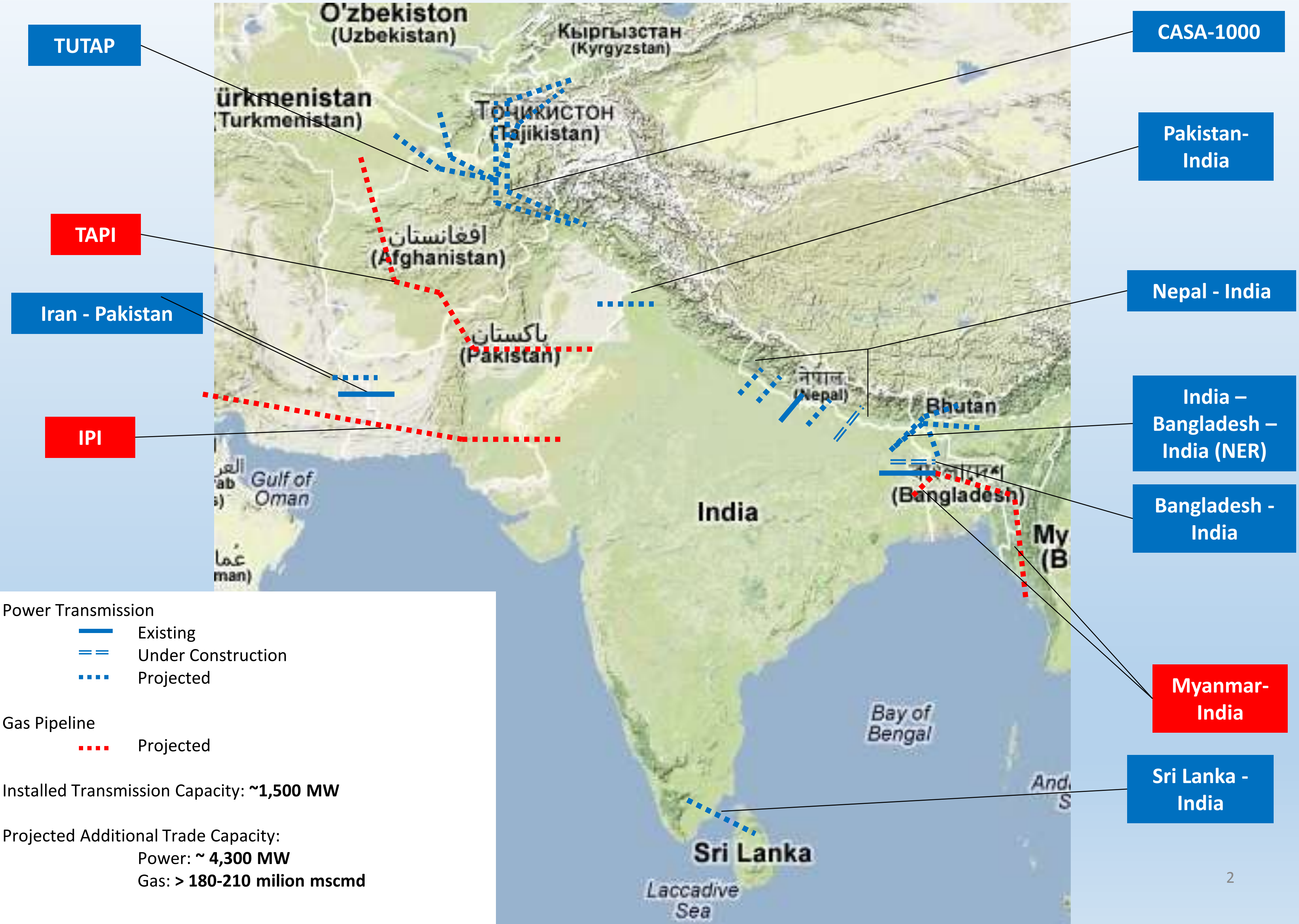
World Bank

Regional Interconnections in South Asia

Anjum Ahmad
Senior Energy Specialist
World Bank, Islamabad

Regional integration in electricity and gas in South Asia



Power Transmission

Existing

Under Construction

Projected

Gas Pipeline

Projected

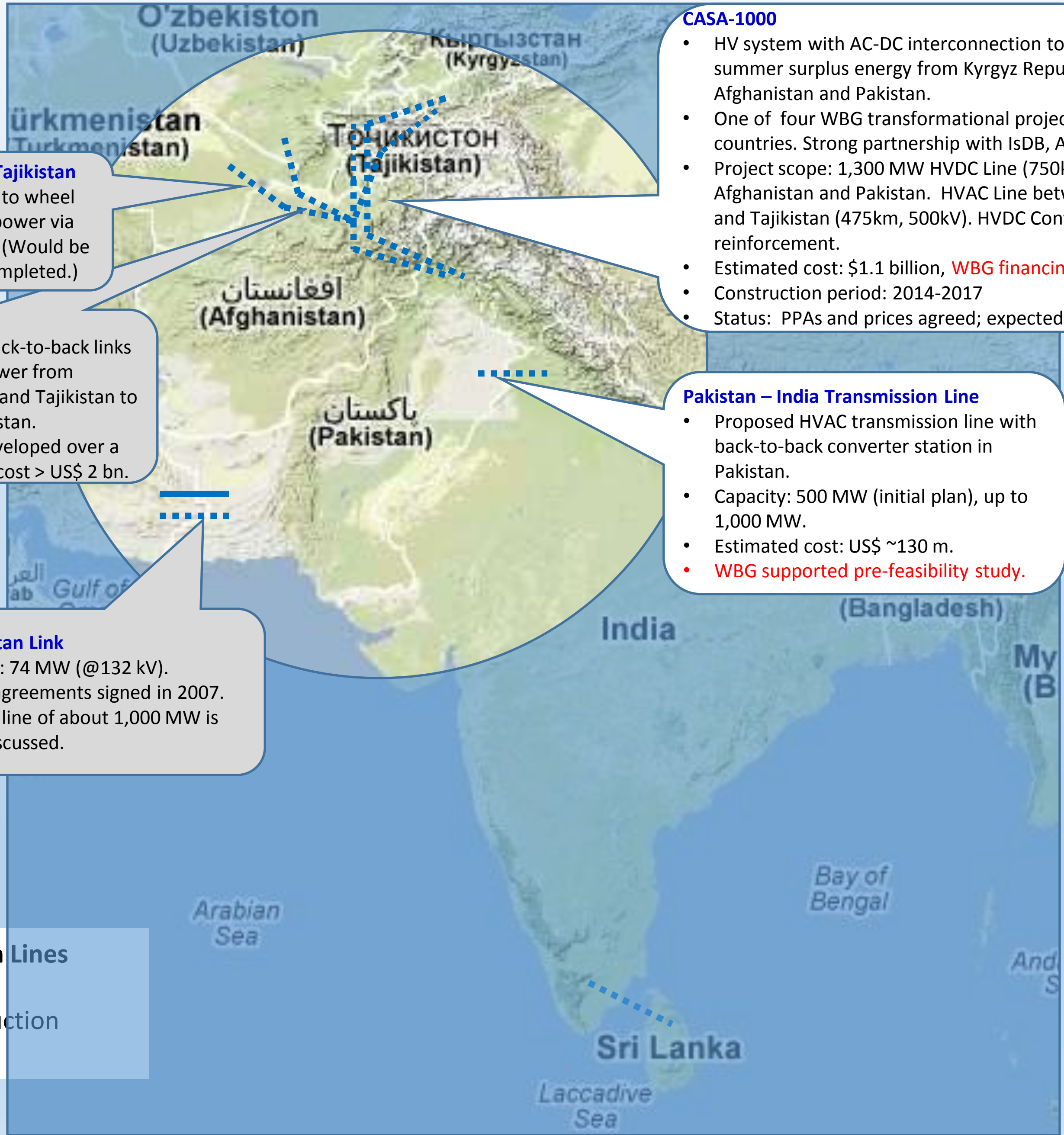
Installed Transmission Capacity: **~1,500 MW**

Projected Additional Trade Capacity:

Power: **~ 4,300 MW**

Gas: **> 180-210 milion mscmd**

SAR: Existing and proposed electricity interconnections – West



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: $1.1 billion, WBG financing: US$ 526.5m
- Construction period: 2014-2017
- Status: PPAs and prices agreed; expected to be signed shortly.

