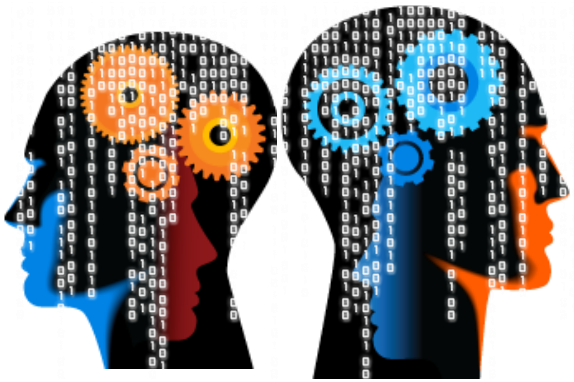
Task Force Meeting: Nepal-India Analytical Studies in Macro Economic Framework

South Asia Regional Initiative for Energy Integration(SARI/EI)

5-6th August, 2015 | New Delhi



Dr. Jyoti Parikh (Executive Director)

Dr. Pradeep Kumar Dadhich (Deputy Director)

Integrated Research and Action for Development (IRADe)

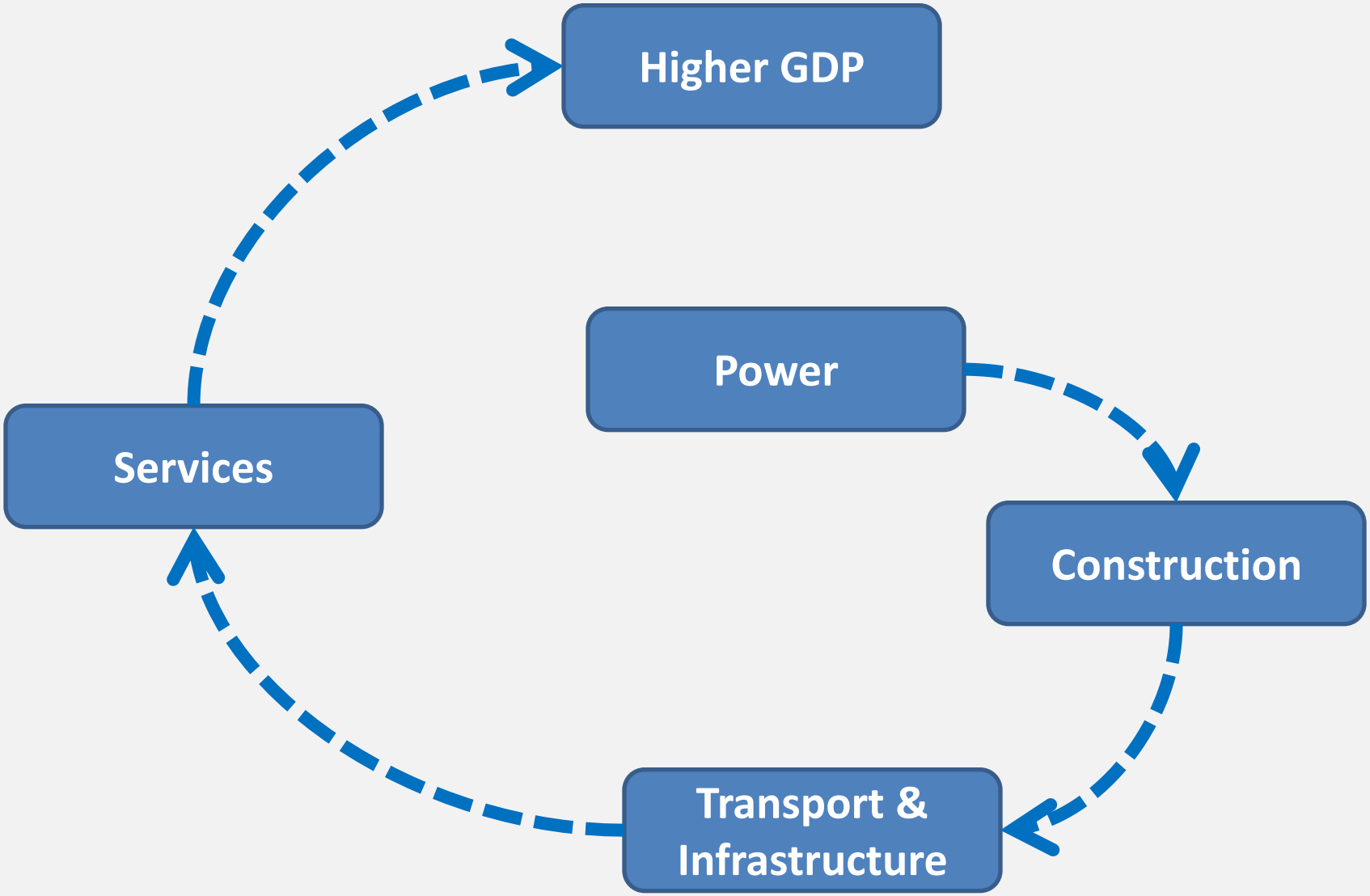
Power Sector Issues:

- How high CBET can go over time (in units) ?
- What factors are needed to build CBET up to maximum level ?
- What Economic Challenges will obstruct the way ?

Financial/ Economic Issues:

- How does CBET kick growth in other sectors such as domestic Power, transport, construction and services etc ?
- What preparations are required so that CBET support other sectors development ?
- How can CBET lead to diversified economies beyond power sector ?

Multiplier Effect of Hydropower Sector on Other Sectors



Political and Diplomatic Challenges:

- How can we facilitate process and solve problems of CBET ?
- What are the interdependencies among the countries ?
- what role is expected by and for each country to get maximum benefits ?

Interdependency brings peace and dividends.

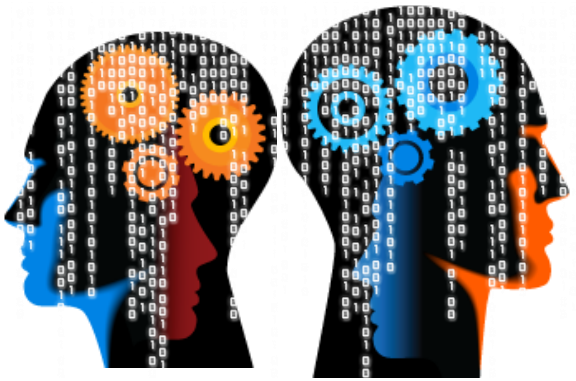
USAID FROM THE AMERICAN PEOPLE

SARI/EI

IRADe Integrated Research and Action for Development

Nepal-India Analytical Studies in Macro Economic Framework

Scope, Approach, Methodology & Deliverables



Purpose & Scope of the 'Macro-Economic Studies' in the SAARC Region

Objective:

To bring out the Macro-economic benefits of CBET and multiplier effect of hydropower for Nepal economy

