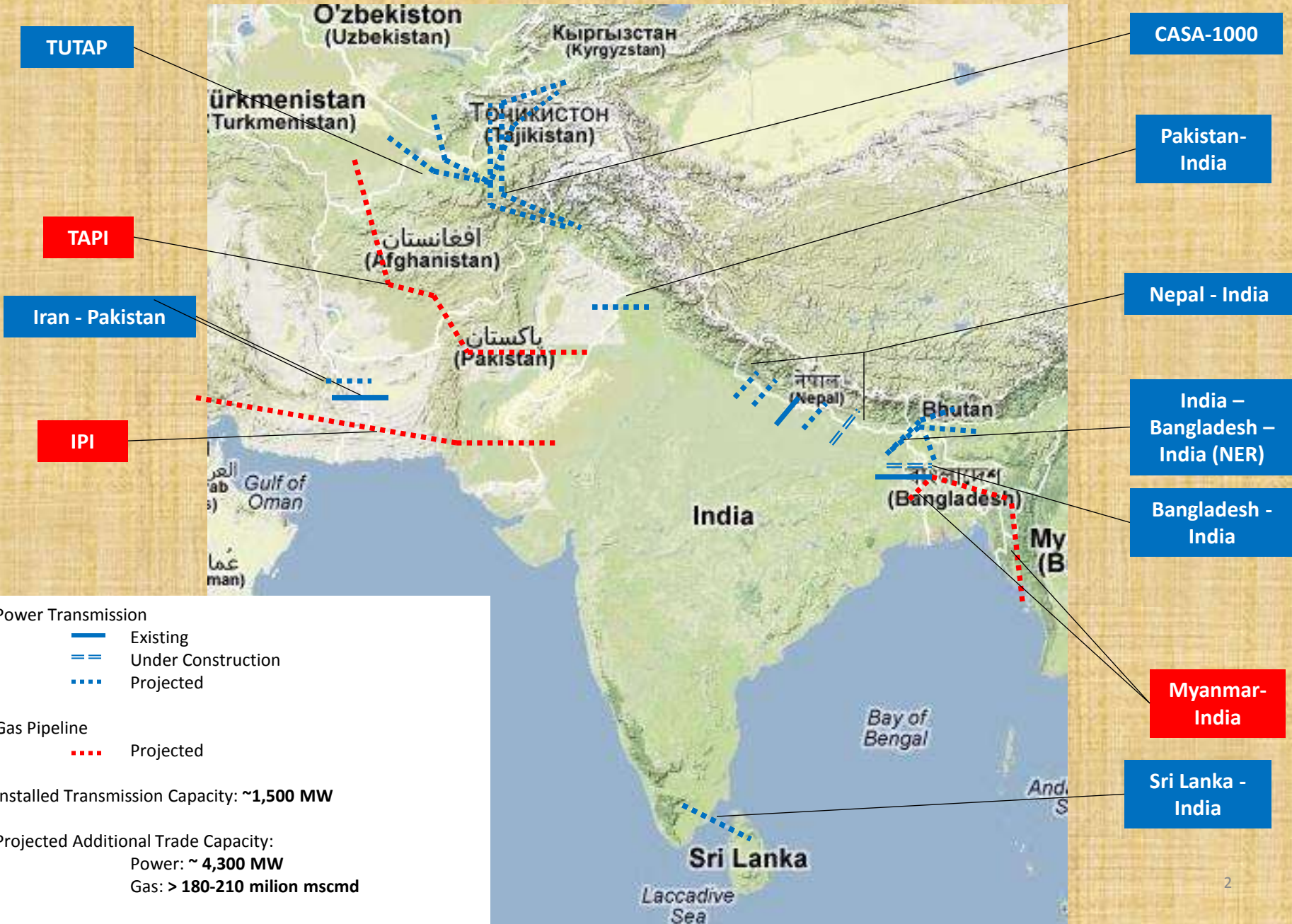


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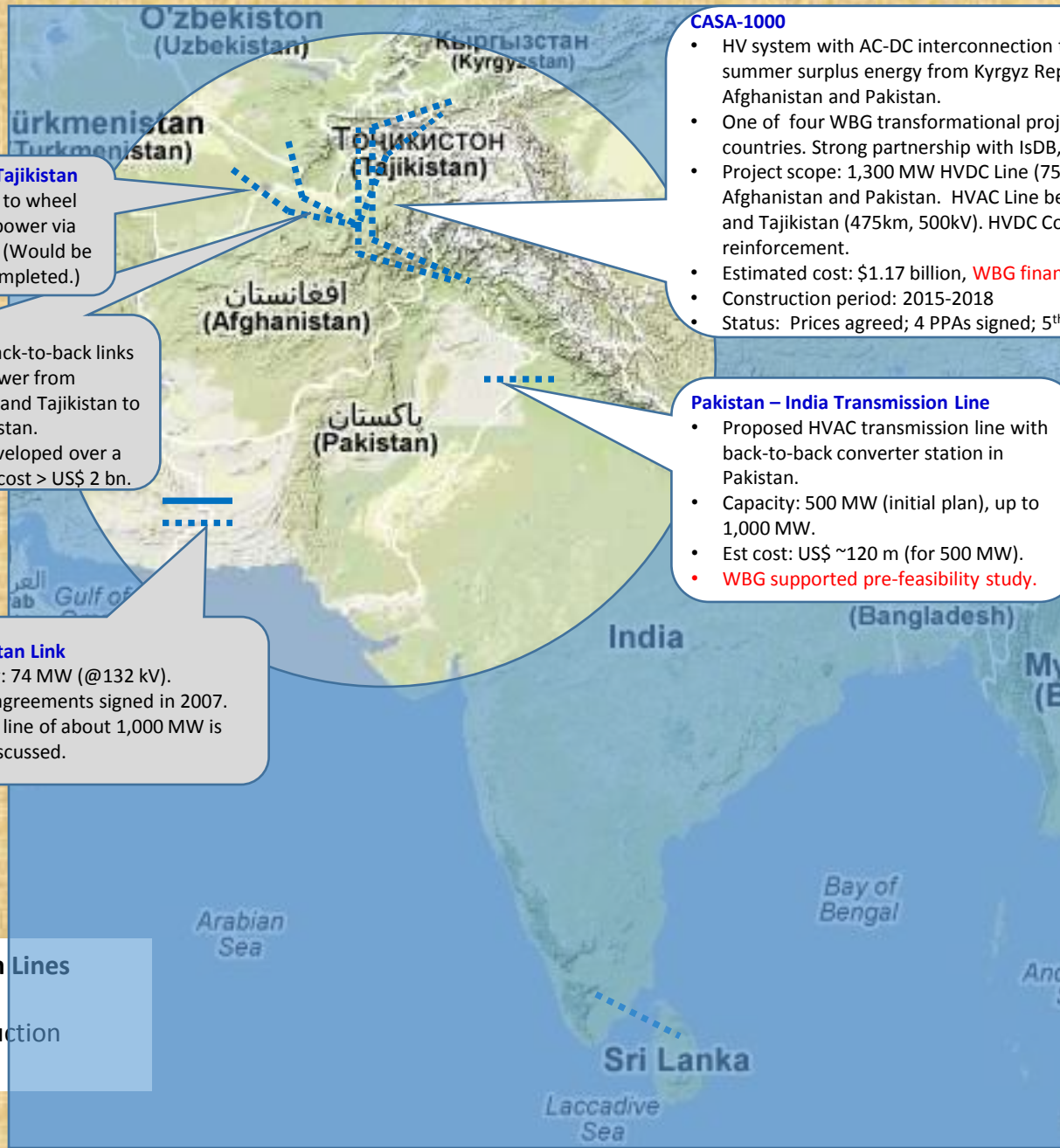
**Regional Power Interconnections  
in South Asia**

**Anjum Ahmad  
Senior Energy Specialist  
World Bank, Islamabad**

# Regional integration in electricity and gas in South Asia



# SAR: Existing and proposed electricity interconnections – West



### Turkmenistan–Afghanistan–Tajikistan

- Existing and planned links to wheel 100-150MW of Turkmen power via Afghanistan to Tajikistan . (Would be superseded if TUTAP is completed.)

