imports

Exports	KAZ	KGZ	TAJ	TKM	UZB	Non CAPS*	Total Exports
KAZ	X	-	-		-		**-**
KGZ	2,668.1	X	230.0		-	926.1	**3,824.2**
TAJ	68.5	3.5	X		683.5		**755.5**
TKM	-	-	-	X	-	-	**-**
UZB	-	-	814.9	0.4	X		**815.3**
Non CAPS*	926.1	-	-		-	X	**926.1**
Total Imports	**3,662.7**	**3.5**	**1,044.9**	**0.4**	**683.5**	**926.1**	**6,321.1**

Electricity Trade in 2008 (GWh)

Imports

Exports	KAZ	KGZ	TAJ	TKM	UZB	Non CAPS*	Total Exports
KAZ	X	-	21.1	-	-	-	**21.1**
KGZ	747.1	X	91.7	-	27.2	-	**866.0**
TAJ	21.1	75.1	X	-	898.5	-	**994.7**
TKM	-	-	1,200.7	X	-	-	**1,200.7**
UZB	-	27.2	603.6	0.7	X	-	**631.5**
Non CAPS*	-	-	-	-	-	X	**-**
Total Imports	**768.2**	**102.3**	**1,917.1**	**0.7**	**925.7**	**-**	**3,714.0**

Source: 1990 World Bank; 2000, 2005 and 2008 Coordinating Dispatch Center (CDC)

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Power Trade

CAPS Electricity Trade 9-year Average (2000-2008)

GWh		IMPORT					TOTAL Export	Net Exporter (+) / Net Importer (-)
		KAZ[1]	KGZ	TAJ	UZB	TKM		
EXPORT	KAZ	X	0	2	0	0	**2**	**-1718**
	KGZ	1642	X	223	516	0	**2381**	**2230**
	TAJ	70	63	X	561	0	**693**	**-658**
	UZB[2]	0	88	705	X	5	**799**	**-284**
	TKM	9	0	420	6	X	**435**	**430**
TOTAL Imports		**1721**	**151**	**1351**	**1083**	**5**	**4310**	**0**

Notes:

[1] - KAZ imports also includes electricity for further re-export for RAO UES

[2] - UZB export to TAJ includes intergovermental agreements and exports to TALCO

Tajikistan Spillage

Year	Spillage	Export	Total
	GWh	GWh	GWh
2000	299.30	369.60	668.90
2001	-	333.80	333.80
2002	2,971.79	266.10	3,237.89
2003	758.37	1,017.10	1,775.47
2004	183.10	693.60	876.70
2005	1201,06	755.50	755.50
2006	50.37	900.00	950.37
2007	20.93	904.20	925.13
2008	71.44	994.70	1,066.14
Average	**483.92**	**692.73**	**1,176.66**
TOTAL	**4,355.30**	**6,234.60**	**10,589.90**

Source: Coordinating Dispatch Center (CDC)

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TAJ Annual Surplus Projections

	Generation			Demand			Surplus/		Export
	Hydro	Therm	Total	Domestic	AFG	Total	Deficit	Imports	Availability
2010	19,883	827	20,710	18,449	400	18,849	1,861	1119	2,980
2011	19,575	827	20,402	18,567	497	19,064	1,338	1119	2,457
2012	19,993	827	20,820	18,681	531	19,212	1,608	1119	2,727
2013	20,248	827	21,075	18,987	551	19,538	1,537	1119	2,656
2014	20,315	827	21,142	19,281	551	19,832	1,310	1119	2,429
Average	20,003	827	20,830	18,793	506	19,299	1,531	1,119	2,650

	Generation			Demand			Surplus/		Export
	Hydro	Therm	Total	Domestic	AFG	Total	Deficit	Imports	Availability
Jan-12	1,556	141	1,697	1,860	-	1,860	(163)	163	-
Feb-12	1,293	127	1,420	1,568	-	1,568	(148)	148	-
Mar-12	1,266	141	1,407	1,570	-	1,570	(163)	163	-
Apr-12	1,246	0	1,246	1,405	-	1,405	(159)	159	-
May-12	1,730	0	1,730	1,550	104	1,654	76	0	76
Jun-12	2,007	0	2,007	1,541	104	1,645	362	0	362
Jul-12	2,378	0	2,378	1,590	103	1,693	685	0	685
Aug-12	2,880	0	2,880	1,539	112	1,651	1,229	0	1,229
Sep-12	1,893	0	1,893	1,410	108	1,518	375	0	375
Oct-12	1,200	141	1,341	1,505	-	1,505	(164)	164	-
Nov-12	1,205	136	1,341	1,499	-	1,499	(158)	158	-
Dec-12	1,338	141	1,479	1,642	-	1,642	(163)	163	-
2012	19,992	827	20,819	18,679	531	19,210	1,609	1,118	2,727