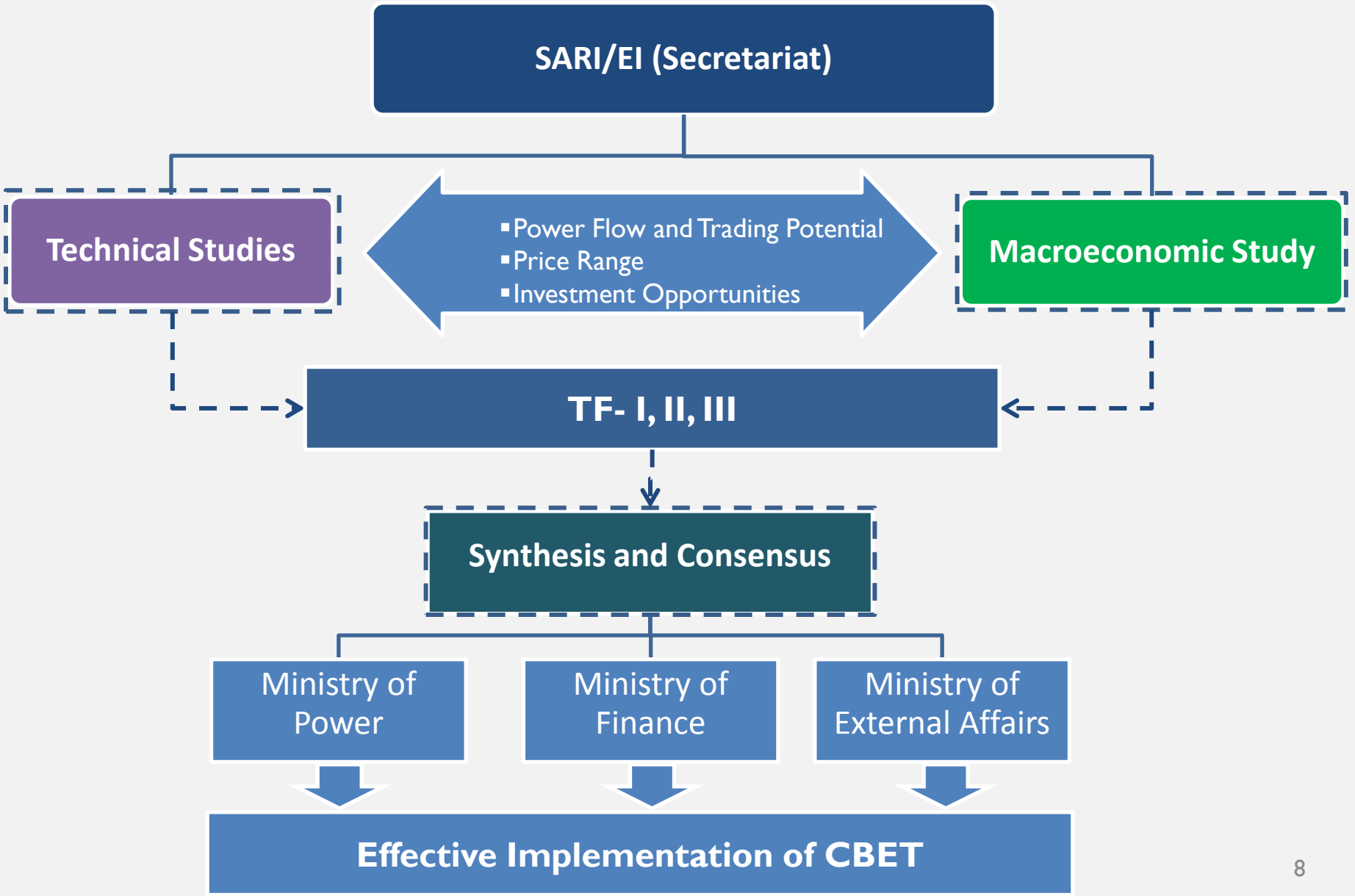
Scope:

- The study covers a range of demand growth, renewable development, interconnection scenarios and other scenarios to properly assess the scenarios for economic impact of CBET.
- Adoption of interdisciplinary research by considering technology, economy, environment and social aspects in long-term.

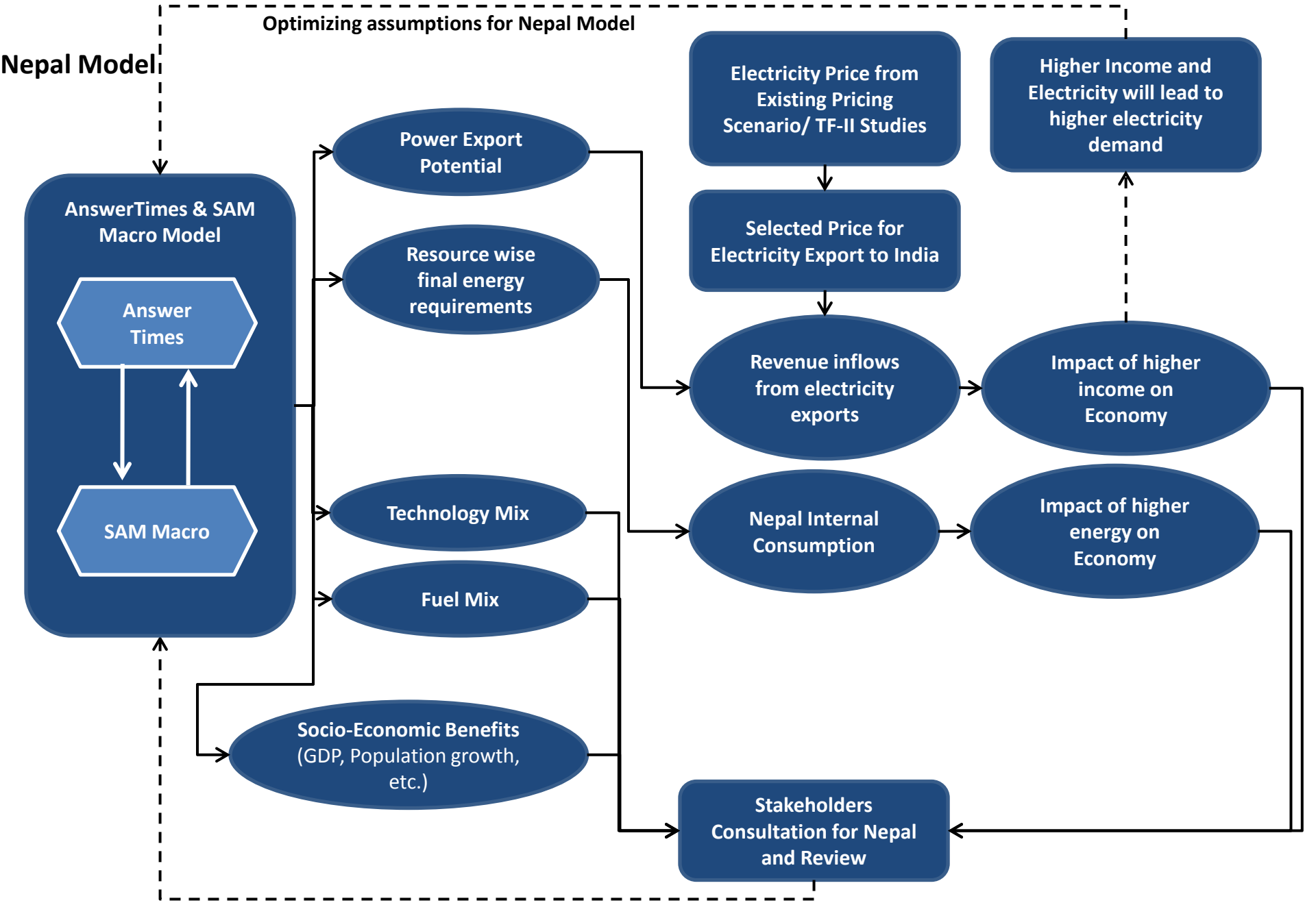
Purpose:

- The study will provide a basis to discuss with the beneficiaries from CBET both in terms of power received (i.e. importing countries) and export revenue generated and its impact on growth and development.
- The study will build the evidence for the decision makers for consensus building between countries and within countries through informed dialogues and negotiations to support creation and implementation of the CBET.

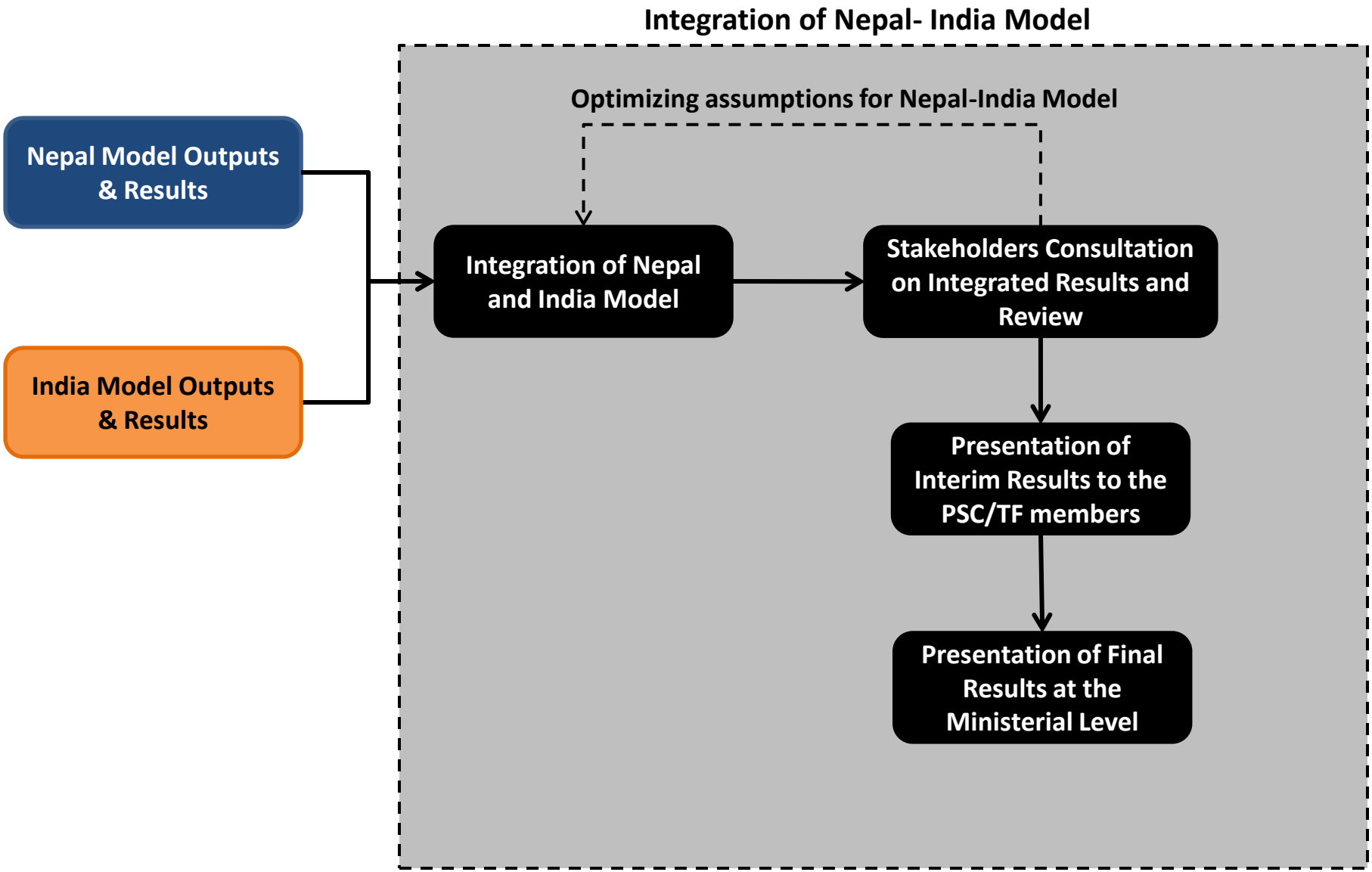
Synthesis of SARI Technical and Macroeconomic Studies



Approach & Methodology for Nepal



Integration of Nepal- India Model



Study Outcomes

- The macroeconomic study on **Nepal-India CBET** will help in achieving the following:
  - Macro model based **Long term electricity demand and supply scenarios** for Nepal and India
  - Assessment of **economic benefits** to both the Nations from CBET (benefits in term of lower energy investments, GDP gains, higher energy availability, etc.)
  - Assessment of possibility and **quantum of power trade** between **Nepal and India on Yearly, Seasonal and Daily basis**
  - **Analysis of price variation on power trade** (impact of price on import and export during off peak and peak)
  - **Evidence for the decision makers for consensus building between** countries and within countries through informed dialogues and negotiations to support creation and implementation of the CBET