### TUTAP Links

- Proposed multi-country back-to-back links (AC-DC-AC) to transmit power from Turkmenistan, Uzbekistan and Tajikistan to Afghanistan and later Pakistan.
- Multiple projects to be developed over a period of time, estimated cost > US\$ 2 bn.

### Iran – Pakistan Link

- Capacity: 74 MW (@132 kV).
- Project agreements signed in 2007.
- Another line of about 1,000 MW is being discussed.

### CASA-1000

- HV system with AC-DC interconnection to export 4,000 GWh of summer surplus energy from Kyrgyz Republic and Tajikistan to Afghanistan and Pakistan.
- One of four WBG transformational projects, 2 regions and 4 countries. Strong partnership with IsDB, ACG, US, UK and EIB.
- Project scope: 1,300 MW HVDC Line (750km, 500kV) in Tajikistan, Afghanistan and Pakistan. HVAC Line between Kyrgyz Republic and Tajikistan (475km, 500kV). HVDC Converter Stations and grid reinforcement.
- Estimated cost: \$1.17 billion, **WBG financing: US\$ 526.5m**
- Construction period: 2015-2018
- Status: Prices agreed; 4 PPAs signed; 5<sup>th</sup> to be signed shortly.

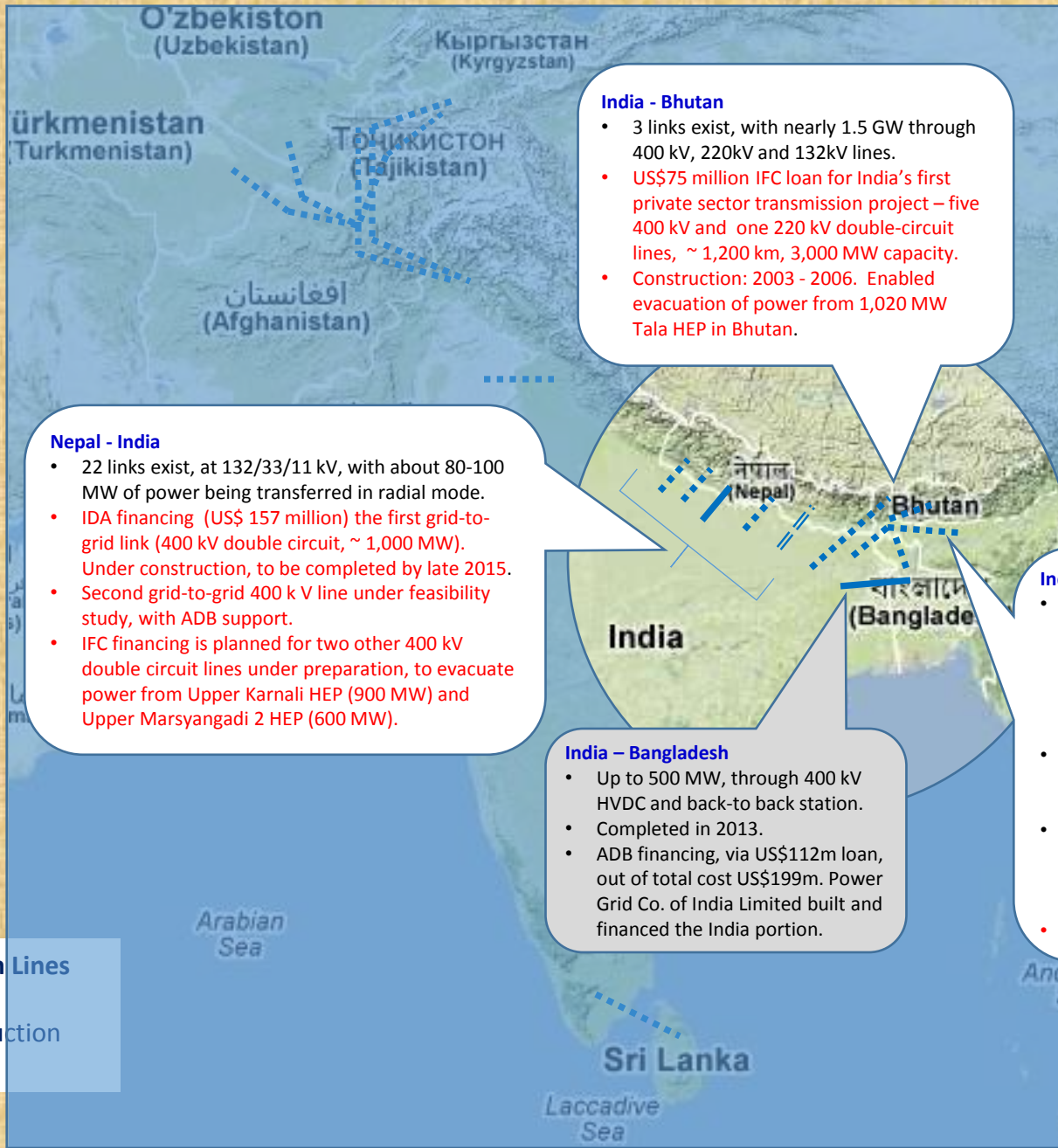
### Pakistan – India Transmission Line

- Proposed HVAC transmission line with back-to-back converter station in Pakistan.
- Capacity: 500 MW (initial plan), up to 1,000 MW.
- Est cost: US\$ ~120 m (for 500 MW).
- WBG supported pre-feasibility study.**

### Power Transmission Lines

- Existing
- - - Under Construction
- ..... Projected

# SAR: Existing and proposed interconnections – East



## India - Bhutan

- 3 links exist, with nearly 1.5 GW through 400 kV, 220kV and 132kV lines.
- US\$75 million IFC loan for India's first private sector transmission project – five 400 kV and one 220 kV double-circuit lines, ~ 1,200 km, 3,000 MW capacity.
- Construction: 2003 - 2006. Enabled evacuation of power from 1,020 MW Tala HEP in Bhutan.

## Nepal - India

- 22 links exist, at 132/33/11 kV, with about 80-100 MW of power being transferred in radial mode.
- IDA financing (US\$ 157 million) the first grid-to-grid link (400 kV double circuit, ~ 1,000 MW). Under construction, to be completed by late 2015.
- Second grid-to-grid 400 kV line under feasibility study, with ADB support.
- IFC financing is planned for two other 400 kV double circuit lines under preparation, to evacuate power from Upper Karnali HEP (900 MW) and Upper Marsyangadi 2 HEP (600 MW).

## India – Bangladesh

- Up to 500 MW, through 400 kV HVDC and back-to-back station.
- Completed in 2013.
- ADB financing, via US\$112m loan, out of total cost US\$199m. Power Grid Co. of India Limited built and financed the India portion.

## India – Bangladesh – India (NER)

- Proposed 7,000 MW line (400 km, 800kV) for transferring power from east to west India, as well as transfers to Dhaka, through a new line in Bangladesh.
- Ongoing discussions between Power Grid Co. of Bangladesh and POWERGRID India
- If further pursued, it would be part of the backbone for a future regional network bringing hydro from Nepal and Bhutan.
- Possible WBG financing.