Comments

1. **Based on 20-year average hydrology**
2. **Source: SNC Lavalin estimates**
3. **Assumes existing TAJ generation plant including Sangtuda 1 (commissioned 2009) and Sangtuda 2 (to be commissioned 2012) with TAJ growth projection of 2%**

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Main Points

- Abundant Energy Resources but unevenly distributed
- Seasonal export/import variations
- Winter electricity deficits and load shedding
- Reduced energy security
- Inability to operate national network independently
- utilized and spilled summer hydro surplus

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Constraints in Bilateral Trade

TAJ-TKM	Governed by annual agreements covering the winter period. Energy is transited through the UZB system. Transmission constraints in UZB can restrict this trade.
TAJ-AFG	To be conducted over a 220 kV line currently under construction and is covered by a 20-year PPA with volume restricted by AFG's ability to use imported power.
UZB-AFG	Conducted over a 220 kV line commissioned in 2009 and is covered by annual agreements with first trade having commenced in 2009. Reinforcement of UZB and AFG grids is required to increase export capacity to planned 300 MW.
KGZ-KAZ	Conducted over a 500 kV interconnection. KGZ's multi-year reservoirs are currently almost empty following a period of low hydrology and winter exports. KGZ will need to manage exports to bring reservoirs back to optimum levels. Exports are also constrained due to unreliability of 500 kV line.

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Central Asia South Asia Regional Electricity Market (CASAREM) - The Concept

Output

- A phased series of regional investment and technical assistance projects to eliminate physical and non-physical barriers for regional electricity trade

Outcome

- A regional and competitive electricity market in Central and South Asia maximizing the efficient use of comparative advantages of each country

Impact

- Improved energy security > increased economic development > reduced poverty

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CASAREM – Approach

- Implement a phased series of projects with initial focus on Central Asian Republics and South Asia
- Pick projects which can be implemented quickly and which deliver early results >> focus on 'low hanging fruit'
- Expand outside CARs & AFG when early projects operational >> leave 'high hanging fruit' to later phase

1st phase already underway:

Project	Int'l Donors	Benefit
Interconnections between UZB-AFG (operational)	ADB, KfW, Gov of India, USAID	Exports from UZB to AFG
TAJ-AFG (commissioning 2010)	ADB, IsDB	Exports from TAJ to AFG
Generation Rehab (Nurek) in TAJ	ADB, KfW	Frequency regulation of CAPS
Transmission and distribution capacity increases in AFG to allow use of imported power	ADB, IsDB, WB	Allows imported energy to be delivered to customers
Strengthening of Transmission in UZB	IsDB	Allows UZB export and be transit country

Project Selection Criteria for later phases

- Government's Strategic Priority
- Regional Benefit
- Domestic Impact
- Financiability
- Climate Change