Nepal's Economic Overview

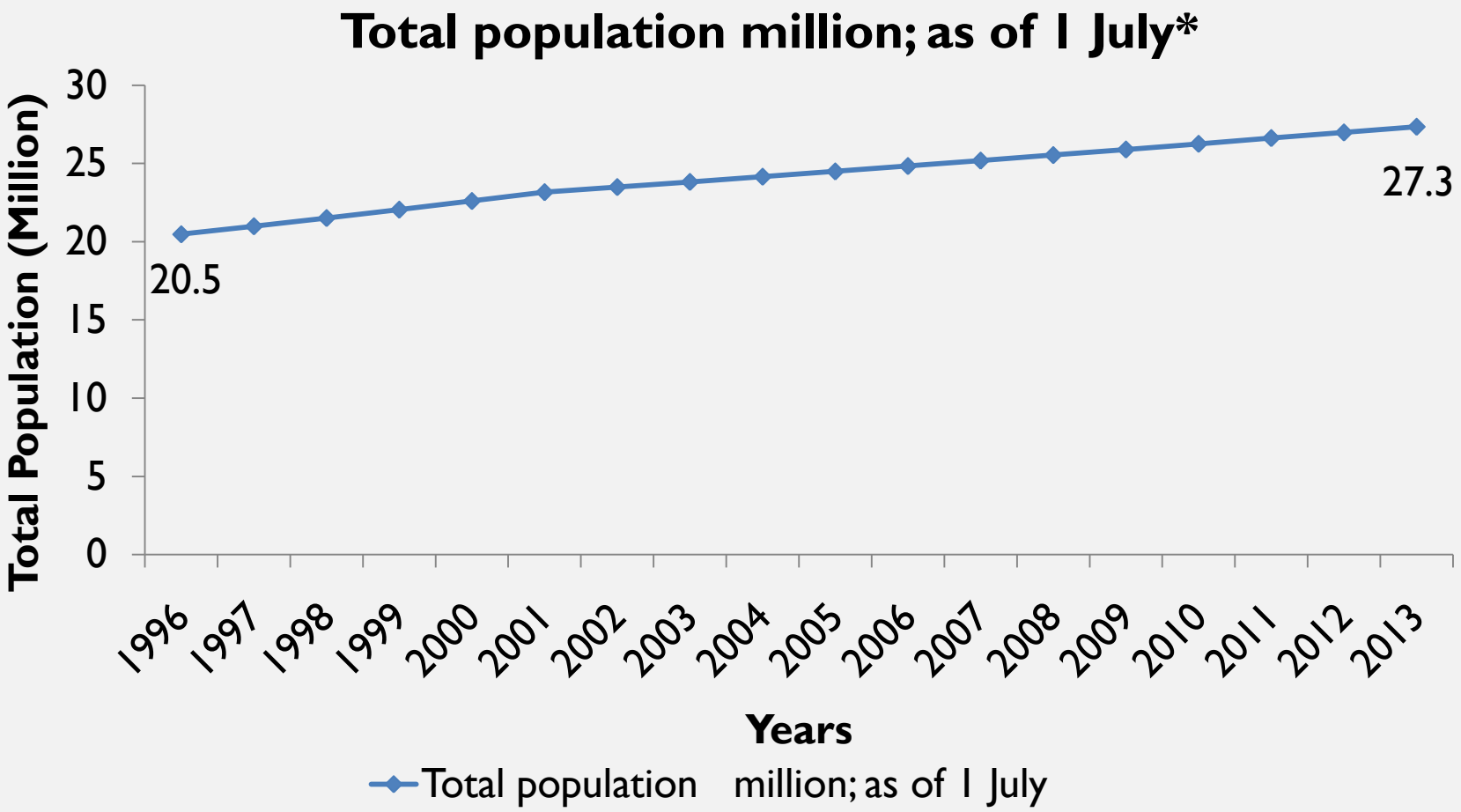
Economic Performance – Some Highlights

- Boost in growth and current account surplus due to robust agriculture and remittances. Growth in Agriculture witnessed at 4.7%, Services at 6.1% (highest in the last 6 years) and Industry marginally at 2.7%.

- Acceleration in GDP growth to 5.2% in FY2014 (ended 15 July 2014) from 3.5% in FY2013.

- The industrial sector is suffering from severe energy crisis and lack of adequate transport infrastructure.

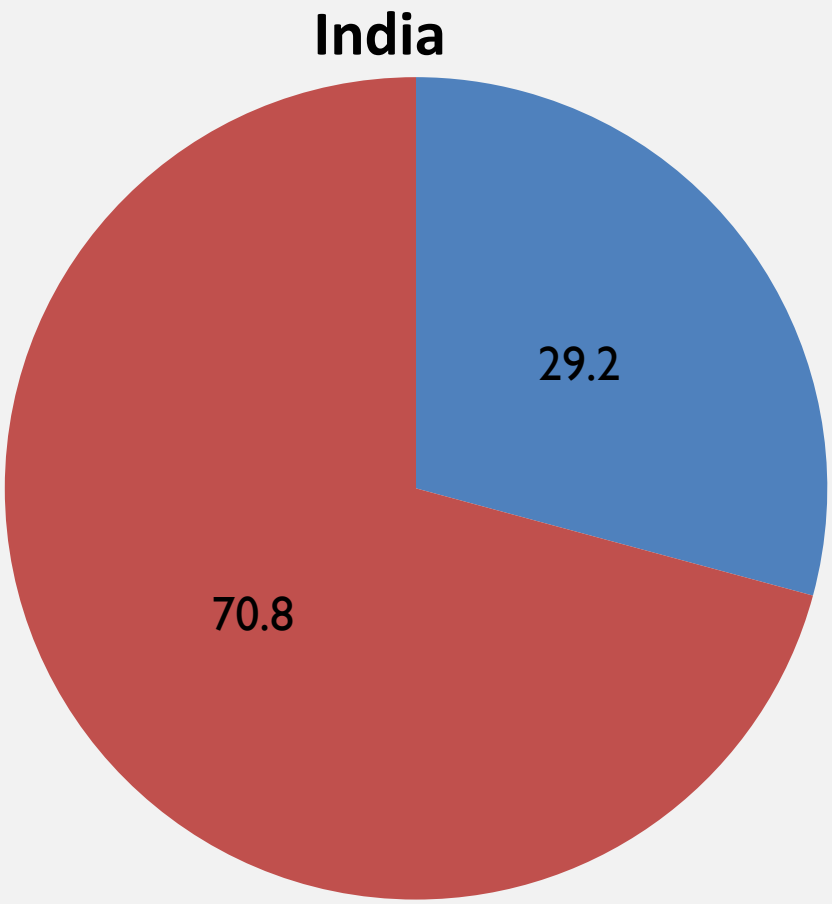
- Nepal is highly susceptible to climate change risks and ranks 11th in the world in terms of vulnerability to earthquakes.
- Nepal is the only country in South Asia to record a budget surplus, its level of indebtedness is modest, it is flush with liquidity.
- The Nepalese authorities have formulated the aspiration of graduating to "developing country" status by 2022.

