Central Asia Regional Economic Cooperation Program

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Strategy and Work Plan (2016–2020) for Regional Cooperation in the Energy Sector of CAREC Countries

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List of Acronyms

ADB	–	Asian Development Bank
AFG	–	Afghanistan
AGE	–	Afghan Gas Enterprise
APMP	–	Afghanistan Power Master Plan
AralDIF	–	Aral Sea Basin Dynamic Information Framework
BEAM	–	Basin Economic Allocation Model
CA	–	Central Asia
CAEWP-KP	–	Central Asia Energy-Water Knowledge Portal
CAPS	–	Central Asian Power System
CAR	–	Central Asian Republics
CAREC	–	Central Asia Regional Economic Cooperation Program
CASA	–	Central Asia South Asia
CCGT	–	combined cycle gas turbine
CDC	–	Coordination and Dispatch Center
CDM	–	Clean Development Mechanism
DC	–	direct current
EAP	–	Energy Action Plan
E-CASAREM	–	East-Central-South Asia Regional Electricity Market
ESCC	–	Energy Sector Coordinating Committee
EUR	–	Euro
EWP	–	Energy Work Plan
GAIL	–	GAIL (India) Limited
GHG	–	greenhouse gas
GSPA	–	gas sales and purchase agreement
HVDC	–	high voltage direct current
IFAS	–	International Fund for Saving the Aral Sea
IGC	–	Intergovernmental Council
ISGS	–	Inter State Gas Systems Limited
JICA	–	Japan International Cooperation Agency
KAZ	–	Kazakhstan
KM	–	Kilometer
kV	–	Kilovolts
KYR	–	Kyrgyz Republic
MC	–	Ministerial Conference
MTPP	–	Medium-Term Priority Projects
MVA	–	megavolt amperes
MW	–	Megawatt
MWh	–	megawatt per hour
PPP	–	public-private-partnership
PVC	–	crystalline photovoltaic cells
RDF	–	Uzbek Reconstruction and Redevelopment Fund

RECA	–	Regional Cooperation in Central and South Asia
RESET	–	Regional Energy Security, Efficiency and Trade
RPMP	–	Regional Power Master Plan
SDC	–	Swiss Agency for Development and Cooperation
SOM	–	Senior Officials Meeting
SPCC	–	special purpose consortium company
TA	–	technical assistance
TAJ	–	Tajikistan
TAPI	–	Turkmenistan-Afghanistan-Pakistan-India
TPCL	–	TAPI Company Limited
TPP	–	thermal power plant
TUTAP	–	Turkmenistan-Uzbekistan-Tajikistan-Afghanistan-Pakistan
UNDP	–	United Nations Development Programme
UNECE	–	United Nations Economic Commission in Europe
UNESCAP	–	United Nations Economic and Social Commission for Asia and the Pacific
UNRCCA	–	United Nation’s Regional Center for Preventive Diplomacy for Central Asia
US	–	United States
USAID	–	United States Agency for International Development
UZB	–	Uzbekistan
WBI	–	World Bank Institute

I. Introduction

1. The member countries participating in the Central Asia Regional Economic Cooperation (CAREC) Program embrace the Program's mission of development through cooperation and join efforts to bring to fruition the shared vision of "Good Neighbors, Good Partners and Good Prospects".

2. Regional economic cooperation is an important vehicle for enhancing national development strategies of the participating countries and realizing the countries' immense development potential in the context of increasingly integrating Eurasia. Infrastructure is a key pillar supporting the participating countries' drive for development through cooperation, with energy infrastructure being vital to ensuring overall economic growth and prosperity.

3. This Energy Strategy is an update to the 2008 Energy Strategy, which was endorsed at the 5th Ministerial Conference on CAREC. This updated strategy reflects accomplishments made by CAREC since 2008, changes in the energy sectors of the CAREC member countries, and current trends in the energy sector in the region, and globally. The strategy has been drafted based on guidance provided by CAREC member countries at June 2015 Senior Officials Meeting (SOM) in Bangkok, Thailand. It seeks to enable the development of solutions to meet future energy demand and to promote development of sustainable energy resources for the region, and for export, by cultivating the potential for mutually beneficial gains among participating countries.

II. Long-Term Vision for the Sector

4. The long-term vision for the region's energy sector is to ensure: (a) energy security through the balanced development of the region's energy resources, infrastructure, and institutions, (b) stronger integration of the region's energy markets to ensure that all physical and juridical persons have access to adequate volumes of commercial energy that is reliable, affordable, financially sustainable, and environmentally sound; and (c) economic growth through energy trade.

III. Strategic Approach to Regional Cooperation

5. Regional energy cooperation is driven by the need to overcome the impact of uneven distribution of energy resources among the CAREC countries by increasing integration of the energy markets, optimizing existing energy interrelationships, and achieving least-cost solutions to energy constraints.

6. There are also external drivers for regional energy cooperation. These drivers include new energy markets in eastern and southern China, Pakistan, India and Iran, and new strategic transit opportunities for oil and gas through Turkey, Georgia, and Russia, which are supported by strong interest from Chinese, Russian and other investors. Rising global energy prices also enhance the attractiveness of the large hydropower project options in Kyrgyzstan and Tajikistan. Regional energy cooperation is especially important for these projects as they are of interest to all countries situated along trans-boundary watercourses.

7. Regional energy cooperation will be advanced through developing market relations, transit arrangements, investments, agreements to jointly utilize infrastructure, knowledge-sharing, new technology adoption and joint use and protection of trans-border rivers and other resources.

Principles for regional cooperation

8. Regional energy cooperation will be promoted in good faith and in observance of the following principles:

a. Sustained political will for reforms and cooperation;
b. Bilateralism and multilateralism;
c. Mutual benefits for all;
d. Gradualism, voluntarism, and consensus;
e. Prudent, marginal and diversified dependence on outside energy resources, to maintain adequate energy security;
f. Mutually compatible regulatory arrangements based on evolving experience, including specific legal and regulatory framework for each cooperation venture based on international cooperation practices;
g. Pursuit of sector reforms, governance and operations conducive to regional cooperation on a commercial basis;
h. Adherence to adequate level of transparency and disclosure standards:
i. Respect for environment through collective action with regards to clean energy, transboundary watercourses; climate change and littoral space;
j. Fair and rational use of natural resources, including transboundary watercourses, and minerals, and
k. Consideration of the concerns of the neighboring countries.

Benefits from regional cooperation

9. The participating countries will pursue benefits from developing new energy market opportunities, establishing common new technology standards and demonstration projects, receiving transit revenues and achieving least-cost development solutions through a rational sharing of resources.

10. In this context, the participating countries look forward to evolving medium-to long-term inter-relationships resulting in:

a. Access to energy export markets and revenues to support export-led growth for states with sufficient resources to export energy, including electricity, oil, gas, and coal. Azerbaijan, Kazakhstan, and Uzbekistan could benefit from the export of hydrocarbons and electricity generated by thermal resources, while the Kyrgyz Republic and Tajikistan could benefit from exporting electricity from hydropower resources;
b. Revenue for transit countries such as Afghanistan and Mongolia, from transit and transmission fees. Mongolia has the potential to become an alternative energy transit route between Russia and China and an exporter of coal, and possibly electricity, to China;
c. China increasing imports from the region, including oil and natural gas from

Kazakhstan, natural gas from Uzbekistan and Turkmenistan, and coal from Mongolia;
d. Azerbaijan trading larger volumes of power with Russia, Turkey (via Georgia), and Iran;
e. Central Asian countries exporting power and natural gas to South Asia (see Appendix 2); and
f. Establishing aggregated markets through demonstration of sustainable new technology demonstrated projects and standards to support technology leap frogging and address threats of climate change.

Technology adoption and sustainable energy

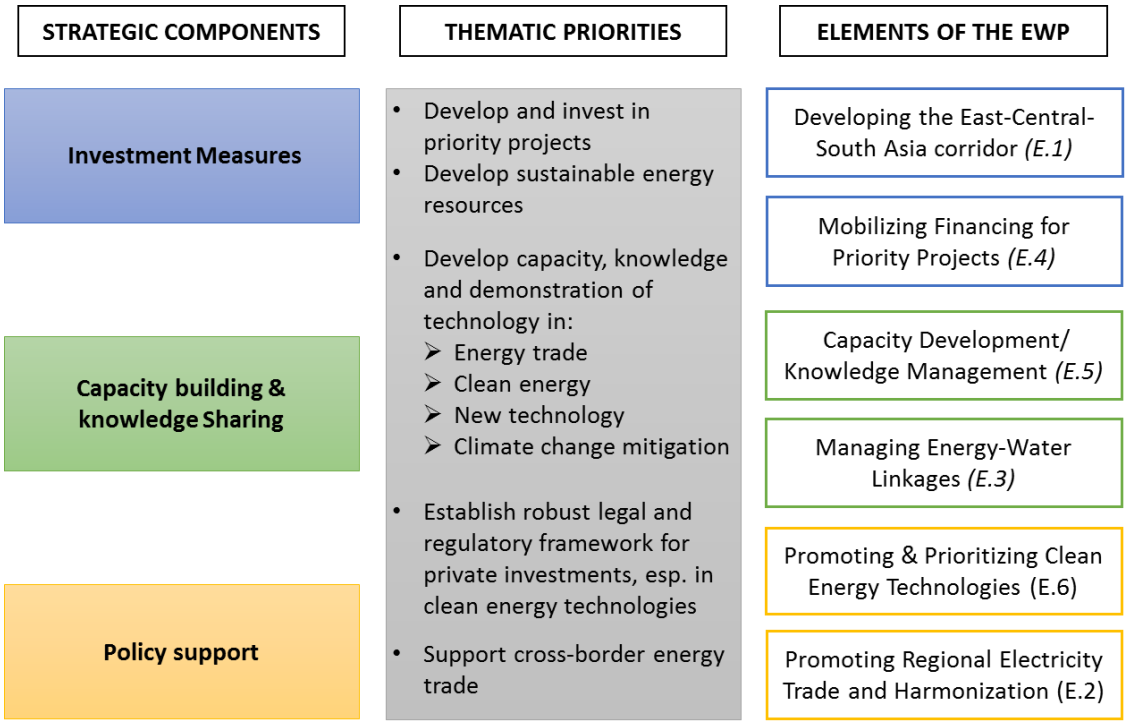
11. The strategic approach for 2016–2020 will emphasize the adoption and use of new electricity sector technologies that have undergone dramatic advances and significant cost reductions since the 2008 Strategy. The new technologies include renewable energy technologies (for example, solar and wind power), storage technologies (on and off-grid storing of electricity using Lithium-ion battery), and energy efficiency (lighting, efficient appliances, electric vehicles and advanced metering technology).