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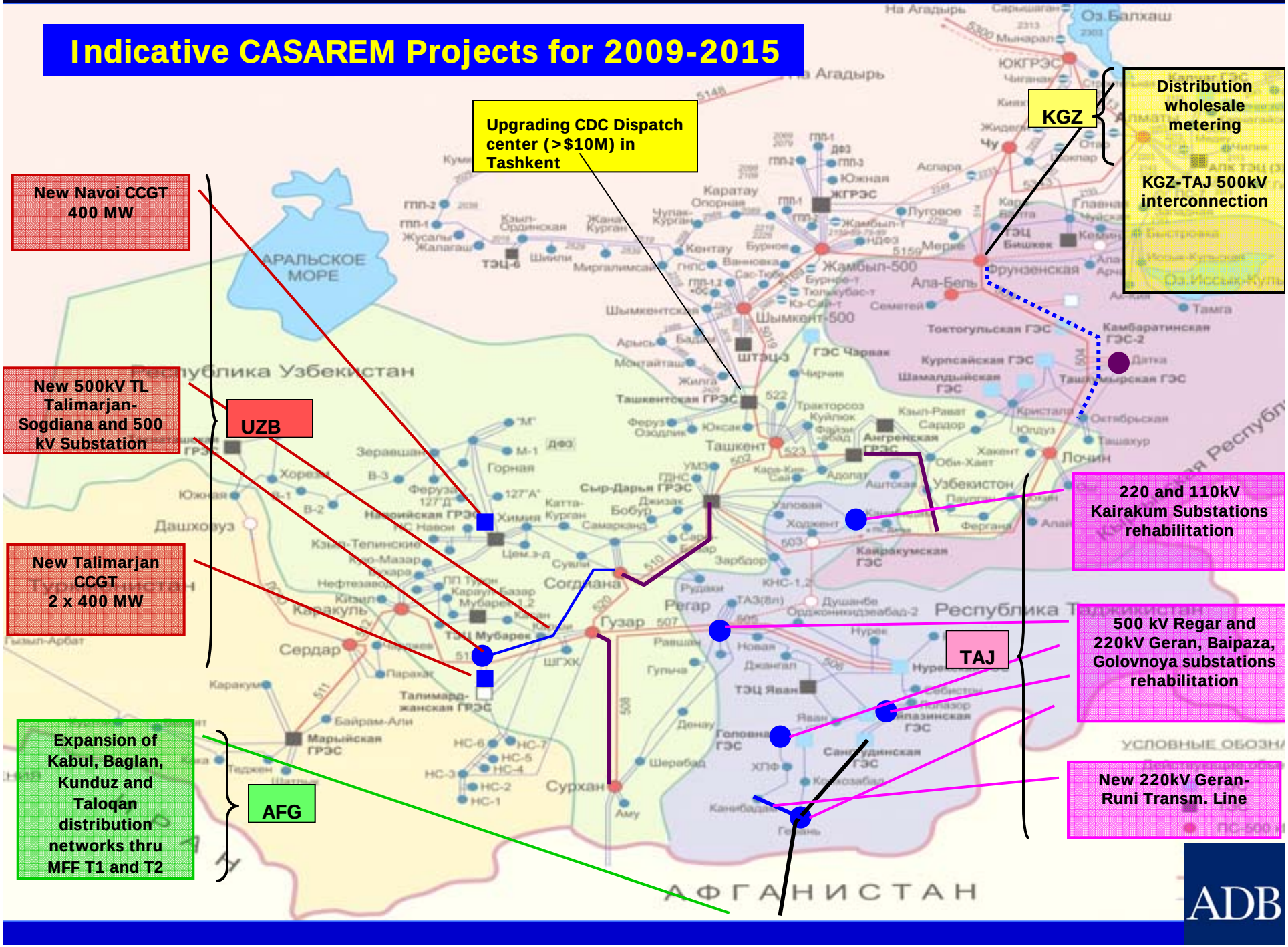
Indicative CASAREM Projects for 2009-2015



Energy Strategy

Studies (Appendix 6)	Investment Projects (Appendix 7)
•15 studies •Oil/Gas/Coal/Power •$10.8 m •Short time frame	•50 Projects •Oil/Gas/Coal/Power •$20 billion •2008-2027 time frame

Need to prioritize!

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Objective

To promote regional trade by optimizing integrated transmission and generation expansion

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Benefits

1	There is complementary mix of the generation resources with differing strengths and weaknesses. Thermal in some countries and hydro with storage in others. Optimal mix could bring all round benefits while reducing **the energy security risks of individual, national systems**. An example would be cases of very wet or dry season.
2	There are **different time zones** in some countries, which could be used for flattening of demand curve of the region as a whole.
3	The overall requirement of **reserve margin** would be significantly lower than individual country needs put together- thus potential for savings in CAPEX for countries.
4	There is strong potential for inter-country **exports** within CAPS as well as to countries outside the region.
5	The thermal plants operation could be more optimized in operation as well as in coordination in the **annual maintenance plans.**
6	The transmission and generation resources shared by region, would save substantive investments and **free scarce investments** for critical areas of health, education and other economic development activities. [1] Hydro reservoirs would also be required to coordinate with demands of downstream irrigation systems.

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ESCC to Endorse a Regional Technical Assistance (RETA) Master Plan Study

A RETA would be undertaken to identify long-term solutions to balancing demand and supply taking into account optimization of current assets, regional demand projections, and commercial opportunities for exports. The RETA would study:

1) demand and growth projections at country level,
2) condition of existing assets and planned rehabilitations and new assets at country level,
3) create a regional generation and transmission model simulating existing and planned scenarios with 10 year horizon,
4) currently planned projects from a regional perspective with identification of alternatives, and
5) prepare a regional plan with identification of benefits.

ADB proposes to finance such a RETA

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ESCC Actions

Policy Environment	Develop: - national generation and transmission plan - integrated regional plan - assess benefits of regional integration.
Capacity Building	Involve national and regional organizations in the developing the model and execution of the plan.
Investments	Promote/accelerate early-win grid strengthening and generation programs.

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Thank You

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