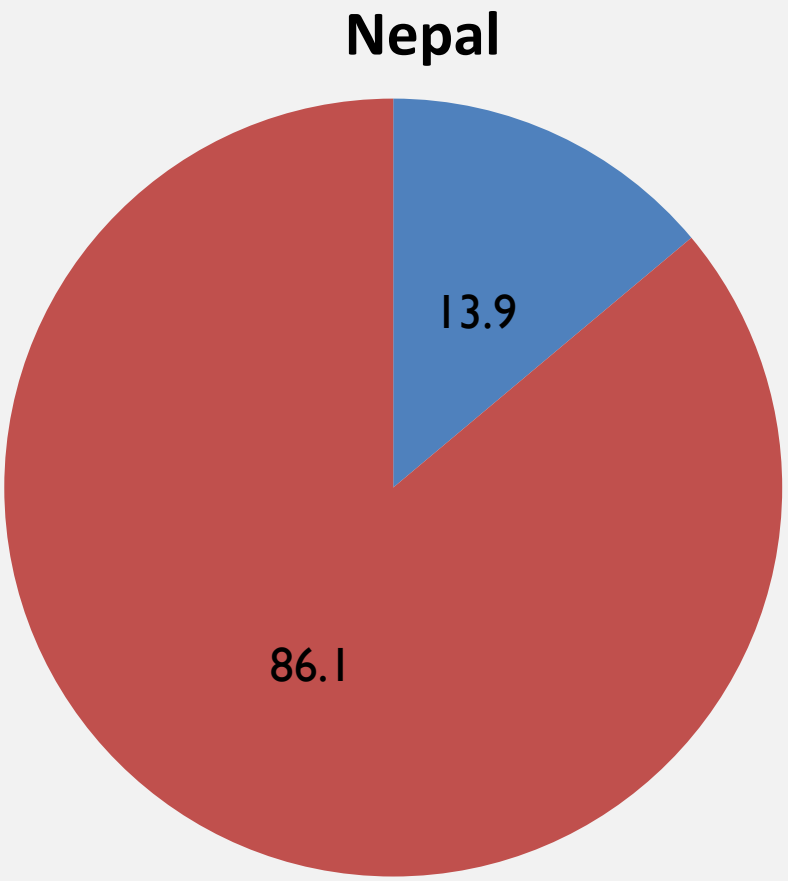


- Nepal, with a population of 27.80 million, recorded a low income level of $19.29 billion for the year 2013.
- It has barely kept pace with the expanding population, making it one of the least developed countries in South Asia.

*Source: Asian Development Bank (ADB), Key Indicators for Asia and the Pacific 2014 , http://www.adb.org/data/statistics, Retrieved on: 16/06/2015

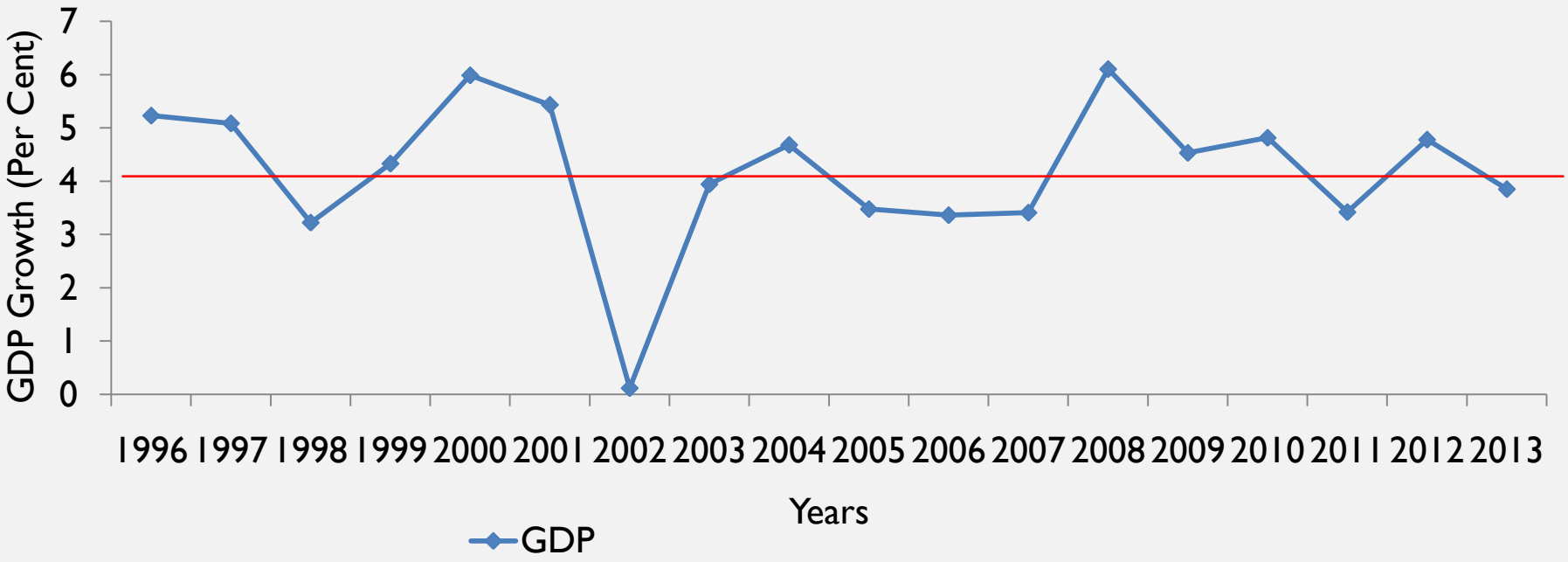
Rural –Urban Population Divide for India and Nepal (2007)





Urban population Rural Population

GDP Growth (Per Cent), FY1996-2013



- The CAGR of GDP for the years 1996-2000 was recorded at 3.99%.
- Maoist conflict, political instability and global recession led to slowing down of GDP growth to 0.1% in 2002.
- The CAGR GDP rate for the period 2002-2013 was 3.84%.

*Source: Asian Development Bank (ADB), Key Indicators for Asia and the Pacific 2014 , http://www.adb.org/data/statistics, Retrieved on: 16/06/2015

Performance of External Sector

- Current account surplus inflated to 4.7% of GDP on large remittance inflows (which grew by 11.9%) despite an ever-widening trade deficit in FY2013.
- Exports increased by 5.1% due to deprecation of the Nepalese rupee.
- Imports grew by 13.9% because of rise in disposable income.
- Imports of petroleum products (20% of the total) recorded a double-digit increase.
- The trade deficit widened to 30.9% of GDP. While the high imports are supported by high remittance income, the slowing exports are a result of the persistent supply-side constraints affecting both production and competitiveness.

Key Policy Recommendations Proposed by ADB*

- Accelerated capital spending is needed to scale up infrastructure investments in order to attract the private investment to attain higher economic growth that is both sustainable and inclusive.

- The public sector has a key role to play to unlock investment by: (i) providing a friendlier environment for the private sector –domestic and foreign- to find it attractive to bid for projects in Nepal, and (ii) developing the essential public infrastructure needed for firms to thrive and private funds to be crowded-in.