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 (Would be superseded if TUTAP is completed.)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.

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.
- Estimated cost: US$ ~130 m.
- WBG supported pre-feasibility study.

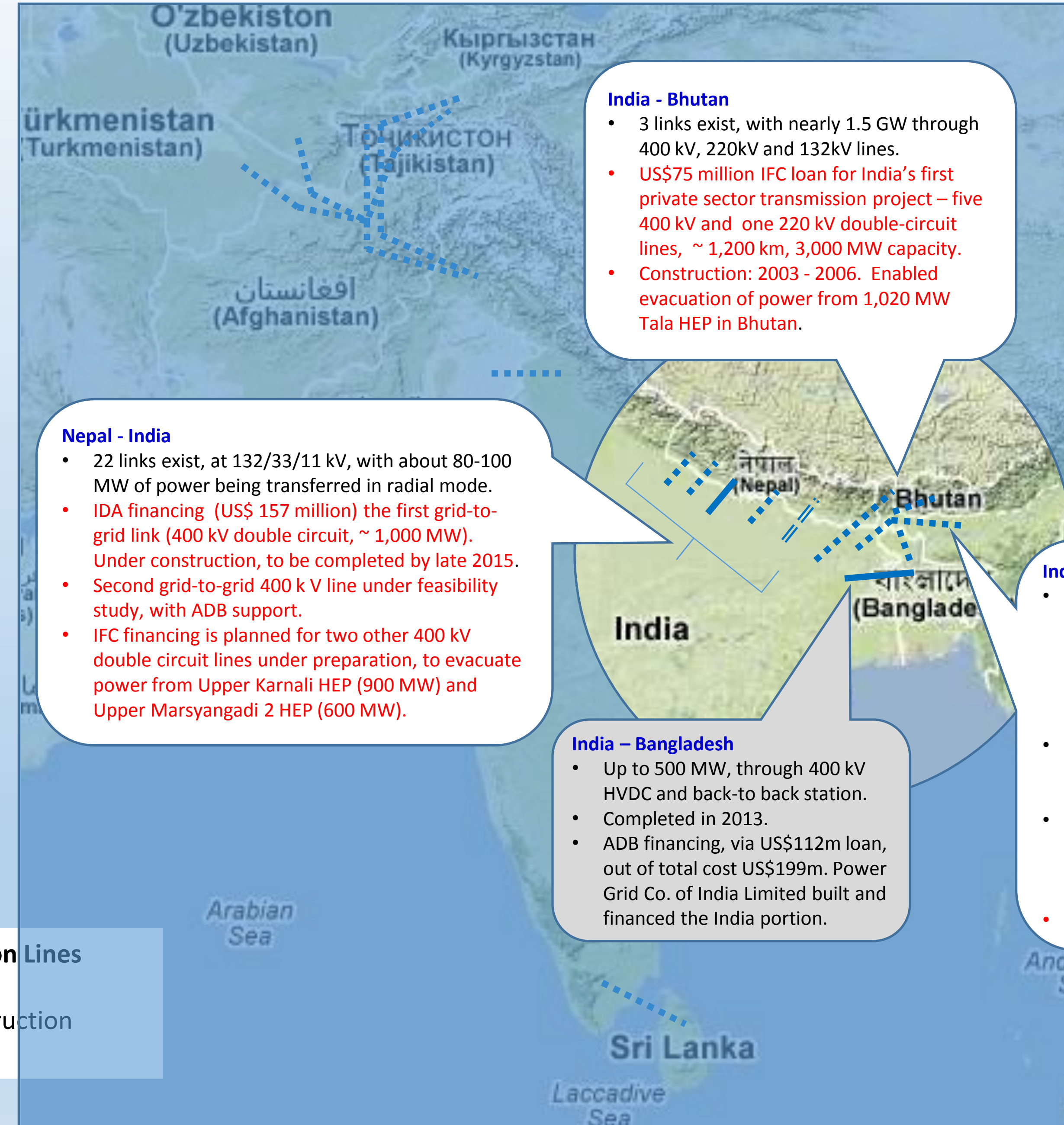
Iran – Pakistan Link

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

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.