IV. Strategic Components and Priorities

12. This strategy describes how the long-term vision for the energy sector will be achieved through three components to the strategy: Investment measures, capacity building and knowledge-sharing, and support for effective policy environments. The first component will drive economically and financially sound domestic and cross-border investment measures, which take into account the interests of all states in the region. The second component, capacity building and knowledge-sharing measures will identify and implement such investment projects. Lastly, the strategy will support the development and maintenance of effective policy environments to ensure sustainability of such investments, and the attraction private sector investments.

13. Experience since approval of the previous Strategy has helped shape priorities for the future. Much of the 2008 Strategy remains relevant but several priorities will shape the actions of CAREC members in the short- and medium-term. Figure 1 summarizes the strategic components as well as the thematic priorities under each strategic component. It also shows how the thematic priorities correspond to the elements in the Energy Work Plan for 2016-2020 (EWP) contained in Appendix A. The thematic priorities are discussed in more detail in the subsections below. They were decided at the June 2015 Senior Officials Meeting (SOM) in Bangkok, Thailand.

Figure 1. Strategic Components, Thematic Priorities and EWP Elements



Note: The *corresponding element in the Energy Work Plan, is described as E.[element number]. For example, element one is indicated as "E.1"*

Investment measures for regional cooperation

14. Investment in domestic and cross-border energy infrastructure is critical to achieving CAREC's vision of better energy security, stronger regional integration, and economic growth through energy trade. Specifically, investment measures should prioritize clean energy technologies, including renewable energy and energy efficiency, and development of cross-border transmission infrastructure.

15. Domestic investments will focus on energy efficiency and clean energy. Energy efficiency investments will improve efficiency in energy production, energy transportation, energy distribution and energy use (including energy used by the transport sector). Investments will cover areas such as: (i) loss reduction; (ii) asset rehabilitation; (iii) least-cost system expansion and operation; (iv) introduction of appropriate heating options; (v) commercialization of energy operations (investments in metering and billing systems, for example); (vi) upgrades to end-use equipment, facilities and buildings (including other demand side management measures), and (vii) support introduction of public electric vehicle fleet. Clean energy investments will include aspects such as: (i) introduction of retrofits for pollution mitigation; (ii) reduction of fuel resources used per unit of goods produced; (iii) elimination of gas flaring; and (iv) development of alternative and renewable energy sources.

16. Cross-border investments will focus on production of ecologically clean energy and energy trade, and will be pursued with mutual agreement among all relevant parties in the following key areas: (i) cross border energy transmission; (ii) production for export; (iii) development of energy resources on a joint/cooperative basis respecting the environmental

protection laws of relevant states; (iv) physical integration of energy markets; (v) development of new technology projects under the Green Climate Fund and other climate investment funds; and (vi) investment to access energy resources abroad.

Capacity building and knowledge sharing

17. Capacity building and knowledge-sharing activities will improve institutional capacity, which is important for the identification, implementation, and sustainability of physical investments over time. This component of the Strategy will be achieved through an exchange of knowledge and experience, both among participating countries and with recognized international sources of best practices.

18. Capacity building and knowledge-sharing focusing on energy trade will focus on trade-related issues including negotiations, contracting (power purchase, power wheeling and transmission services), energy forecasting, energy regulation and regional dispatch and system control. Activities related to capacity building and knowledge-sharing for new and emerging technologies will emphasize, among others, three emerging new technologies: (i) energy efficiency, (ii) solar power and battery based storage, and (iii) electric vehicles.

Policy support

19. Policy Support, the third component of the Strategy, is critical to attracting and ensuring the sustainability of investments and regional trade agreements. Under this component, CAREC will support measures that lead to a policy environments that will enable private sector investments and new technology adoption. Specifically, CAREC will prioritize support for tariff, renewable energy, energy efficiency, and transmission third party access policies.

20. Policy support for renewable energy and energy efficiency will aim to increase uptake of clean energy technologies in the region. CAREC will pursue renewable energy investment options, complemented by international incentives offered through the Green Climate fund and other climate investment funds. In order to ensure a level playing field between renewables and conventional energy, CAREC will also explore the possibility of minimizing the subsidies to conventional energy. Support for energy efficiency policies will aim to incentivize rational and economic use and trade of energy resources, introduce advanced technology and infrastructure and improve the financial viability of energy utilities. Operations under the Green Climate fund and other climate investment funds will also contribute to support for energy efficiency initiatives in the participating countries.

21. Policy support for cross-border energy trade will focus primarily on:

a. Third country access to regional transmission systems. Countries not directly connected to the East-Central-South Asia Regional Electricity Market (E-CASAREM) should have opportunity to sell into the market
b. Public Private Partnership (PPP) arrangements. Fiscal constraints in the region mean that much investment will need to be financed by private investors. Attracting private financing in power generation and transmission requires improvements in the still nascent legal and regulatory environment for PPPs.
c. Cooperation in using trans-boundary watercourses. Opportunities for cooperation in use of trans-boundary watercourses will be explored for the potential benefits offered in managing water resources, mitigating climate change, and generating power.

V. Strategy Implementation and Monitoring

22. This strategy will be implemented through the Energy Work Plan (EWP) for 2016–2020, included in Appendix A. The elements of the EWP were discussed at the Energy Sector Coordinating Committee working group meetings in March 2015 and at the SOM meeting in June 2015.

23. Achievements in the energy sector are currently measured through five indicators, intended to capture the contribution of CAREC's physical infrastructure expansion and rehabilitation operations to energy security, energy efficiency, and the CAREC region's ability to enhance power trade as a result of completed projects. The indicators were first assessed in 2013, and they are expected to be evaluated annually in the CAREC Development Effectiveness Review (DEfR) process. In addition, seven new indicators were proposed during the September 2015 SOM meeting for reporting of results in new technology adoption, without specific targets until the markets mature. Detailed descriptions of each indicator can be found in Appendix A. The energy sector output indicators and the energy sector results framework are presented in the following tables:

Table 1. Energy Sector Output Indicators

Indicator	***Unit***	**2013 (Baseline)**	**2014[1]**	**2015[2]**
Transmission lines installed or upgraded transmission lines	km	612	1,150	2,073
Increased energy generation capacity	MW	300	600	736
Rehabilitated generation capacity	MW	0	520	585
New substations	MVA	250	4,200	4,629
Upgraded substations	MVA	400	5,200	5,551

[1] Based on data received from AFG, KAZ, MON, PAK and UZB, as of 11 September 2015.

[2] Based on data received from AZB, MON, and UZB as of 11 April 2016.

Table 2: New Energy Sector Output Indicators

Indicator		Unit	2014 (Baseline)[2]	2015[2]
Wind Power Installed	Capacity	MW net	61	111
	Generation	MWh	122.5	122.5
Solar Power Installed	Capacity	MW net	24	44
	Generation	MWh		
Electric vehicle Adoption[1]		Nos[1]		
LED public lighting[1]		Km of roads[1]	987	1,188
		No. of Units[3]	500,294	733,502
Energy Efficiency Savings		MWh	23,824	9,965

[1] Targets will not be set initially for these indicators. The ESCC will instead monitor progress against these indicators in the coming years and decide whether targets should be set in the future.
[2] Based on data received from AZB, MON, and UZB as of 11 April 2016.
[3] Based on data received from UZB as of 11 April 2016.

24. The indicators will continue to be compiled for each country in the format given in Table 1 above, on the basis of official information each country and information from other sources. A regional table will be prepared using the data from the country tables. It is recognized that reporting data for the indicators will be voluntary on the basis of best national efforts.

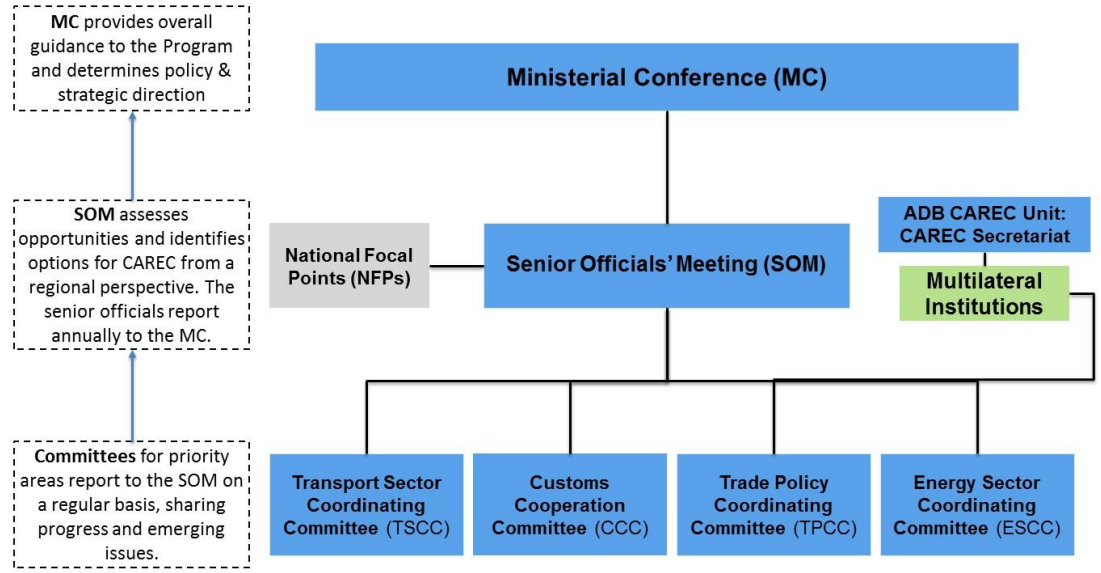
Annex: Energy Sector Coordinating Committee Work Plan: 2016–2020

I. Introduction

1. The Central Asia Regional Economic Cooperation (CAREC) Program is a partnership of 10 countries and six multilateral development partners, which uses regional cooperation to promote economic growth and poverty reduction. The program facilitates practical, results-based regional projects, and policy initiatives critical to trade expansion and sustainable development. The Strategic Framework for the CAREC Program for 2011 to 2020 (CAREC 2020), which was endorsed at the 10th Ministerial Conference in November 2011, guides the CAREC program for the period until 2020 and highlights the need to accelerate progress across core business areas, including the energy sector.