- Gross fixed capital investment has to be raised to at least 30% of GDP from the current 22% to support higher economic growth.

*** Source: "Macroeconomic Update of Nepal", Vol.2, August 2014, ADB**

Preliminary Analysis of Nepal's SAM

What is SAM?

This is a single-entry accounting representation of the flow of goods and services and payment between sectors, classes of economic actors and other accounts.

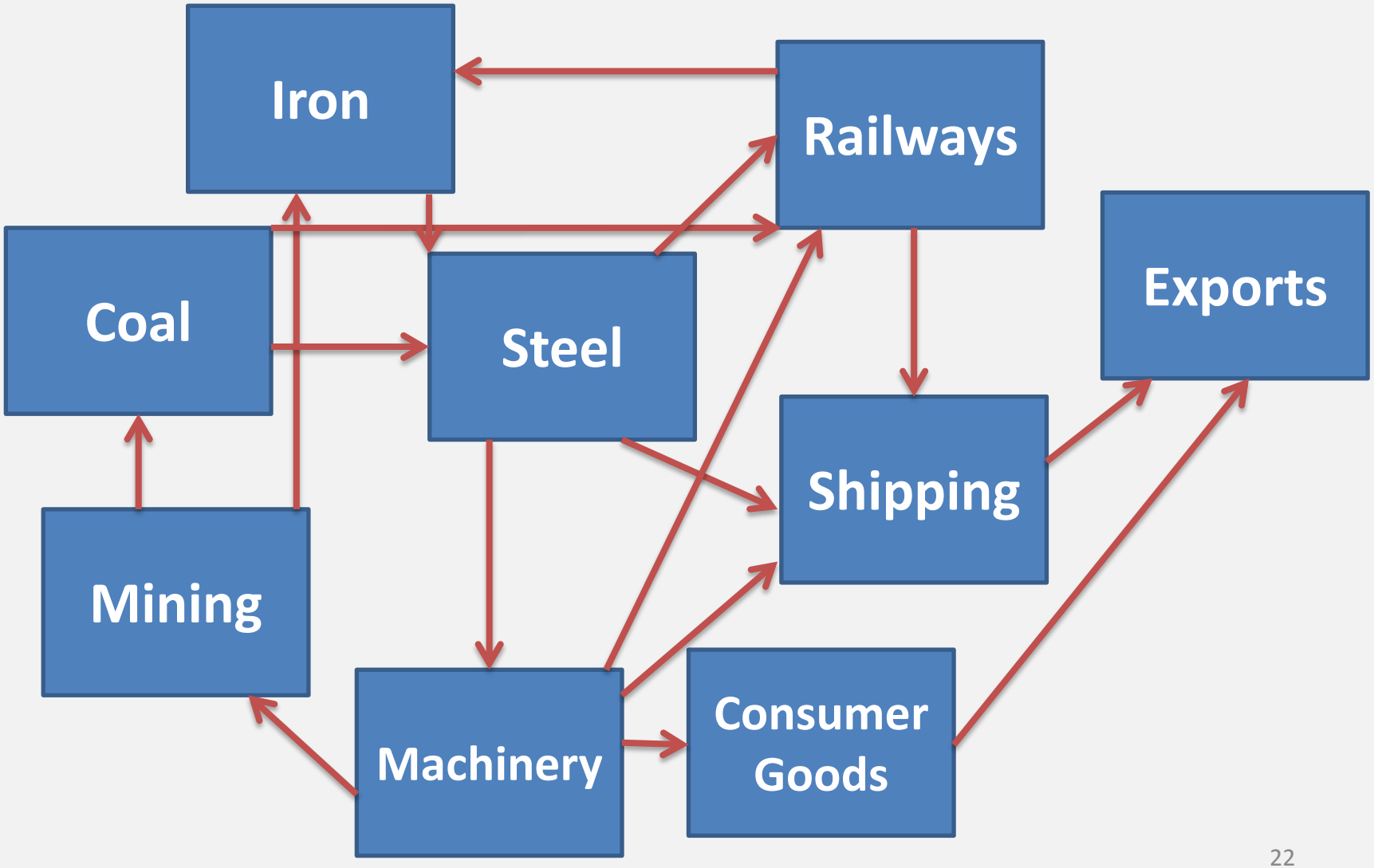
<u>Characteristic of SAM:</u>

The accounts are represented as a *square matrix; where the incomings and outgoings for each account are shown as a corresponding row and column of the matrix.*

Linkages in SAM

Backward Linkages Sectors provide major inputs to the Power Sector which in turn becomes a major input for Forward Linkages Sectors.

Example of Sectoral Linkages



Example for SAM

		Production Activities							Factors		Institutions		Capital Account	Rest of the world	Total
		Coal	Iron	Steel	Railways	Mining	Machinery	Shipping	Labour	Capital	Household	Government			
Production Activities	Coal Iron Steel Railways Mining Machinery Shipping	I-O Table									Household's consumption	Government's consumption	Gross fixed capital formation	Exports	Aggregate demand
Factors	Labour Capital	Value added												Net factor income from abroad	Factor income
Institutions	Household Government	Taxes on intermediary goods									Taxes, transfer payments and interest on public debt		Taxes on investment goods	Net current and capital transfer from abroad, taxes on exports	Institutions' total income
Capital Account									Depreciation		Household's savings	Government's savings	Foreign savings	Gross savings of the economy	
Rest of the World															Foreign exchange payments
Total		Total cost of production							Total factor endowments		Institutions' total expenditure		Aggregate investment	Foreign exchange receipts	

Insights from Social Accounting Matrix for Nepal for 2007*

- According to **SAM 2007**, the gross output of the commodity "electricity generation" is 22780 million NR, value added is 13925 million NR and the value of inputs is 8855 million NR.

- Electricity generation occupies 29th position, preceded by insurance and recreation services of all 57 commodities based on backward linkages. But, it occupies 16th position among non-agricultural sectors, which means in the economic transition as the industrial development happens, power will play a vital role in the economic development.

- The backward linkage for electricity generation is 9.51 which means that if the demand of power increases by one unit, 9.51 additional units of output is produced in the economy across the sectors.

* Source: Selim Raihan and Bazlul Haque Khondker, 2011, *A Social Accounting Matrix for Nepal for 2007: Methodology and Results*, Munich Personal RePEc Archive

Insights from Social Accounting Matrix for Nepal for 2007* ….. contd.

- High backward linkages have been observed in agricultural commodities, for example, the backward linkage for Jute and Plant Fibres Cultivation is seen at 11.84, Wheat Cultivation at 11.77, other cultivation at 11.65, Paddy Cultivation at 11.64.

- This shows Nepal is still dependent on agriculture to a large extent.