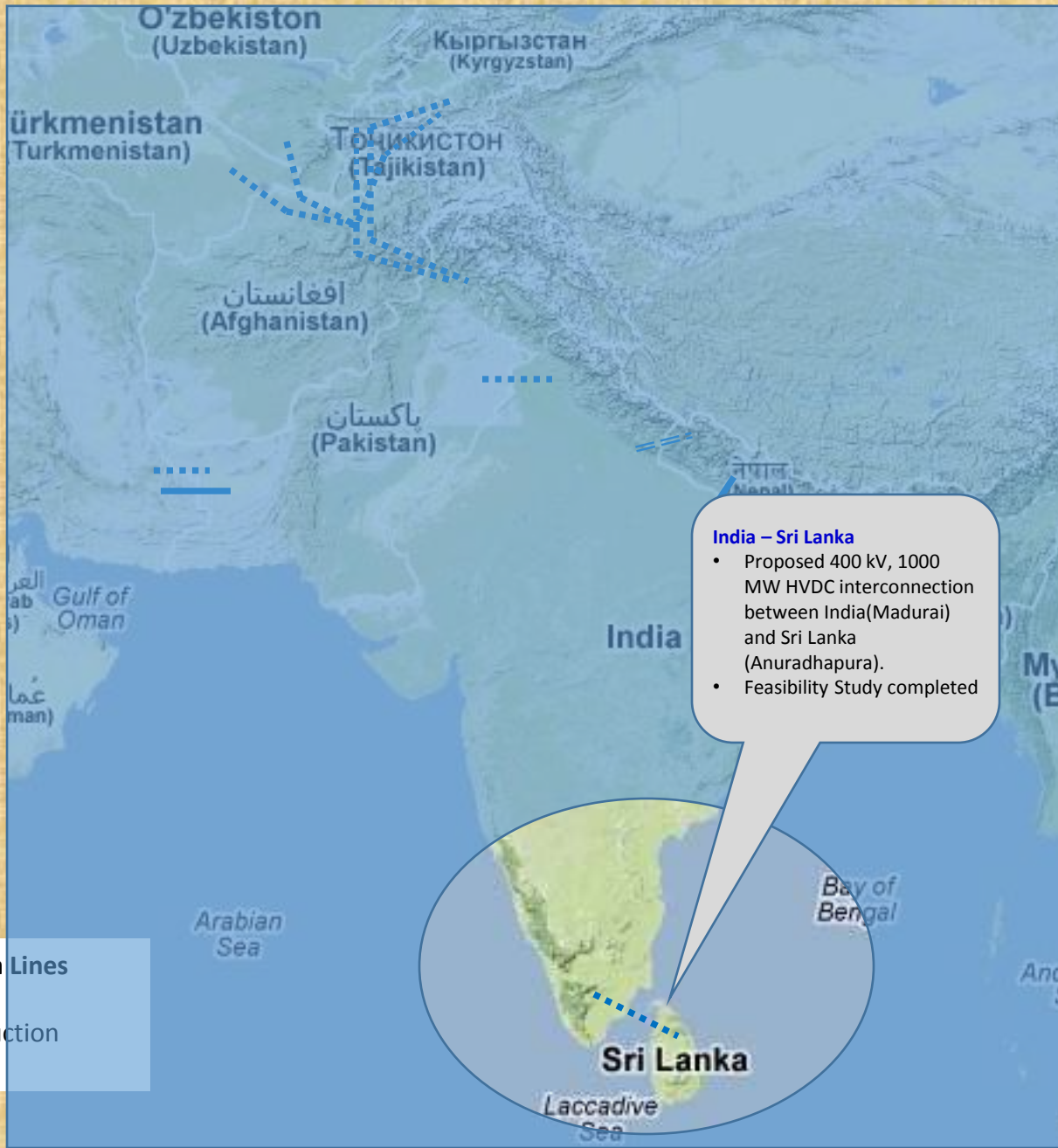
## Power Transmission Lines

— Existing

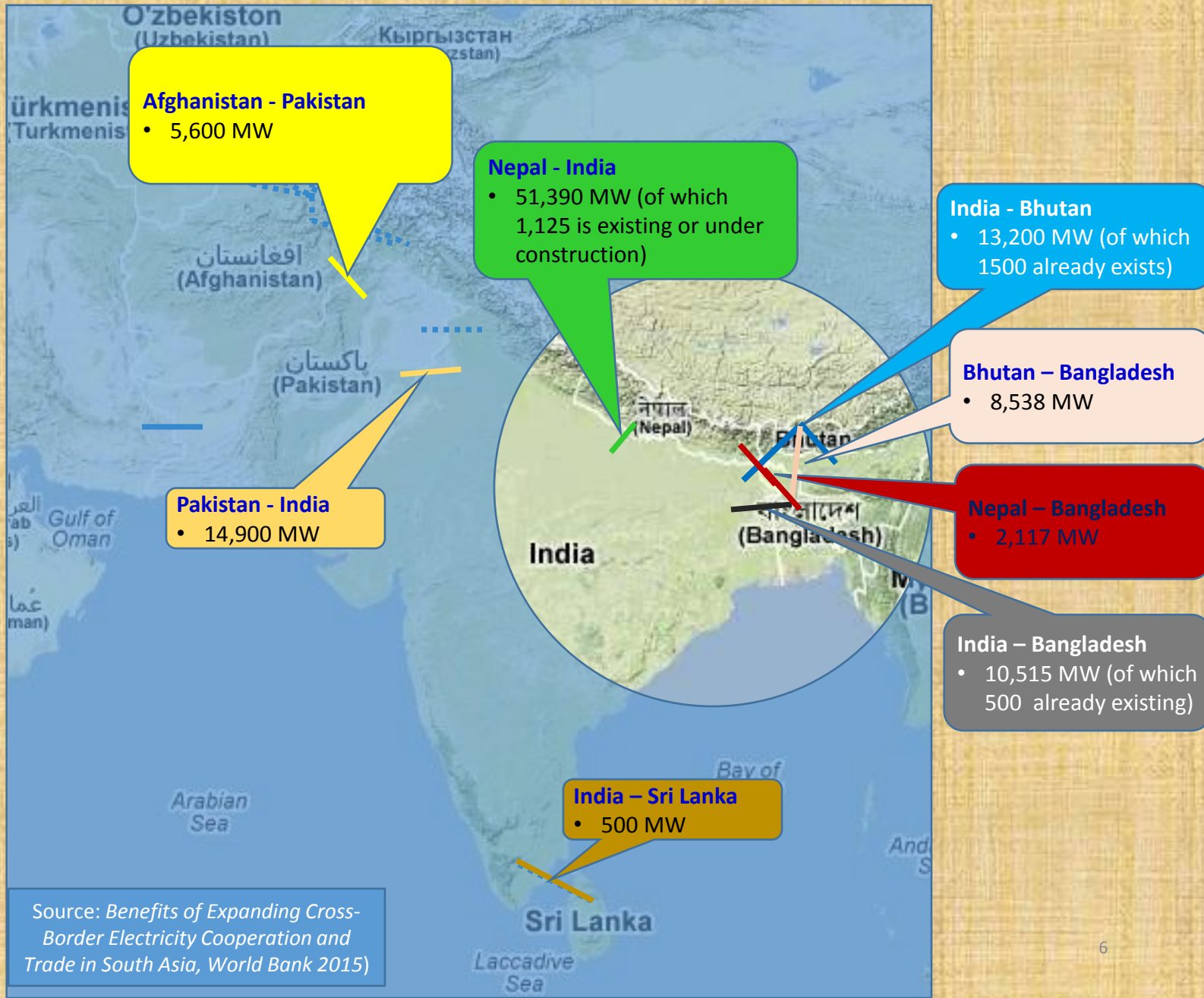
== Under Construction

.... Projected

# SAR: Existing and proposed interconnections – South



# Projection of SAR Transmission Interconnection by 2040 (if there is full regional integration of electricity grids)



Source: *Benefits of Expanding Cross-Border Electricity Cooperation and Trade in South Asia*, World Bank 2015)

# Regional cooperation can lead to:

- Large reallocation of generation investment across countries and technologies (especially but not only for hydro)
- More than 105,000 MW of transmission capacity by 2040 to support unlimited cross-border power flows
- USD 222 billion in net cost savings (USD 97 billion in present value at 5% discount rate)
- Fuel cost savings is the main source of benefits; these savings are more than five times the cost of additional investment

*Source: The Benefits of Expanding Cross-Border Electricity Cooperation and Trade in South Asia, World Bank, June 2015*

# Barriers to cross-border cooperation and trade include:

- Lack of physical interconnection capacity
- Lack of regional regulatory infrastructure for prioritizing and coordinating increased interconnection
- Domestic sector policies that discourage increasing interconnection or power transactions using existing capacity
  - Pricing/revenue recovery; capital shortages
  - Risks to effective contract enforcement



# Why domestic market performance is an important complement

- Bilateral arrangements with government involvement, PPAs with negotiated prices - good start for expanding cross-border trade
- But need domestic market reforms to overcome deep sector drawbacks that trade alone cannot remedy
- These reforms also can help facilitate growth in cross-border trade and investment, increase in efficiency (larger, more competitive market)