2. The Institutional framework of CAREC guides and strengthens the partnership in planning, prioritization, and implementation of all aspects of the Program. There are three principal levels of the governing structure of CAREC: the Ministerial Conference (MC), the Senior Officials' Meeting (SOM) and the four CAREC priority areas, which are transport, trade facilitation, trade policy, and energy. Figure 2 shows the relationship between and the function of each level of the governing structure.

Figure 2. Institutional Framework of CAREC



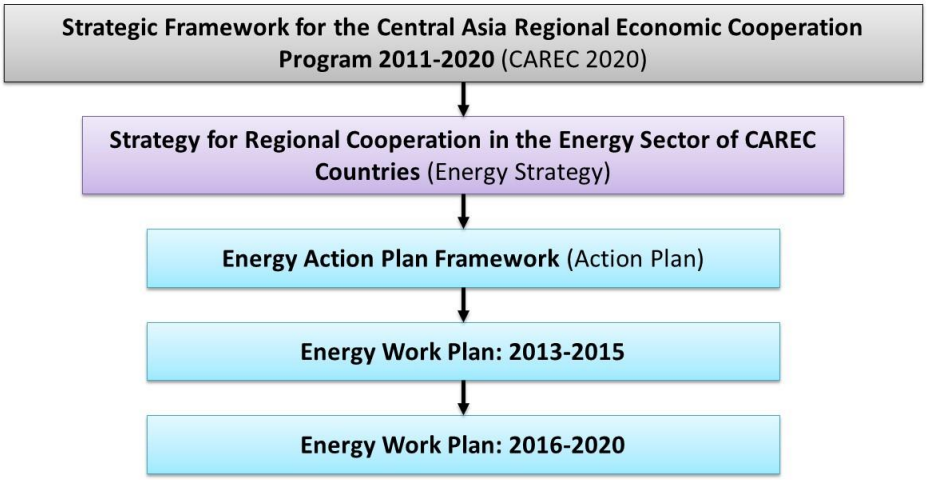
3. A number of strategy documents define the framework for the activities of the CAREC Program in the energy sector:

a. The Strategy for Regional Cooperation in the Energy Sector of CAREC Countries ("Energy Strategy"), which was approved in November of 2008, is the flagship document defining the energy sector objectives of CAREC. The Energy Strategy provides direction for the development of the energy sector in the CAREC countries and helps crystallize the CAREC visions of energy security, energy market integration, and energy trade-driven growth.

b. In October of 2009, the Eighth Ministerial Conference (MC) endorsed an Energy Action Plan (EAP) Framework, which laid the foundation for the coordinated and effective development of the regional energy sector, through the prioritization of investments in Central Asia, and attention to key aspects of regional coordination of trade and to energy-water synergies. The first Energy Work Plan (EWP) for the period from 2013 to 2015 was the successor to the EAP and aimed to be a mechanism to facilitate the step-by-step realization of CAREC projects and programs in the energy sector. The 2013–2015 EWP is anchored in CAREC 2020 and the Energy Strategy, which together provide the basis for determining future priorities, and for tracking progress against the vision and targets in the sector.

4. This 2016–2020 EWP is a continuation of the first EWP for the period from 2013 to 2015, and is intended to guide CAREC activities in the energy sector until the end of the decade. Figure 3 shows the relationship between each of the policy documents governing the activities of the CAREC Program in the energy sector.

Figure 3. CAREC Energy Sector Strategy Documents



5. The remainder of this document is structured as follows: Section II describes the regional energy sector context in which the EWP was developed; Section III presents the results of the 2013–2015 EWP; and Section IV describes the elements and planned activities under the 2016–2020 EWP.

II. Regional Energy Sector Context

6. During the Soviet era, the energy system of the Central Asian Republics (CARs) was designed to take advantage of regional endowment of diverse energy resources. The CARs were interconnected to some extent by gas supply network and to a lesser extent by oil pipelines. The electrical interconnection, through the 500kV Central Asian Power System (CAPS), was the backbone of this energy exchange arrangement. Regional cooperation in the power sector mixed the thermal-based power systems of Kazakhstan, Turkmenistan, and Uzbekistan systems with the hydro-based systems of Tajikistan and the Kyrgyz Republic. Tajikistan and the Kyrgyz Republic exported energy during the summer when their ability to produce hydropower was at a

maximum, and imported energy during winter when they were in energy deficit. The Tajikistan and Kyrgyz Republic water releases were coordinated to meet the irrigation needs in the downstream countries.

7. Regional power trade collapsed in the early 1990s, from 25 TWh in 1990 to 3.4 TWh in 2011, as a result of the collapse of the Soviet Union, profoundly impacting the CARs. Water storage limitations resulted in frequent summer spillage in Tajikistan, yet both Tajikistan and the Kyrgyz Republic face winter energy deficits because of demand growth, disconnection from CAPS, and reduction in gas imports. In recent years, poor hydrologic conditions have made the winter energy deficit more pronounced, with the winter of 2007-2008 being particularly severe. Consequently, Kazakhstan, Uzbekistan and Turkmenistan are forced to generate electricity using expensive fossil fuels, such as natural gas coal and oil, instead of importing inexpensive surplus electricity generated from hydropower in neighboring countries; upstream countries are compelled to develop more expensive local resources to compensate for lack of winter generation from hydropower.

8. Operation of the CAPS system is the responsibility of the Coordination and Dispatch Center (CDC) located in Tashkent, Uzbekistan. Turkmenistan withdrew from CAPS in 2003 and is now interconnected with Iran's power system. Turkmenistan continued, for a time, to export to CAR countries from islanded power plants, but stopped doing so in 2009. Tajikistan also withdrew from CAPS in 2009. Turkmenistan, Uzbekistan and Tajikistan export power to Afghanistan, which is also interested in joining CAPS and wishes to meet a part of its growing demand with imports from CAR countries. While energy trading also includes bilateral arrangements, these arrangements face constraints stemming from physical infrastructure limitations, including lack of power systems synchronization, political, and commercial barriers. CAREC's vision and strategy for the region's energy sector, established in the Energy Strategy, was formulated to address these problems.

9. Central Asian countries also face common challenges in their respective energy sectors, largely as a result of their shared history. Many difficulties that Central Asian countries face in managing domestic energy networks and regional linkages are rooted in energy and irrigation infrastructure systems inherited from the Soviet Union era. Poor infrastructure maintenance and divergent priorities within individual countries have further aggravated the situation. Work under the CAREC program has aimed to help countries find solutions to these national-level problems as well as to further develop regional power integration.

III. Progress of the Energy Work Plan for 2013–2015

10. The Energy Work Plan (EWP) provides a roadmap for CAREC activities in the energy sector based on the Energy Strategy and CAREC 2020. The EWP introduced six key elements of energy sector development: i) Developing the Central Asia-South Asia Corridor, ii) Resolving regional energy dispatch and trade issues, iii) Managing energy-water linkages, iv) Mobilizing funds for building energy assets, v) Implementation of energy sector priority projects, and vi) Capacity building and knowledge management. The progress and remaining issues of EWP for 2013-2015 are the basis for the EWP for 2016 to 2020.

11. Within the framework of EWP 2013–2015, achievements in the energy sector are measured through five indicators, intended to capture the contribution of CAREC's physical infrastructure expansion and rehabilitation operations to energy security, energy efficiency, and the CAREC region's ability to enhance power trade as a result of completed projects. The energy

sector output indicators are: installed or upgraded transmission lines (km), increased energy generation capacity (MW), rehabilitated generation capacity (MW), new substations (MVA), and upgraded substations (MVA). The indicators were first assessed in 2013. They are expected to be evaluated annually in the CAREC Development Effectiveness Review (DEfR) process; however, the indicators have not been reassessed since 2013 because sufficient data have not been provided from member countries. Provision of sufficient data that are also aligned among member countries remains an issue for the next EWP.

12. The remainder of this section describes progress made on each element under the 2013–2015 EWP.

Element 1: Developing the Central Asia-South Asia Energy Corridor

13. Central Asia enjoys abundant energy resources; however, the resources are not of the same nature nor are they evenly distributed. For instance, Kazakhstan has large oil and coal reserves, Uzbekistan and Turkmenistan have sizeable gas reserves, and Kyrgyz Republic and Tajikistan have substantial hydro power resources. This uneven distribution of resources justifies and qualifies regional cooperation. Given adequate regional cooperation, each country can import and export the most appropriate energy form at the appropriate time to mutual advantage, and differences in energy services can be optimally combined to reduce costs and mitigate supply risks. The objective of this element is to increase energy security, energy efficiency and trade by optimizing integrated transmission and generation infrastructure expansion.

14. The CAREC Energy Strategy identifies five potential energy corridors in Central Asia in need of investment: (i) Central Asia- East Asia; (ii) Central Asia-South Asia; (iii) Intra-Central Asia; (iv) Central Asia-Russian Federation; and (v) Central Asia-European Union. Given the very large combined power infrastructure needs of these sub-regions, the energy corridors needed to be prioritized. To do so, each corridor was ranked across the three key themes that were outlined in the EAP: (a) energy demand and supply balance and infrastructure constraints; (b) regional dispatch and regulatory development; and (c) energy- water linkage. The Central Asia-South Asia Corridor was identified as one of the two regions with the highest need and potential for integration. The other region was Intra-Central Asia, which is also critical to the development of the Central-South Asia corridor.