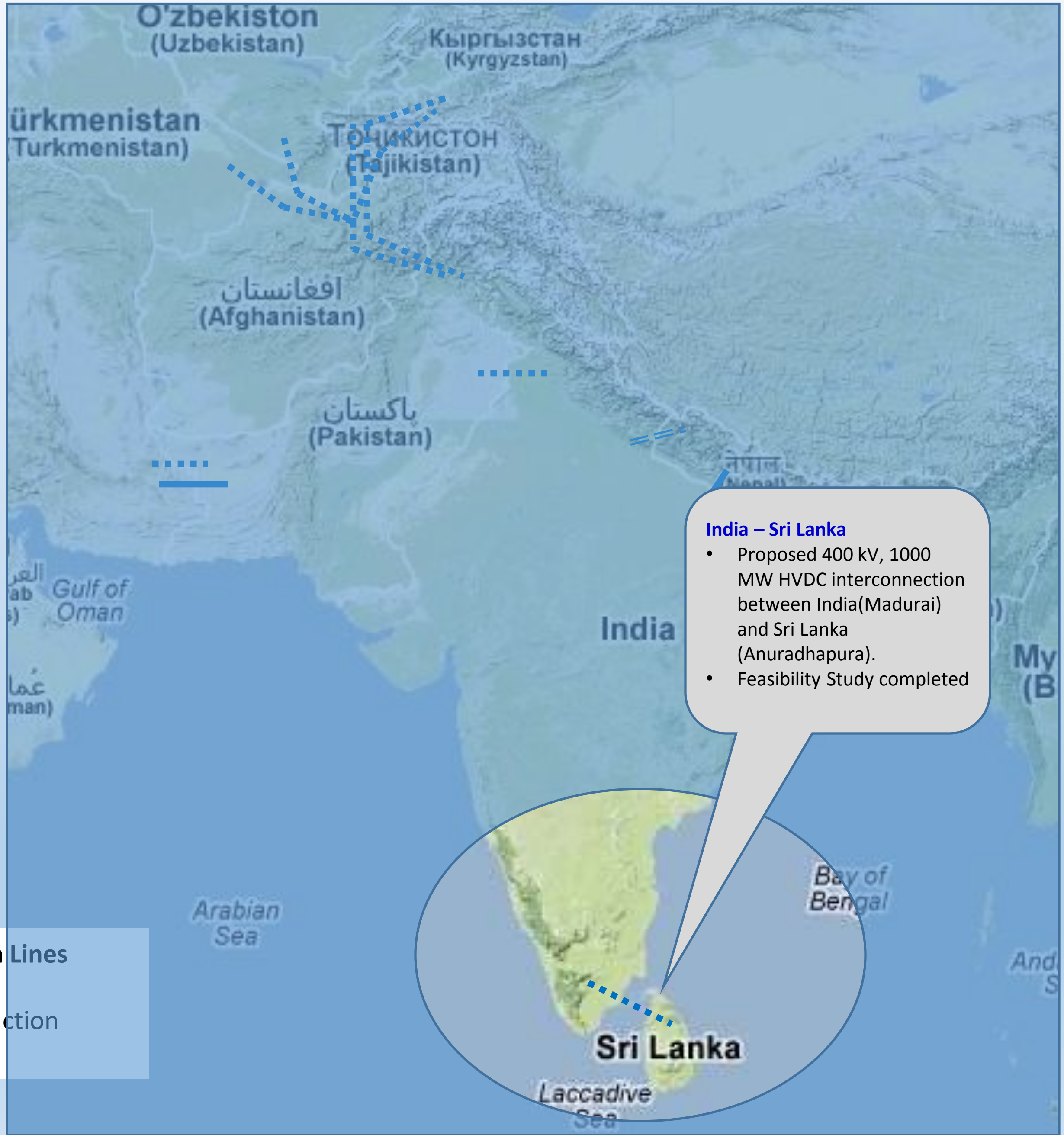
Nepal - India
- 22 links exist, at 132/33/11 kV, with about 80-100 MW of power being transferred in radial mode.
- IDA financing (US$ 157 million) the first grid-to-grid link (400 kV double circuit, ~ 1,000 MW). Under construction, to be completed by late 2015.
- Second grid-to-grid 400 k V line under 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