# Role of SAARC

- SAARC Framework Agreement for Electricity Trade signed on Nov 27, 2014 in Kathmandu.
- Requires due diligence by each member country on whether they comply with various articles of the Framework. SAARC Energy Center can catalyze and monitor the progress on various agreements under the Framework.
- Examples:
  - Article 7: *“Member States may enable the transmission planning agencies of the Governments to plan the cross-border grid interconnections through bilateral/trilateral/mutual agreements between the concerned states.....”*
  - Article 5: *“Member States may share and update technical data and information on the electricity sector in an agreed template”*
  - Article 11: *“Member States shall enable the national grid operators to jointly develop coordinated procedures for the secure and reliable operation of the inter-connected grids .....*”
  - Article 14: *“Member States may enable and encourage knowledge sharing and joint research .....*”

# CASA-1000 Project

Electricity trade between hydropower surplus countries in

**Central Asia (Kyrgyz Republic and Tajikistan)**

and electricity deficient countries in

**South Asia (Afghanistan and Pakistan)**

by putting in commercial and institutional arrangements and transmission infrastructure

# Agreements and Commercial Framework

## 1. Five Power Purchase Agreements

- KR-Pakistan
- KR-Afghanistan
- Tajikistan-Pakistan
- Tajikistan-Afghanistan
- Afghanistan-Pakistan