15. Various cross-border projects and programs aimed at increasing energy trade between Central Asia and East and South Asia are being implemented, or are under active consideration by CAREC member countries and multilateral institutions. Infrastructure development projects under implementation are the TAPI (Turkmenistan-Afghanistan-Pakistan-India) gas pipeline project, the CASA-1000 power transmission project, and the TUTAP (Turkmenistan-Uzbekistan-Tajikistan-Afghanistan-Pakistan) power transmission project. In addition, the East Asian Super Grid Project is currently under consideration.

a. The CASA-1000 power transmission, a Central-South Asia Regional Electricity Market (CASAREM) project with financing led by the World Bank, envisions the creation of a shared power market among the countries of Central and South Asia. The line is expected to support up to 1,300 MW of clean electricity trade between Central Asia and South Asia.

b. Another CASAREM project, the TUTAP power transmission project, with

financing led by the Asian Development Bank intends to use existing and planned assets in Afghanistan to connect Turkmenistan, Uzbekistan, Tajikistan and Pakistan to the Afghanistan power grid.

c. The proposed ADB technical assistance and subsequent investments will link East Asia to CASAREM. The East Asia Super Grid Project envisions connecting the power systems of Mongolia, Russia, China, South Korea, Japan, and possibly North Korea.

d. The TAPI gas pipeline is a proposed 1,800 kilometer pipeline which will run from Turkmenistan to Afghanistan, Pakistan and India and is expected to export up to 33 billion cubic meters of natural gas per year.

16. Table 3 describes the achievements of each initiative under the 2013 to 2015 EWP.

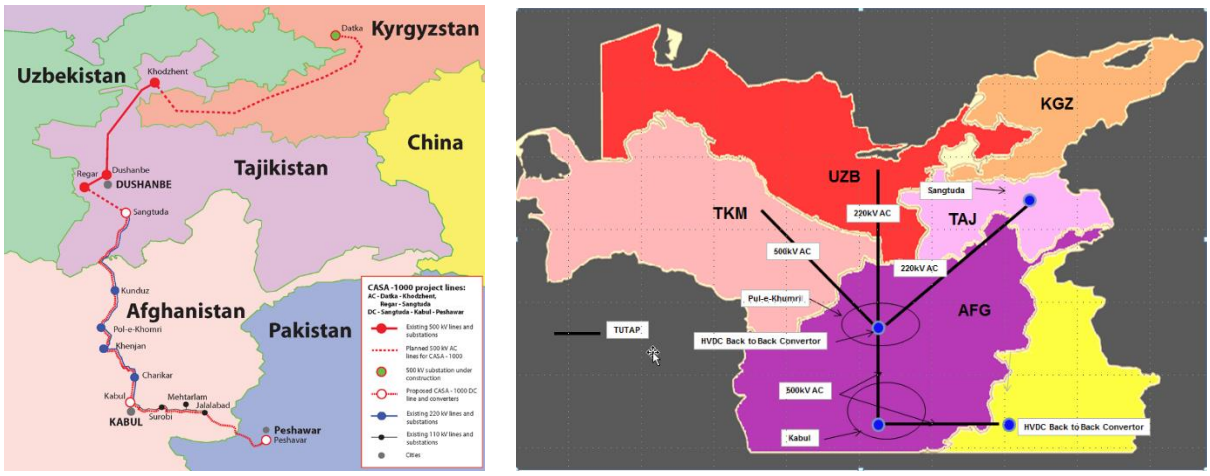
Table 3: Achievements under 2013-2015 EWP: Element 1

No.	Activity	Achievements under 2013-2015 EWP
1	TAPI Gas Pipeline	▪ Gas Sales and Purchase Agreement between Turkmengaz and AGE was signed in July of 2013. ▪ Transaction Advisory Services Agreement between Turkmengaz, AGE, ISGS & GAIL and ADB was signed in November 2013. ▪ Operations Agreement between Turkmengaz and AHE, ISGS and GAIL was signed in July 2014. ▪ TAPI Pipeline Company Limited (TPCL) was established in November 2014 and held its first meeting of the Board of Directors. TPCL will build, own and operate the TAPI pipeline. ▪ The TAPI Steering Committee hopes to begin construction in 2015, but a consortium leader must be selected before this can occur. ▪ A consortium leader was expected to be named after the February 2015 meeting of the steering committee; however, this announcement has been delayed. ▪ Pending the selection of a consortium leader, the pipeline could be operational by 2018. ▪ In the 20th ESCC meeting, it was reported that ADB, as transaction advisor, is facilitating the selection of the consortium leader. It was decided that Turkmen gas will be the lead sponsor and work is progressing
2	CASA-1000 Power Transmission Line	▪ As of late March 2015, approximately 75% of the project costs had secured financing. Agreements were as follows: ➢ The World Bank ($526.5 million), Afghanistan Reconstruction Trust Fund, ARTF ($40 million), US Government ($15 million) and European Investment Bank (EUR 140 million). ▪ The Power Purchase Agreement, Master Agreement and Coordination Agreement have been largely agreed and are expected to be signed by mid-2015. ▪ The Joint Working Group of CASA-1000 Member Countries

		agreed on the cost sharing principles for transmission costs and community support during operation. ▪ Procurement of converter stations and operator for the CASA-1000 project, High Voltage DC line for Afghanistan and Owners' engineers are progressing. ▪ Project completion is scheduled for the winter of 2017–2018.
3	TUTAP power transmission project	▪ Tajikistan-Afghanistan and Uzbekistan-Afghanistan 220kV connections exist and currently supply the Afghanistan network. ▪ The Turkmenistan component of the Turkmenistan-Afghanistan 500 kV line, which will initially operate at 220 kV, is under construction and is estimated to be completed in 2019. Bids for the Afghanistan component of the line are under evaluation, and contracts are expected to be awarded by 2016. ▪ Within Afghanistan, ADB is preparing a 500-kV transmission line project from Sheberghan to Pule Khumri (200 kM) including a 300 MW back to back HVDC converter station at Pule Khumri. The project is expected to be considered by ADB Board in Q4 of 2015. ➢ The project will bridge the missing 500-kV link in northern Afghanistan to extend the ADB-assisted 500-kV power interconnection from Turkmenistan to Kabul and provide 1,000 MW additional transmission capacity.
	East Asia Super Grid Project	▪ Financing of US$1.75 million from ADB is being processed for the support of a feasibility study for the project.

17. All current power infrastructure development projects planned under CAREC transit through Afghanistan. An addendum to the Afghan Power Sector Master Plan was conducted under the 2013–2015 EWP to evaluate concerns about the impact of these projects on the Afghanistan power system configuration. The addendum considered the impact of CASA-1000 on future development needs of Afghanistan, including the impact of the delayed Turkmenistan interconnection, the Tajikistan-Afghanistan rating corrected to 600 MW, and options for Afghanistan to synchronize with neighboring countries. It also considered the impact of interconnection with Turkmenistan, a correction to the capacity rating of Tajikistan-Afghanistan line, and the options for Afghanistan to synchronize with neighboring countries. The findings of the addendum concluded that TUTAP and CASA-1000 complement each other, resulting in higher financial returns. Figure 4 shows the planned routes of the CASA-1000 and the TUTAP transmission lines.

Figure 4. Planned Power Transmission Line Routes: CASA-1000 (left) and TUTAP (right)



Source: ADB, "Central Asia---South Asia Regional Energy Trade," Regional Energy Trade Workshop, Manila, 8 September 2014.

Element 2: Resolving Regional Energy Dispatch and Trade Issues

18. There are strong power transmission networks in Central Asia, constituting approximately 1,600 km of 500 kV lines and 1,400 km of 220 kV lines. This network is operated by the Coordinating Dispatcher Center for energy (CDC) in Tashkent, which controls and monitors the demand-supply balance, power voltage, and frequency. CDC is a nongovernment, noncommercial organization working under the apex power council, which is made up of heads of power utilities/ transmission companies of Kazakhstan, Kyrgyz Republic, Tajikistan and Uzbekistan.

19. Adequate utilization of an extensive transmission network like CAPS depends on development of facilities to dispatch and coordinate power flows, and a proper regulatory and institutional system to manage and maximize benefits to participants. The facilities at CDC are old and in need of significant investment to bring them up to par with modern control and dispatch centers. Kazakhstan has already initiated steps to modernize its national control center and its nine regional control centers. Similar investments may also be needed in the national dispatch centers of all the member countries. To complement these facilities, institutional systems to regulate and manage the system through a central entity (having confidence of all the players) would be required.

20. The objective of this element of the EWP is to maximize the benefits of a unified CAPS operation. This entails moving towards the integrated planning of the transmission system on a regional basis, developing institutional capacity, and enhancing the role of CDC and national dispatch centers.

21. Multiple studies and events aimed at resolving regional energy dispatch and trade issues were completed under the 2013-2015 EWP. These activities are summarized in Table 4 below.

Table 4: Achievements under 2013-2015 EWP: Element 2

No.	Activity	Achievements under 2013-2015 EWP
1	"Enhancing Central Asia Regional Power Trade and Cooperation" Program *World Bank initiative to increase efficiency of regional power systems, enhance reliability and security of electricity supply, reduce power shortages, and encourage GHG abatement*	▪ The first phase identified technical and methodological barriers facing regional power trade in Central Asia, including metering, protection systems, transit methodology, and pricing for power, capacity and other ancillary services. ▪ The second phase focused on supporting removal of barriers identified during the first phase through international knowledge sharing workshops and the preparation of notes on regional trade issues. ▪ Representatives from Balkan countries shared their experiences with regional trade and cooperation and the lessons they have learned from their experience during the September 2014 ESCC meeting.
2	Study on conditions of parallel operation of the power systems of South Kazakhstan, the Kyrgyz Republic and Tajikistan	▪ Study examined the conditions of parallel operation of the power systems of South Kazakhstan, the Kyrgyz Republic and Tajikistan ▪ Also considered the proposed construction of new transmission facilities within the CASA-1000 project and their impact on steady-state and transient stability of the Central Asia Interconnected Power System. ▪ A report completed in late March 2014 summarizes the lessons learned and recommendations for mitigating potential problems
3	Training and seminars	▪ USAID conducted training seminars on energy information systems, security and integration support for electricity markets, automated meter reading, and supervisory control and data acquisition systems. ▪ USAID also commissioned and offered university level curriculum on the design and operation of power markets in the fall of 2013
4	Study on "Regional Power Trade Development in Central Asia" *Study will evaluate current condition of the power market models, pricing rules, and tariff regulation mechanisms. It will also analyze existing power sector agreements among the Central Asian countries*.	▪ A working group, comprised of the head of the Central Dispatch Center and three power sector representatives from each Central Asian country (except Uzbekistan), on regional market arrangements was established to support the study. ▪ The working group developed the Terms of Reference (ToR) for the study in May of 2015 ▪ Work on the study has begun, and, in July 2015, the consultant engaged to carry out the study presented a draft model for computing financial benefits from trade for each Central Asian country to the CAREC countries. It is expected to be completed in November 2015
5	PRC—Mongolia Energy Trade Expert Group	▪ During the September 2015 ESCC meeting, delegates from Mongolia informed that their country and the PRC agreed to form an Expert Group of their respective ministries of energy to discuss energy trade issues and potential between Mongolia and the PRC

Element 3: Managing Energy-Water Linkages

22. Hydropower resources concentrated in the upstream republics of the Kyrgyz Republic and Tajikistan provide important energy services and complement other energy sources available in the rest of the region. However, given large existing and potential water storage capacity of hydropower projects, the role of the hydro resources extends beyond power generation. Other sectors such as drinking water and irrigation in both upstream and downstream countries are affected. Agriculture, the mainstay of several economies in the region, requires irrigation water during summer season. However, countries with large hydro potential (and extreme cold climates) have the ability to store water in summer in order to generate power to meet domestic needs for heating and lighting deficits in the winter. Decisions in the management of water extend even beyond these direct uses, with both domestic and regional implications for water quality, climate change mitigation and adaptation, ecological protection and even water quantity through evapotranspiration.