* Source: Selim Raihan and Bazlul Haque Khondker, 2011, *A Social Accounting Matrix for Nepal for 2007: Methodology and Results*, Munich Personal RePEc Archive

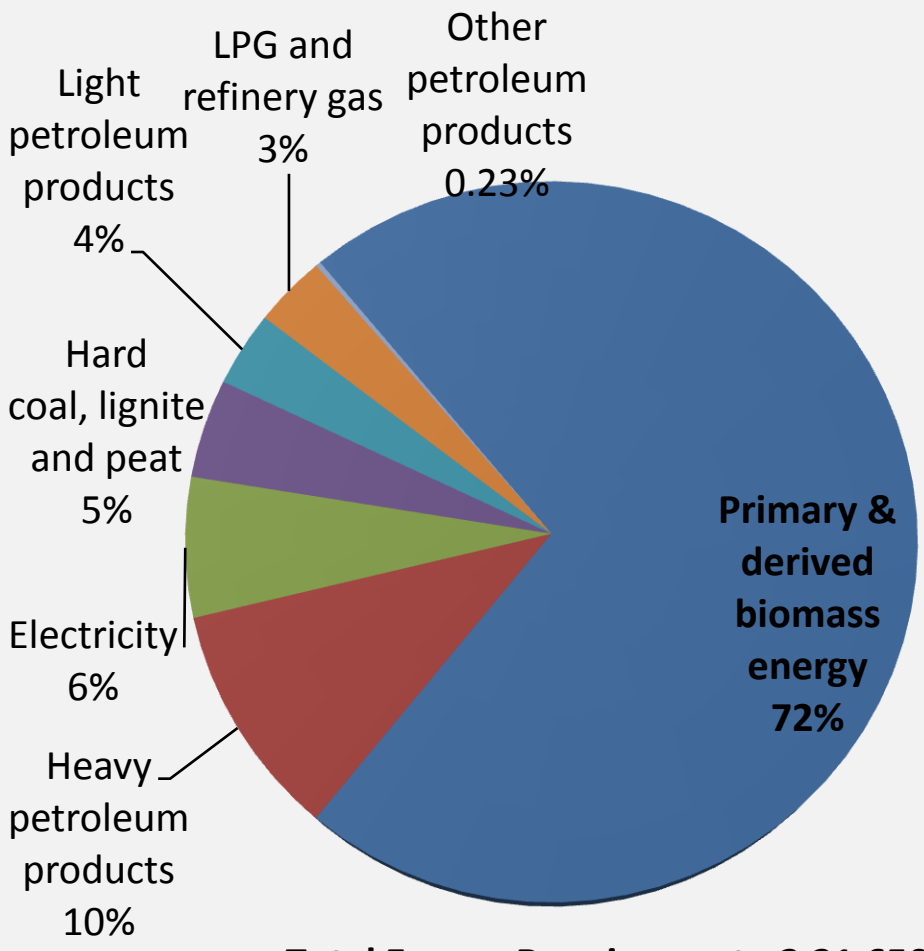
Comparison of Elasticity of Electricity between India and Nepal

- The value of elasticity of electricity with respect to GDP for India is 0.857 for the period 2004-2013, which means one per cent increase in GDP will lead to 0.857% increase in electricity.
- The value of elasticity of electricity with respect to GDP for Nepal is .591 for the period 2004-2013. Nepal has lower elasticity because it is an agrarian economy.
- But with the economic transition, value of electricity elasticity is likely to increase for Nepal and therefore, SAM based macro model is suitable to get a clear picture.