## 2. Master Agreement

## 3. Coordination Agreement between KR and Tajikistan

## 4. Host Government Agreements

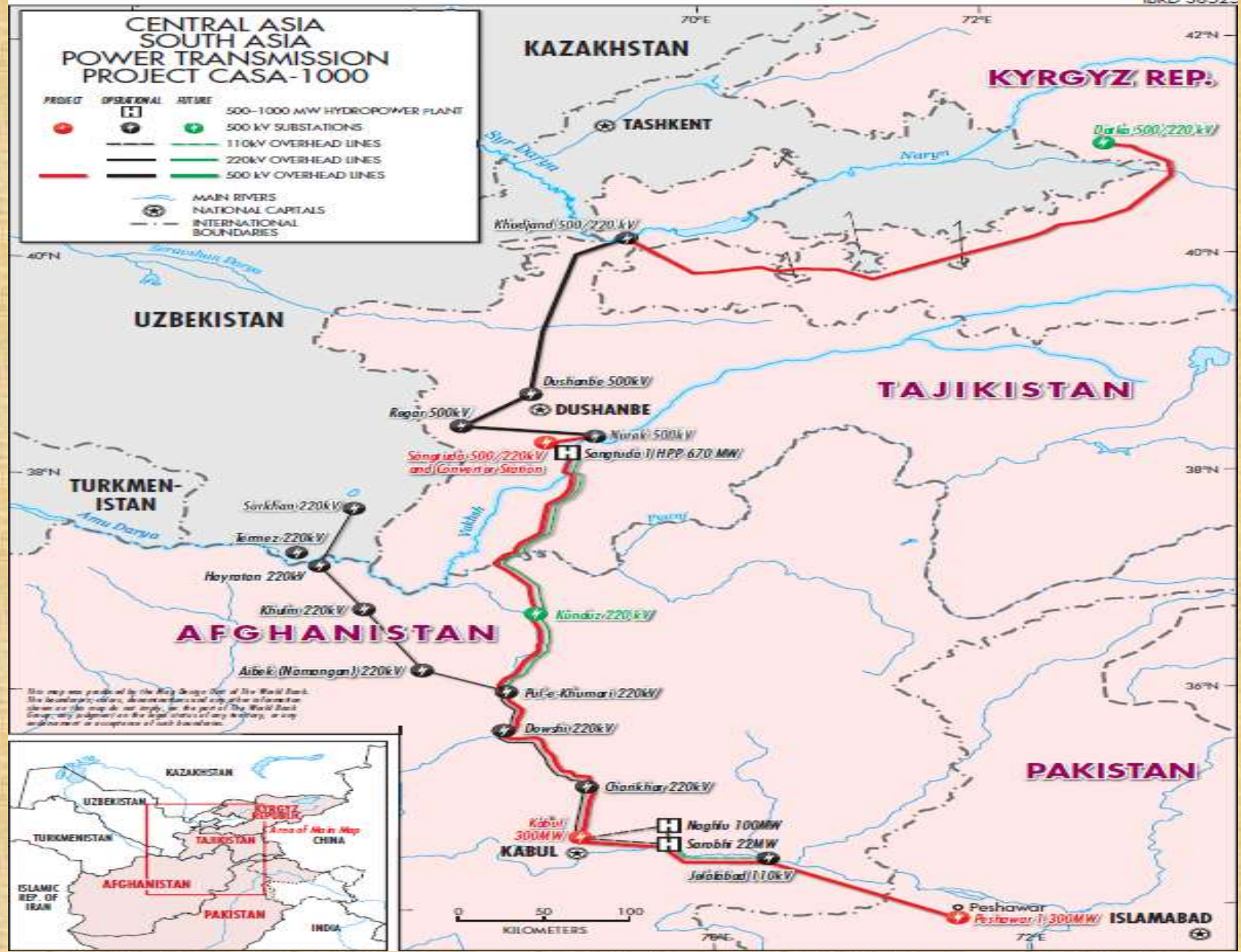
# Infrastructure

- 500 kV line Datka-Sugd (477 km), with Tajik network transferring Kyrgyz power to Sangtuda
- 1300 MW AC-DC Converter Station at Sangtuda
- 750 km HVDC line Sangtuda-Kabul-Peshawar
- 300 MW Converter Station at Kabul (with both import & export capability)
- 1300 MW DC-AC Converter Station at Peshawar

# CENTRAL ASIA SOUTH ASIA POWER TRANSMISSION PROJECT CASA-1000

PROJECT	OPERATIONAL	ASTIRE	
			500-1000 MW HYDROPOWER PLANT
			500 kV SUBSTATIONS
			110kV OVERHEAD LINES
			220kV OVERHEAD LINES
			500 kV OVERHEAD LINES

MAIN RIVERS  
 NATIONAL CAPITALS  
 INTERNATIONAL BOUNDARIES



This map was prepared by the Map Service Unit of the World Bank. The boundaries, colors, denominations, and other information shown on this map do not imply, in the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.



## Project Cost Estimates

Kyrgyz Republic	\$ 233 million
Tajikistan	\$ 301 million
Afghanistan	\$ 404 million
Pakistan	\$ 232 million
<b>Total</b>	<b>\$1,170 million</b>

***Note:** These costs are feasibility study estimates. Updated costs will be determined once bids for lines and convertor stations are in.*

# Pakistan Share of Cost and Financing

Total Cost

\$232 million

Available

- World Bank \$120 million
  - IsDB \$ 35 million
  - Donors and Trust Funds \$ 3 million fm DFID (\$14 m gap)
  - Implementing Agency (NTDC) \$ 32 million
  - Total available \$190 million
- Gap \$ 42 million

**Note:** Donors and Trust Funds, estimated at \$17 million, will cover non-infrastructure costs such as Community Support Program, Owner's Engineer, Engineering & Supervision etc.



# CASA Website

## www.casa-1000.org

Русский