23. Water management, especially in the face of climate change, also links back to energy security and system stability through the management of reservoirs for ancillary services such as power frequency regulation and reserve capacity. The objective of this element is to strengthen regional cooperation by integrating energy and water analysis. This analysis will improve understanding of water-energy linkages and enable decision makers to query options and investments applying to both energy and water sectors. This work does not encompass decision-making on water or energy sharing agreements. Institutionally, the energy-water analytical framework creates a focal point for dialogue based on a widely accepted, credible, and understood characterization of each sector, and their co-dependencies.

24. Various studies and training activities aimed at improving the capacity to manage Central Asia's energy-water linkages were completed under the 2013 to 2015 EWP. Table 5 summarizes these activities.

Table 5: Achievements under 2013-2015 EWP: Element 4

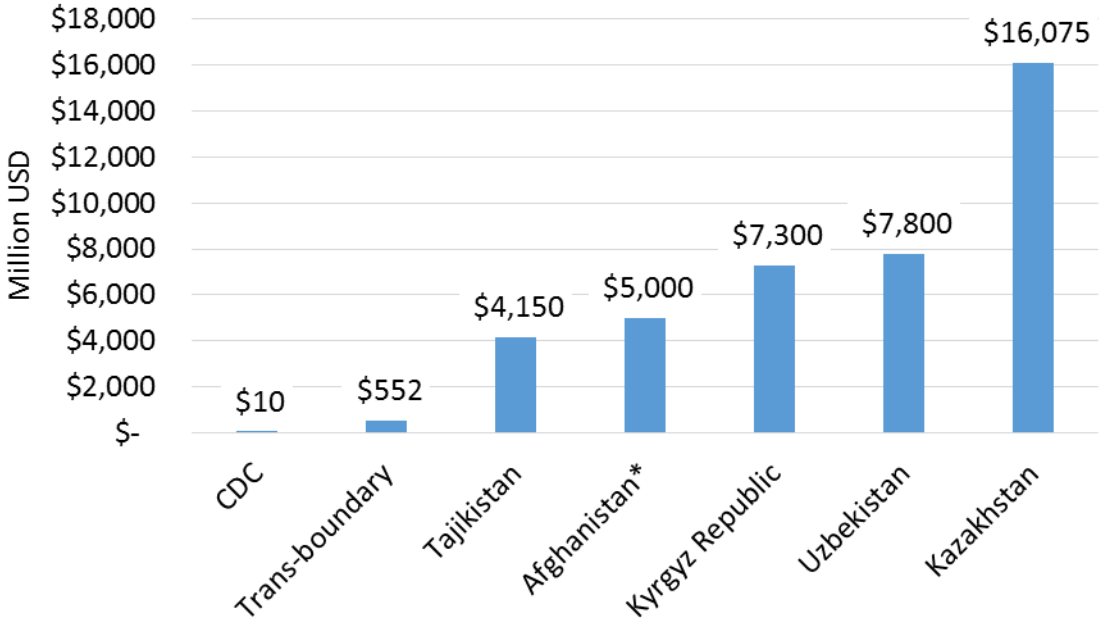
No.	Activity	Achievements under 2013-2015 EWP
1	Establishment of an energy-water roadmap framework to strengthen analytical tools and knowledge coordination	▪ The framework, which was first presented for comments in November 2012, identifies eight principles to establish a new paradigm for future energy-water analysis in the region ▪ The framework proposes a multi-year (2013-2015) regional work program (on data, modeling, institutional strengthening, and capacity development) with complementary activities at the national level.
2	Introduction of the BEAM ("Basin Economic Allocation Model") and AralDIF Models	▪ In January 2013, two workshops were held to introduce these new technologies and approaches of resource modeling to Central Asia experts. Participants received hands-on training on BEAM and were introduced to AralDIF. ▪ The AralDIF model was showcased at a February 2013 Sustainable Development World Bank Global Meeting

3	Central Asia Energy-Water Knowledge Portal (CAEWP-KP)	▪ CAEWP-KP is a multi-phased effort to provide an open, readily accessible and user friendly node of information, data and reports on energy and water in Central Asia. ▪ The first phase of CAEWP-KP, completed in 2013, focused on collecting and consolidating existing information on issues such as climate variables, groundwater, forest cover, etc.
4	Central Asia Energy-Water Knowledge Network *Network to create a consistent community to deepen knowledge sharing across sectors and countries, help build capacity within a wider range of professionals, and provide strategic guidance energy-water issues under CAREC*.	▪ The World Bank and the World Bank Institute (WBI) initiated an effort to identify a core Community of Practice of energy and water sector specialists. ▪ In February 2013, the first of several planned exchanges with institutions (governments, academia, and other groups/agencies) from across the region identified the opportunities to establish centers of excellence and the means and mechanisms (virtual and physical) for future activities. ▪ There is now a Central Asia energy-water knowledge data portal and network.
5	Studies on Energy Vulnerability to Climate change	▪ Studies on the vulnerability of the energy sector to climate change were conducted in Kyrgyz Republic, Turkmenistan, Kazakhstan and Tajikistan ▪ The studies identified climate risks and possible adaptation measures, which emphasized cross-sectoral issues (energy-water). ▪ A regional study on Energy Vulnerability to Climate Change is underway and is expected to be completed by December 2015

Element 4: Mobilizing Funds for Building Energy Assets

25. There is a substantial need to investment in energy assets in the CAREC region. The Regional Power Sector Master Plan (RPMP) estimates that a total of USD 35 billion is required to be invested in Central Asia Power systems of Kazakhstan, the Kyrgyz Republic, Tajikistan and Uzbekistan, from 2013 to 2022. The Power Sector Master Plan for Afghanistan estimates a need for investment of USD 10 billion in the Afghan power sector from 2013 to 2032 (see Figure 5). However, these economies may not be able mobilize such investment requirements considering their current GDP and growth rate. For example, the average investment required for Kyrgyz Republic is almost 10% of its GDP. The limitation of national budgets and domestic capital markets in the CAREC countries necessitate practical investment mobilization strategies.

Figure 5. Estimated Investment Required for Priority Project, by Country (2013-2022)



Source: ADB, "Central Asia Regional Economic Cooperation: Power Sector Regional Master Plan," 2012.

*Estimated investment needs for Afghanistan are based on the AFG Power Sector Master Plan and encompass the period from 2013-2032, adjusted for 9 years out of 20-year planning horizon.

26. The October 2013 CAREC SOM endorsed ADB's proposed technical assistance (TA) to develop the CAREC Power Sector Financing Roadmap for CAREC member countries. The TA aims to assess the capacity and willingness of CAREC countries to finance power infrastructure from their own resources, and from other potential sources of financing, for both national and cross-border projects. The project concept was approved and funding of US$1.5 million was sourced from ADB and the People's Republic of China. The TA was approved in September 2014, and CAREC members have now been informed of the required inputs from countries for TA implementation.

27. Consultants were fielded in March 2015 and presented their preliminary findings in the 20th ESCC Meeting. Their progress report included regional power sector investment requirements and development plans, legal and institutional frameworks, and financing sources for power projects and potential power sector PPP projects. The study is expected to be completed by early 2016.

Element 5: Implementation of Energy Sector Priority Projects

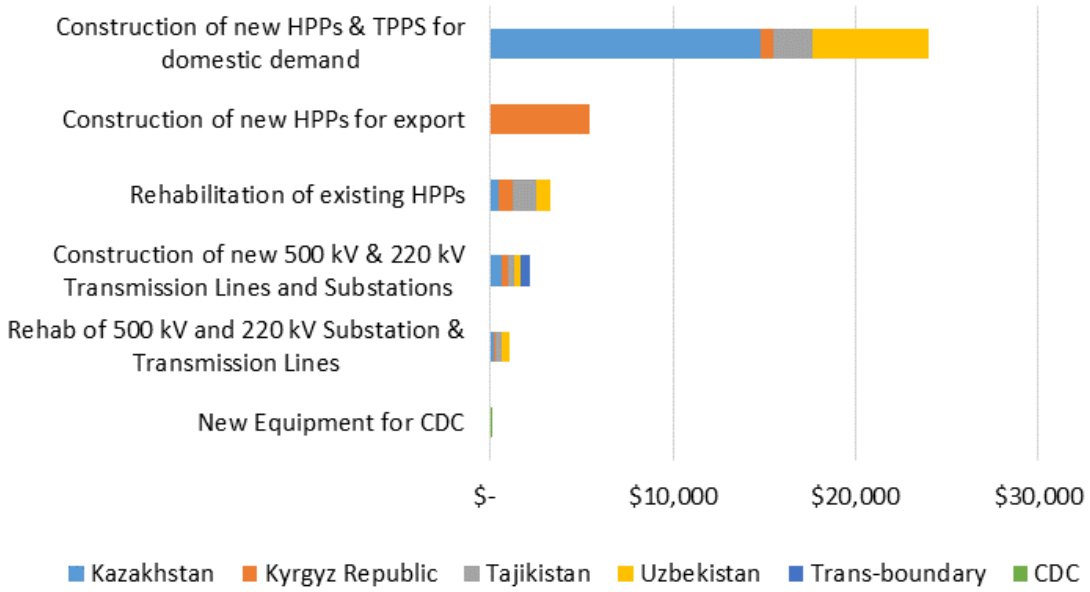
28. As described above, there is a considerable need to infrastructure investments in the energy sector of Central Asia. The CAREC Energy Secretariat has been preparing and updating a medium-term priority projects list for the energy sector since 2011. The consolidated list of priority projects is compiled using inputs from CAREC member countries. Projects included on the list are required to follow the following criteria:

a. Projects located in CAREC countries with grids interconnected with other CAREC countries;

b. With financing to be approved in 2013–2015; and
c. Involving rehabilitation or installation of new generation (50 MW or above) or high voltage transmission (220 kV or above) assets.