India – Sri Lanka

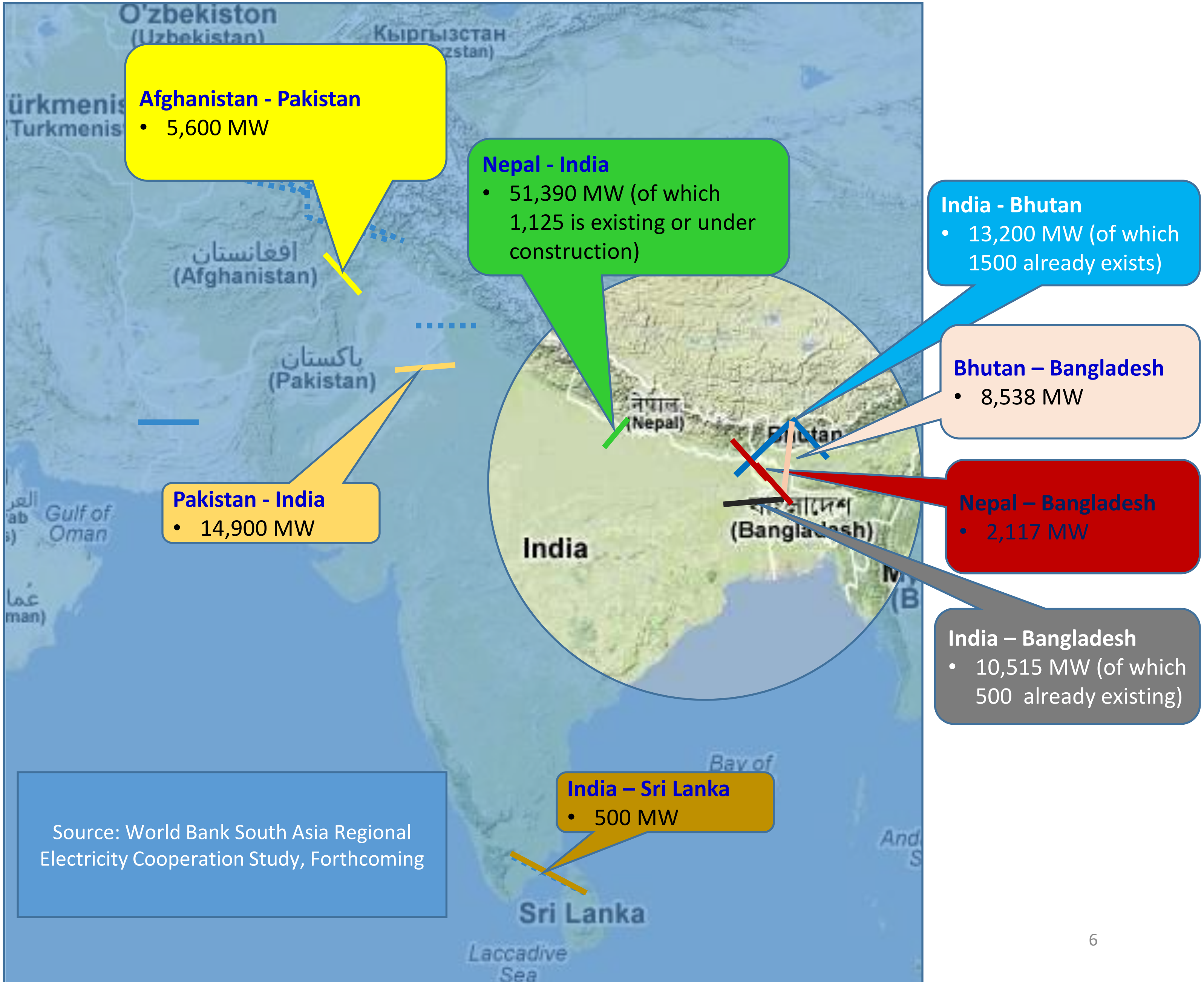
- Proposed 400 kV, 1000 MW HVDC interconnection between India(Madurai) and Sri Lanka (Anuradhapura).
- Feasibility Study completed

Power Transmission Lines

- Existing
- Under Construction
- Projected

Projection of SAR Transmission Interconnection by 2040

(if there is full regional integration of electricity grids)



Regional cooperation leads 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
- Over USD 226 Billion in net cost savings (over USD 114 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

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 ……."*

Thank You