# CASA → 1000

HOME

ABOUT CASA-1000

PARTICIPATING COUNTRIES

DOCUMENTS & REPORTS

IGC

Procurement

COMMUNITY BENEFITS



Students in Tajikistan

*This project demonstrates landmark cooperation among the Kyrgyz Republic, Tajikistan, Pakistan, and Afghanistan.*

*We now have new content on the website. Its appearance will change further, and we purpose to update the content regularly.*

**Electricity. It's essential for development, economic growth, job creation, and modern life. Without it, poverty endures.**

The Kyrgyz Republic and Tajikistan are two countries in Central Asia endowed with some of the world's most abundant clean hydropower resources with water cascading from the mountain ranges and filling the rivers every summer. Both of these countries have a surplus of electricity during the summer. Nearby in South Asia, Afghanistan and Pakistan suffer from chronic electricity shortages while trying to keep pace with a fast-growing demand for it. Pakistan cannot meet its citizens' electricity needs, especially during the sweltering summer months, leading to frequent power cuts that hurt industrial production, sometimes close small businesses, and lead to job losses. Meanwhile millions of people still live without electricity altogether.

A new electricity transmission system to connect all four countries, called CASA-1000, would help make the most efficient use of clean hydropower resources in the Central Asian countries by enabling them to transfer and sell their electricity surplus during the summer months to the deficient countries in South Asia. The CASA-1000 project would also complement the countries' efforts to improve electricity access, integrate and expand markets to increase trade, and find sustainable solutions to water resources management.

**What's New**

**Thank You**