29. Each member country has compiled the list of medium-term priority projects based on 10-year (2013–2022) national investment plans. Required investment for the priority projects is estimated to be USD 45.8 billion (see Figure 5), with nearly 75 percent of priority investments in Kazakhstan, the Kyrgyz Republic, Tajikistan and Uzbekistan being for construction of new generation capacity to meet domestic demand. Figure 5 shows types of priority investments identified in the Regional Power Sector Master Plan.

Figure 6. Estimated Investment in CAPS, by Investment Type ($million; 2013-2022)



Source: ADB, "Central Asia Regional Economic Cooperation: Power Sector Regional Master Plan" 2012. (Table 9.3-1 Summary Investment Costs)

Element 6: Capacity Building and Knowledge Management

30. Capacity building and knowledge-management are crucial for increasing institutional competence, and for the identification, implementation, and sustainability of physical investments over time. The objective of this element is to encourage information dissemination, sharing of best practices, and strengthening of institutional capacity.

31. The 2013 to 2015 EWP aimed to close the capacity gap in the CAREC countries through a number of capacity-building opportunities. Table 6 describes capacity building and knowledge management activities, workshops and seminars implemented under CAREC since 2013. A more detailed list of capacity building and knowledge sharing activities can be found in Appendix AB.

Table 6: Achievements under 2013–2015 EWP: Element 6

No.	Activity	Achievements under 2013-2015 EWP
1	Trainings and workshops	▪ Energy Efficiency Training Seminar ▪ Regional Energy Trade Workshop; Training on Forecasting; Regulation; and electric vehicle (E-Mobilia)
2	Field visits	▪ Kapchagai Solar Power Station ▪ Malaysian Greentech Corporation; ▪ Changping HVDC Demonstration Project; ▪ Sihui Electric Bus Charging/Battery Swapping Station ▪ Philippine Wholesale Electricity Supply Market ▪ Kawasaki Smart Community Center (Toshiba Science Museum, and Smart Community Show Space), Nissan (electric vehicle) ▪ Isogo Coal Power Plant, Tokyo Electric Power Company (Dispatch Facility), ▪ Toshiba Fuchu Factory (Hydrogen Energy Research and Development; Smart Home with super-efficient appliances)
3	Knowledge sharing presentations	Presentations on: ▪ The Energy Charter Treaty and the World Trade Organization ▪ Renewable energy initiatives in CAREC countries ▪ Electricity market development in Kazakhstan ▪ Status of the energy system in Kyrgyz Republic ▪ Energy initiatives of the UNECE, UNESCAP and UNDP ▪ Regional cooperation in the framework of the Energy Charter. ▪ Energy resources and regional cooperation for Mongolia ▪ Air Pollution Reduction Measures in Ulaanbaatar, Mongolia ▪ New Japanese clean energy technologies.
4	Regional Cooperation in Central and South Asia (RECA) meetings	▪ 3 Regional Cooperation in Central and South Asia (RECA) meetings: Astana, Kazakhstan (2013), Ashgabat, Turkmenistan (2014), Bishkek, Kyrgyzstan (2015)
5	Improvement of Energy Page on CAREC website	▪ Updated directory of ESCC events, and uploaded reference documents and diagnostic studies

IV. Energy Work Plan for 2016–2020

32. The Energy Work Plan for 2016-2020 has been developed taking into consideration progress under the 2013–2015 EWP as well as the current priorities and challenges of CAREC countries.

33. Before the March 2015 ESCC meeting, CAREC member countries shared with the CAREC secretariat the priorities and challenges they have in their respective energy sectors. The top priorities reported by CAREC countries were adding new generation, transmission and distribution capacity and rehabilitating existing assets. Other commonly reported priorities include implementing legal and regulatory reforms, increasing renewable energy generation and improving sector management through capacity building. Most of the challenges reported by the CAREC countries were related to problems resulting from, or contributing to, aging infrastructure. Countries reported concerns about energy security and reliability, energy intensity resulting from high losses and inefficient generation and the inability to obtain funding for new assets or rehabilitation of existing assets. Countries also expressed that insufficient human resource and management capacity was an additional challenge in their respective energy sectors. Figure 7 and Figure 8, respectively, show the priorities and challenges identified by the CAREC countries.

Figure 7. Common Energy Sector Priorities among CAREC Countries

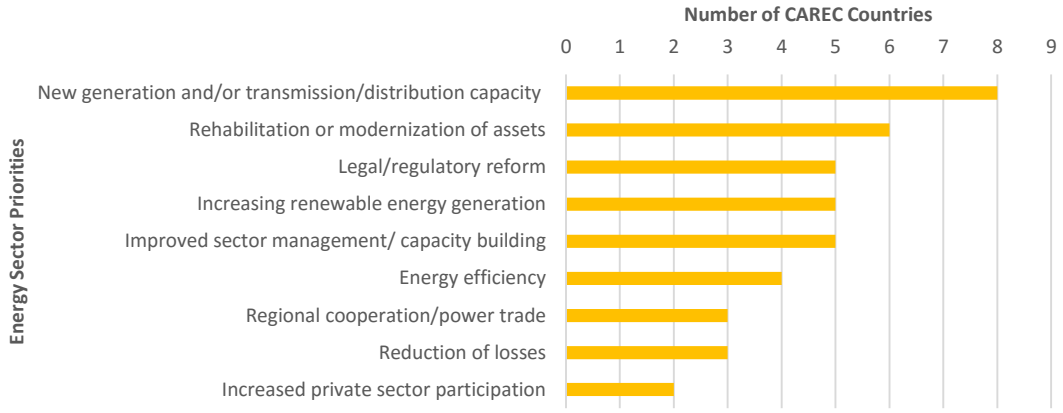
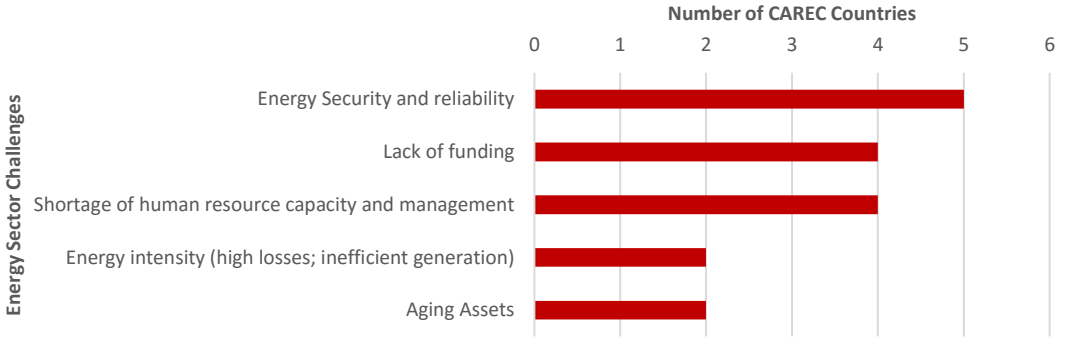


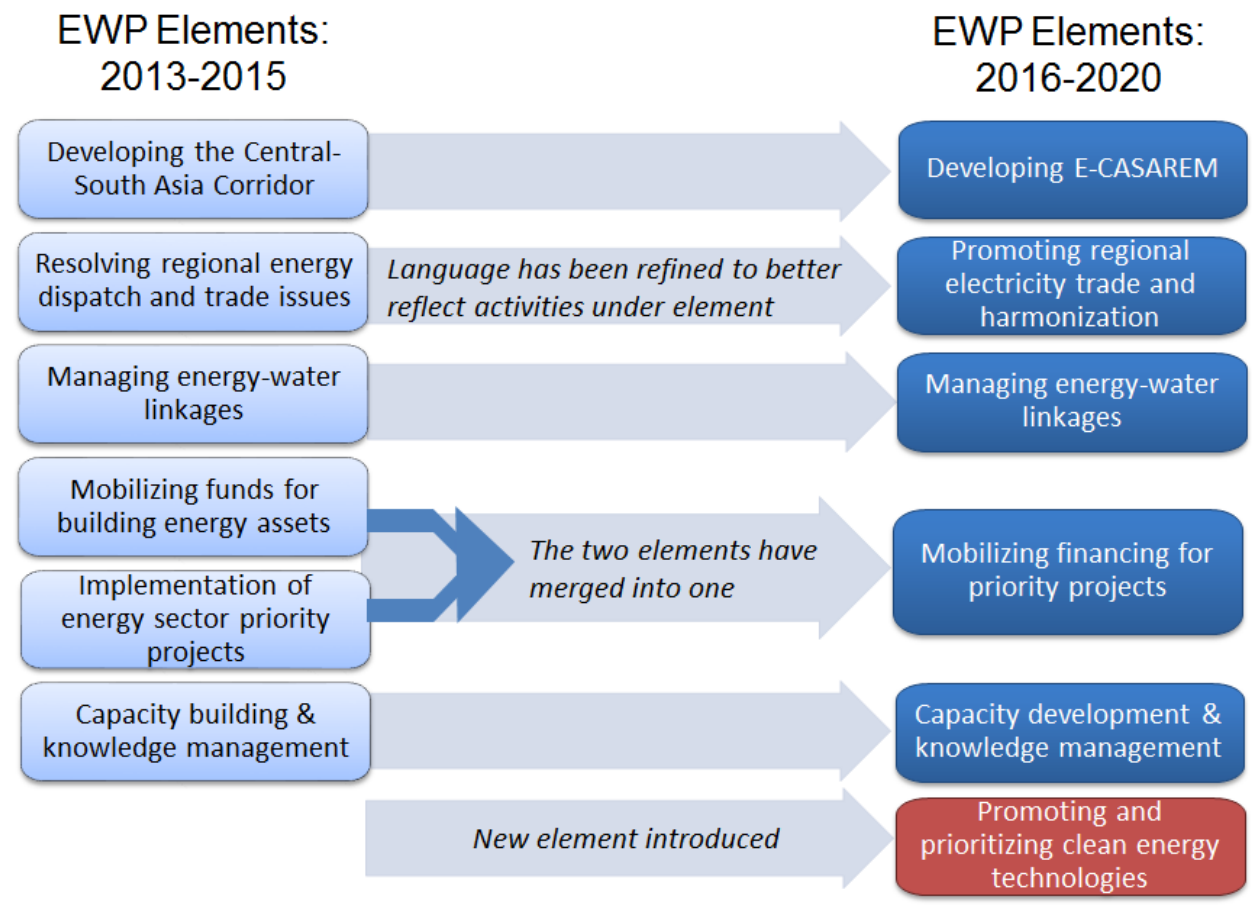
Figure 8. Common Energy Sector Challenges among CAREC Countries



34. The elements of the 2016–2020 EWP have been adapted from the 2013–2015 EWP. Revisions to the elements include minor changes to the language of Element 2 to better reflect activities under the element, combination of Elements 4 and 5 into a single Element, and addition of an element for the promotion of clean energy technologies. Figure 6 demonstrates the

changes to the EWP elements that have been made in the 2016–2020 EWP.[1]

Figure 6. Changes to the Elements of the Energy Work Plan



Element 1: Developing the East-Central Asia-South Asia Regional Energy Market

35. Activities under element one, Developing the East-Central Asia-South Asia Regional Energy Market, will continue the work began under the 2013-2015 EWP. As described earlier, there are a number of cross-border energy infrastructure projects under implementation in the CAREC region. These projects are: i) the TAPI gas pipeline, ii) the CASA-1000 power transmission line, and iii) the TUTAP power transmission project. Implementation of these projects will continue under the 2016–2020 EWP.

36. **i) TAPI gas pipeline**: The Steering Committee for the TAPI pipeline hopes to begin construction on the project in 2015; however, a consortium leader must be selected before this can occur. A consortium leader was expected to be named after the February 2015 meeting of the TAPI steering committee; however, this announcement has since been delayed. It is now estimated that a selection will be made by the end of 2015.

[1] Changes to the EWP elements were agreed upon at the 19th CAREC ESCC meeting held from 30–31 March 2015 in Ulaanbaatar, Mongolia.

37. **ii) CASA-1000:** During the 2016-2020 EWP, the CASA-1000 project will continue to secure financing for the project, finalize operational agreements, develop “open access” arrangements, procure equipment and construct the line. Completion of the CASA-1000 project is expected by 2018.

a. The remaining financing gap of 25% (approx. US $300 million) is anticipated to be filled through financing from the Islamic Development Bank, the European Bank for Reconstruction and Development, other bilateral sources and additional World Bank funds.
b. The Power Purchase Agreement, Master Agreement and Coordination Agreement for the project have been largely agreed and are expected to be signed by mid-2015.
c. Development of "open access" rules and procedures to manage and facilitate the use of spare capacity of the CASA-1000 transmission system is underway and will be finalized during the 2016-2020 EWP.
d. Legal, procurement and finance committees for the CASA-1000 project have begun implementation of the project. Procurement of converter stations and operator for the CASA-1000 project; High Voltage DC line for Afghanistan and Owners’ engineers are progressing.

38. **iii) TUTAP:** Implementation of the TUTAP project is underway, and will continue progressing during the 2016-2020 EWP. The 220kV connections from Tajikistan to Afghanistan and Uzbekistan to Afghanistan exist and are currently supplying the Afghanistan network. In addition, implementation of the Turkmenistan-Afghanistan 500 kV interconnection, which will initially operate at 220 kV, has begun. The Turkmenistan component of the line is under construction and is estimated to be completed in 2019. Bids for the Afghanistan component of the line are under evaluation, and contracts are expected to be awarded by 2016. Within Afghanistan, ADB is preparing a 500-kV transmission line project from Sheberghan to Pule Khumri (200 kM) including a 300 MW back to back HVDC converter station at Pule Khumri. The project will bridge the missing 500-kV link in northern Afghanistan to extend the ADB-assisted 500-kV power interconnection from Turkmenistan to Kabul and provide 1,000 MW additional transmission capacity. The project is expected to be considered by ADB Board in Q4 of 2015.

39. **iv) East Asia Super Grid:** The ADB has proposed technical assistance to support the development of the East Asia Super grid, which will be part of E-CASAREM. Financing of $1.75 million is being processed for 2015.

Element 2: Promoting Regional Electricity Trade and Harmonization

40. Activities under the second Element will be a continuation of work began under the 2013 to 2015 EWP. The Study *on Regional Power Trade Development in Central Asia* which will help promote power trade in Central Asia (CA) will continue being carried out during the 2016-2020 EWP, with financial support from the World Bank. The study will evaluate the current condition of the power market models, pricing rules, and tariff regulation mechanisms in the power sector. It will also analyze existing power sector agreements among the Central Asian countries, including international infrastructure projects and trans-boundary trade mechanisms, and examine international best practice for establishing power markets. The study will build on the results of the 2010 study on regional trade completed by Mercados and the 2012 Regional Power Sector Master Plan completed by Fichtner.

41. The consultants engaged by the World Bank will continue preparing the study during the 2016-2020 EWP, with the support of the Working Group on regional market arrangements. The consultants are expected to present a finalized model a study report by end November 2015. During the 20th ESCC, the Central Asian countries were requested to expediently share the missing information on their respective power sectors with the consultants.

Element 3: Managing Energy-Water Linkages

42. A regional study on Energy Vulnerability to Climate Change began under the 2013 to 2015 EWP and is expected to be complete by December 2015. This study aims to support Central Asian countries in understanding climate change-induced energy sector vulnerabilities and building resilience to these vulnerabilities through the development of coordinated adaptation policies. The study will run hydrologic and economic models, which are specific to Central Asia and are thus well suited to articulate changes in the components of water flow (glacier melt, snow, and precipitation) and provide insight into energy sector adaptation policies. Using the models and other resources, the study will consolidate a vulnerability assessment of the impacts, risks and adaptive capacity of the energy sector. The results of assessment will provide guidance for decision-makers on options for investments in and management of power generation, transmission, and distribution assets, with a focus on challenges and opportunities for effective regional coordination of climate change adaptation.

43. Discussions will also continue on the possibility of establishing a working group to deal with water resource management issues. The working group would be composed of both water and energy experts from the countries in Central Asia. Its purpose of the working group will be to expose officials in CAREC member countries to principles of good practice in managing cross-border hydro resources.

Element 4: Mobilizing Financing for Priority Projects

44. The ESCC Secretariat has been consolidating and annually updating inputs from CAREC member countries to come up with a list of priority energy projects. This list will be compiled and regularly updated, based on the national investment plans of the member countries.

45. Work has begun on the Power Sector Financing Roadmap and will be completed during the 2016–2020 EWP. The Roadmap aims to examine potential sources of financing for power sector development in CAREC countries, covering both national and cross-border projects, and to identify potential projects that could be developed on a public–private partnership basis. The project will analyze the enabling environment in each country for private investment in the power sector, establish business cases, transaction strategies and identify modalities for financing priority projects.

46. In addition, CAREC will continue its work to support an enabling environment for private investment and attract financing for new infrastructure in the region. To this end, an investors' forum will be held in 2016, coinciding with the ESCC meeting scheduled for the year.

Element 5: Capacity Development and Knowledge Management

47. CAREC countries have proposed a number of common capacity building and knowledge sharing activities for the future. Four general themes to be highlighted under this element during the 2016–2020 EWP are:

a. Knowledge Sharing (smart meters, project management, independent regulation, tariff policy, forecasting, planning and energy efficiency)
b. Technology Adoption (smart metering, solar power, battery storage, electric vehicles, energy efficiency)
c. Regulatory Issues (framework for independent regulation, tariff setting for time-of-use tariffs, pre-paid meters, IPPs tariffs, and benchmarking)
d. Training (demand management, forecasting, solar power, battery storage, energy efficiency, managing large transmission and distribution projects)

48. The ESCC will continue striving to ensure coordination of capacity building and knowledge sharing activities. As part of this effort, the ESCC will try to incorporate site visits and country presentation activities in meetings to encourage information dissemination and sharing of best practices among member countries.

49. Under the 2016–2020 EWP, the ESCC will also work to strengthen cooperation with other energy entities such as Energy Charter, International Energy Agency, International Hydropower Association, etc., especially on improving capacity building and knowledge management events for CAREC countries.

Element 6: Promoting and Prioritizing Clean Energy Technologies

50. Three technologies—Lithium-ion batteries, solar power and energy efficient appliances—have made a substantial impact in the energy sector of developed countries in recent years. This has largely been a result of the drastic decrease in the cost of solar power, the cost and weight of lithium-ion batteries, and the energy required to power appliances such as light bulbs, televisions, air conditioners and fans. In addition, these changes have had implications for rural electrification; in some cases, making off-grid connection or decentralized grids more economically viable than extension of the main transmission and distribution networks.

51. Market penetration of these and other clean energy technologies could follow in the footsteps of the expansion of mobile phone use, taking more than 10 years to reach the population of developing Asia, unless action is taken to accelerate technology adoption. The objective of Element 6 is to increase awareness of decision makers and opinion leaders about global energy trends and recent innovations in clean energy technologies. In addition, the element aims to promote adoption of new technologies, create aggregated market to attract investment and remove market barriers to take advantage of them.

52. This element will work to accelerate the adoption of new and appropriate technologies in the region through three activities:

a. **Raising awareness** of selected new technologies that are being adopted in developed economies. The awareness will cover: technical aspects, business models, and quantification of benefits that may be achieved under local conditions.

b. **Support demonstration projects** in one of the suitable countries of the region, and share the knowledge and business models to be used by other countries in the region.

c. **Establish markets and securing funding** by combining fragmented markets

into a larger aggregated market to attract private investment to scale up viable demonstration projects. In addition.om various climate investment funds including the Green Climate Fund may be tapped to finance large projects either in a country or a range of countries in the region

53. Specifically, it is proposed that CAREC support new technology adoption during the 2016-2020 EWP through regional Technical Assistance to pilot new technology projects. It is envisioned that such activities could combine small markets and attract investors and companies.

54. Opportunities for clean energy technologies include, inter alia, off-grid and on-grid power storage solutions, solar power, efficient lighting, appliances, and electric vehicles. These examples of clean energy technologies have the following benefits:

a. Off-grid and on grid storage solutions to shift peak demand, develop ancillary services and improve supply reliability
b. Use of solar power can reduce the need for fossil fuel-based power generation to meet day-time peak demand and reduce day time peak
c. Efficient lighting and appliances can reduce the evening peak demand, delaying the need for additional distribution and transmission capacity
d. Electric vehicles reduce the reliance on imported oil and improve energy security.

Appendix A **Description of Energy Sector Output Indicators**

Indicator	Description
Transmission lines installed or upgraded (km)	The length, in kilometers, of new, high voltage[2] lines built, rehabilitated, or upgraded during the reporting year.[3]
Increased energy generation capacity (MW net)[4]	The incremental generation capacity added in megawatts net, (and average volume energy produced in MWh) during the reporting year through new investment.
Rehabilitated generation capacity (MW net)	The incremental generation capacity added during the reporting year, in MW net, and average volume energy produced in MWh) through investment in plant rehabilitation or upgrade.
New substations (MVA)	The capacity, in megavolt amperes, of new high voltage substations built in the reporting year.
Upgraded substations (MVA)	The incremental capacity, in megavolt amperes, added through the rehabilitation or upgrading of existing substations.
Wind Power Installed, MW net/MWH[5]	The incremental generation capacity added during the reporting year, in megawatts net, through new wind investment. and Production, in megawatt hours, from wind power plants during the reporting year.
Solar Generation Installed, MW net/MWh	The incremental generation capacity added during the reporting year, in megawatts net, through new solar PV investment. and Production, in megawatt hours, from solar PV during the reporting year.
Electric Vehicle Adoption, Nos	Number of electric vehicles in use (reporting hybrid and pure electric vehicles separately).
LED public lighting, km of roads	The incremental length of roads, in kilometers, lit by public streetlights using LED bulbs.
Energy Efficiency investment	The amount (in equivalent US dollars) invested in energy efficiency.

[2] High voltage is considered to be any transmission line or substation rated 110 kV or higher.

[3] Upgrade or rehabilitation are, for the purpose of these indicators, considered to be any capital expenditure in an amount greater than US$500. This threshold is used to distinguish “capital expenditure” and “investment” from expenditure on maintenance.

[4] MW net refers to net generation capacity. Net generation capacity is the electrical output of a power plant after deducting consumption of the plant itself (“own use”).

[5] Both grid-connected and off-grid generation should be reported for solar and wind.

Appendix B **2013–2015 Capacity Building and Knowledge Sharing Activities**

No.	Activity	Date	Location
1	Presentation on the Energy Charter Treaty and the World Trade Organization	7 June 2013	Ashgabat, Turkmenistan
2	Visit to the Kapchagai Solar Power Station	September 2013	Almaty, Kazakhstan
3	Presentations on renewable energy initiatives in CAREC countries	September 2013	Almaty, Kazakhstan
4	Regional Cooperation in Central and South Asia (RECA) meeting	7 October 2013	Astana, Kazakhstan
5	Presentations on: ▪ the electricity market development in Kazakhstan ▪ status of the energy system in Kyrgyz Republic	April 2014	Bishkek, Kyrgyz Republic
6	Energy Efficiency Training Seminar: Central and West Asia Region	28–29 May 2014	Kuala Lumpur, Malaysia
7	Visit to the Green Energy Office, Malaysian Greentech Corporation	30 May 2014	Kuala Lumpur, Malaysia
8	Presentation on the Energy Charter Secretariat's regional cooperation in the framework of the Energy Charter.	4 September 2014	Beijing, People's Republic of China
9	Visits to the Changping HVDC Demonstration Project and the Sihui Electric Bus Charging/Battery Swapping Station	5 September 2014	Beijing, People's Republic of China
10	Presentations on the respective energy initiatives of the UNECE, UNESCAP and UNDP	September 2014	Beijing, People's Republic of China
11	Regional Energy Trade Workshop	8–9 September 2014	Manila, Philippines
12	Visit to the Philippine Wholesale Electricity Supply Market	9 September 2014	Manila, Philippines
13	Regional Cooperation in Central and South Asia (RECA) meeting	9 December 2014	Ashgabat, Turkmenistan
14	Presentation on the causes of the fall of oil prices during 2014-15.	March, 2015	Ulaanbaatar, Mongolia
15	Presentations on: ▪ Air Pollution Reduction Measures Project in Ulaanbaatar ▪ Energy resources of Mongolia and the potential for regional energy sector cooperation.	March, 2015	Ulaanbaatar, Mongolia
16	CAREC Energy Workshop on New Technologies	27-29 July 2015	Tokyo, Japan
17	Training sessions on Forecasting, Regulation and Off-Grid Electrification Kits	7-9 September 2015	Kuala Lumpur, Malaysia
18	International Greentech and Eco Products Exhibition and Conference	9 September 2015	Kuala Lumpur, Malaysia
19	3rd World E-Mobilia Conference	10 September 2015	Kuala Lumpur, Malaysia

Appendix C **Existing Interrelationships between CAREC Countries**

	Afghanistan	Azerbaijan	China	Kazakhstan	Kyrgyz Republic	Mongolia	Pakistan	Tajikistan	Turkmenistan	Uzbekistan
Afghanistan	**X**						Energy imports to PAK transit through AFG	AFG imports power from TAJ		AFG imports power from UZB
Azerbaijan		**X**		Discussions of oil and gas exports from KAZ to AZB (through BTC & BTE) are underway						
China			**X**	PRC has energy investments in KAZ	PRC imported power from KGZ during 2003-2007	PRC imports coal from MON		PRC financing of North-South power line & hydro project	PRC has energy investments in TKM	PRC oil and gas exploration investments in UZB
Kazakhstan		Discussions of oil and gas exports from KAZ to AZB (through BTC & BTE) are underway	Export of Kazakh oil to China	**X**	Hydropower imports from KGZ Transit for power exports north by swap arrangements water sharing agreements			KAZ imports hydropower from TAJ water sharing agreements		KAZ imports UZB gas/power water sharing agreements
Kyrgyz Republic			KGZ exports power to PRC	KGZ imports oil, coal and gas from KAZ and exports power to KAZ	**X**			Export of power. Electricity transit north – south in relation to Tajikistan		KGZ imports oil, coal and gas from KAZ and exports power to KAZ
Mongolia			MON exports coal to PRC			**X**				
Pakistan	Energy imports to PAK transit AFG						**X**			
Tajikistan	TAJ exports power to AFG			TAJ exports power to KAZ	Transit for Power exports north			**X**		TAJ imports UZB gas and they have power transit/exchange agreements

Turkmenistan	Exports power to AFG		Exports gas to PRC						**X**	
Uzbekistan	Exports power to AFG		PRC has oil and gas exploration concessions in UZB	Exports gas to KAZ	Exports gas to KGZ			Exports gas and power to TAJ		**X**
				Power transit/ water sharing agreements	Imports power from KGZ			Power transit/ water sharing agreements		

Appendix D **Evolving Energy Inter-relationships among CAREC Countries**

	Afghanistan	Azerbaijan	China	Kazakhstan	Kyrgyz Republic	Mongolia	Pakistan	Tajikistan	Turkmenistan	Uzbekistan
Afghanistan	**X**			Potential for power imports to AFG through E-CASAREM	Potential for power imports to AFG through E-CASAREM			Direct power imports and imports via E-CASAREM Possible gas exports to Tajikistan	Possible gas imports through TAPI	Power imports from Uzbekistan
Azerbaijan		**X**		Potential flow of Kazakh oil and gas through BTC and BTE pipelines			PAK has interest in importing Azeri gas		Flow of Turkmen oil and gas through BTC and BTE pipelines	
China		PRC has oil field exploration investments in AZE	**X**	Energy exploration, production and pipeline investments and oil and gas imports	Potential power investments and imports		Possible electricity exports from China-Pakistan	Investments in coal, hydropower and North-South power transmission Possible power imports		Gas transit to China
Kazakhstan		Oil and gas exports from KAZ to AZB (through BTC & BTE) are under discussion. Littoral agreements are in place	Export of Kazakh oil, gas and possibly thermal power to China	**X**	Import of Kyrgyz hydropower. Investment in Kambarata Hydropower. Export of coal and gas to KYR					Import of Uzbek gas for Southern Kazakh provinces
Kyrgyz Republic	Power export to E-CASAREM via Tajikistan		Possible export of power to PRC	Transit for power flow between KAZ and TAJ	**X**		Power imports via E-CASAREM	Power exports to E-CASAREM through TAJ		Import of Uzbek gas
Mongolia			Coal and potential power exports to PRC	Possible import of oil, petroleum products and LPG		**X**				

Pakistan	Power imports via E-CASAREM and gas imports via TAPI will transit AFG	Interest in importing Azeri gas	Possible electricity imports from PRC		Power imports via E-CASAREM		**X**	Power imports via E-CASAREM	Possible gas imports through TAPI	
Tajikistan	Increased power exports Gas imports from AFG		Possible export of hydropower	Transit for Kazakh power for E-CASAREM	Transit for Kyrgyz Power for E-CASAREM		Power imports via E-CASAREM	**X**		Import of Uzbek gas
Turkmenistan	Gas exports to AFG through TAPI						Gas exports to PAK through TAPI		**X**	
Uzbekistan	Increased Export of power to AFG		Gas transit to China	Export Gas to South Kazakhstan	Export gas to Kyrgyzstan			Export of gas to Tajikistan. Power transit		**X**
Other Countries		Power exchange with Georgia, Iran and Russia. Oil and gas exports to Turkey and further to the West Europe	Oil (partly transiting through Mongolia), gas and power imports from Russia Russian export of gas and power to China	Kazakh oil, gas and power exports to (and via) Russia Possible access to a Persian Gulf port and a Mediterra-nean port	Frequency support to CAPS	Become a transit country for energy flows between Russia and China	Potential interconnection with India as part of CASA – 1000			Russian imports of Uzbek gas