Nepal's Power Sector Overview

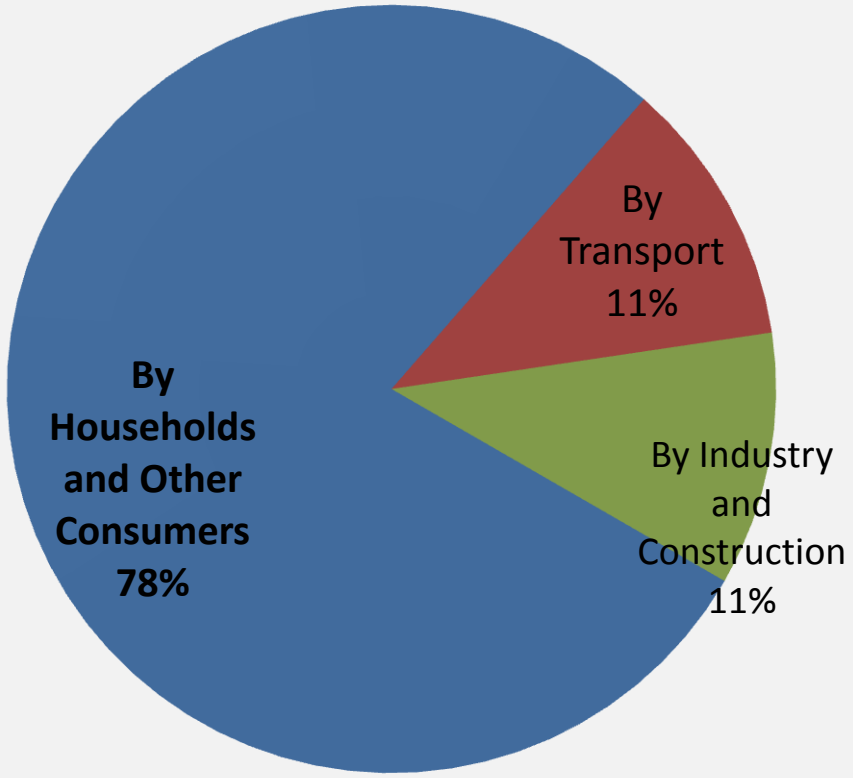
Nepal Energy Scene in 2010

Total Energy Requirement



Total Energy Requirement= 2,21,650 terajoules

Sector-wise Final Energy Consumption

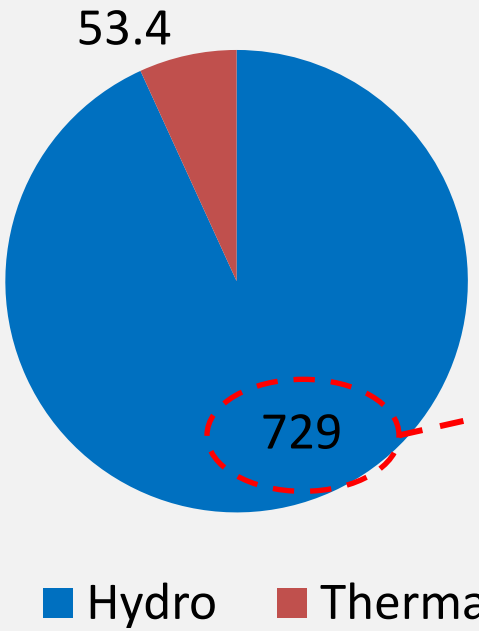


Total Energy Consumption= 2,15,475 terajoules

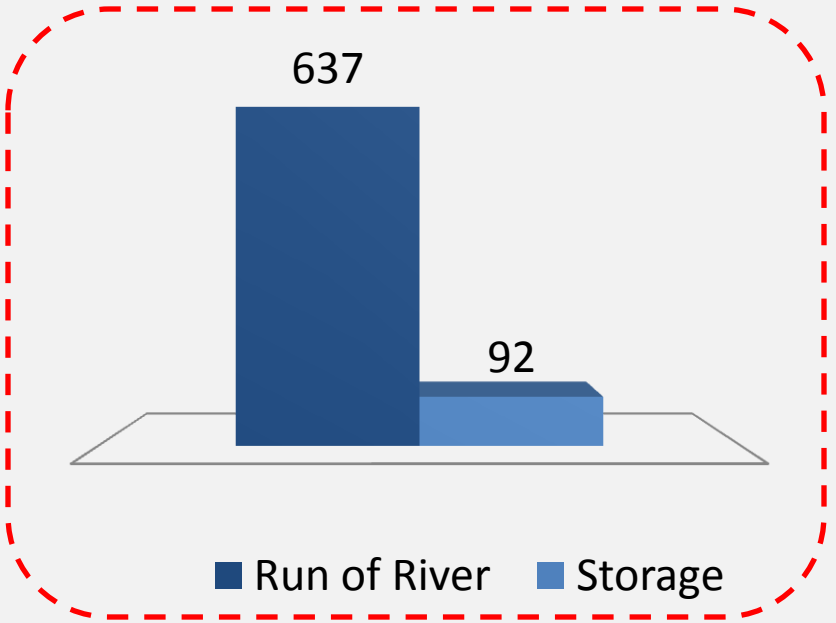
Source: Energy Balances and Electricity Profiles 2010, United Nations Statistics Division

Existing Power Generation Capacity- Nepal

Grid based total Installation (in MW)



Type-wise Hydro Installation (in MW)



- Total Capacity- **787 MW** as on July 2014 (including 4.6 MW of Off grid)
- Present, **hydro capacity only 1.7% of economically viable hydro potential**
- NEA owned capacity:
  - ❑ 526 MW= 473 MW hydro + 53 MW thermal
- IPPs owned hydro capacity = 256 MW

Source: NEA

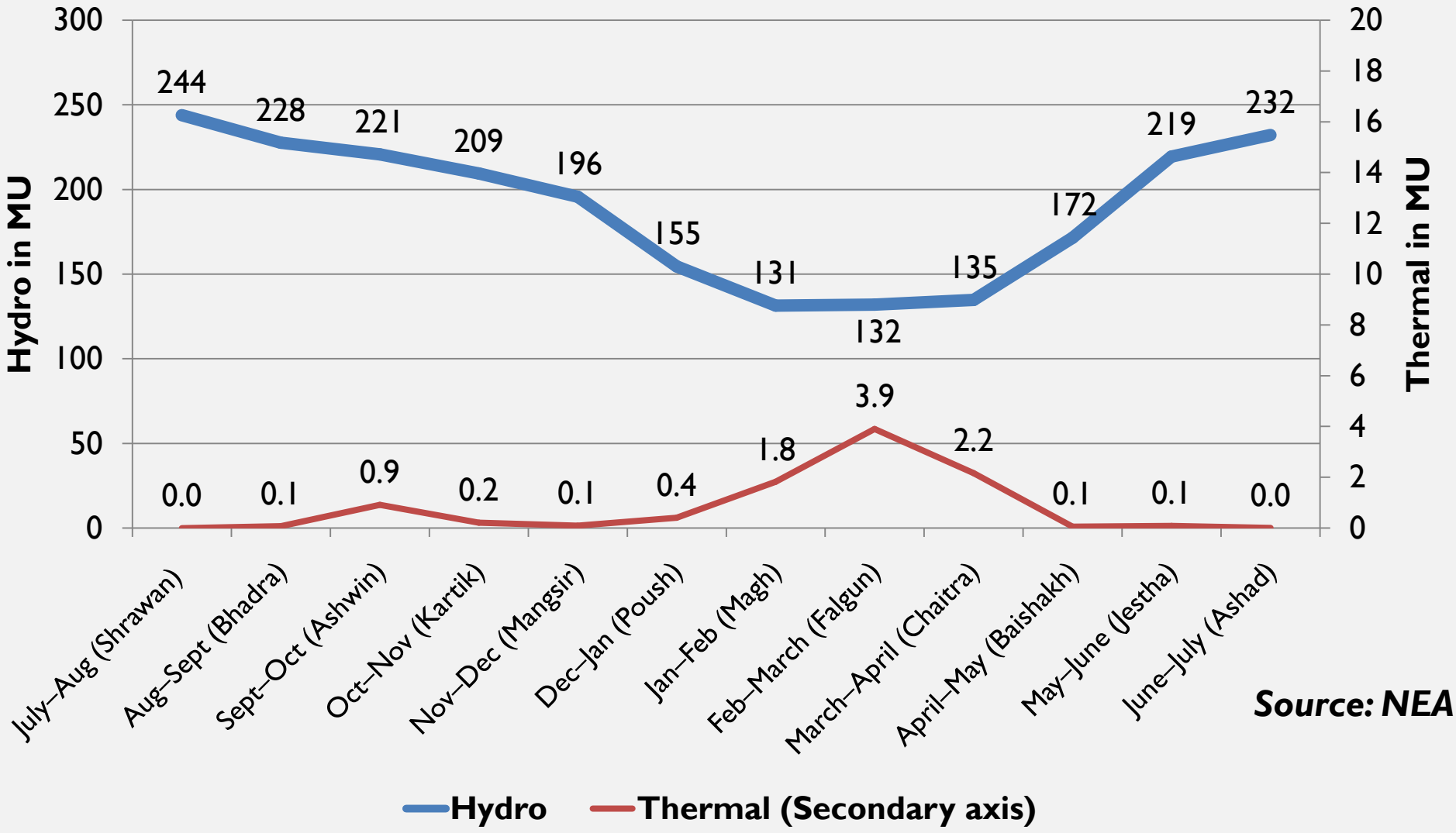
Electricity Demand Supply position of Nepal Power System

	FY13	FY14
Peak Demand (in MW)	1094 MW	1201 MW
Actual Supply (in MW)	719 MW	791 MW
Imports from India	102 MW	116 MW
Load Shedding	375 MW	410 MW
Load Shedding in Hours (during dry months)	12 hr per day	12 hr per day

Source: NEA Annual Report

- **NEA system losses = 24.8% (in FY14)**
- **Supply expected to remain short of Demand for the next 2-3 years**
- NEA suffered net loss of NPR 5,704 million in FY14

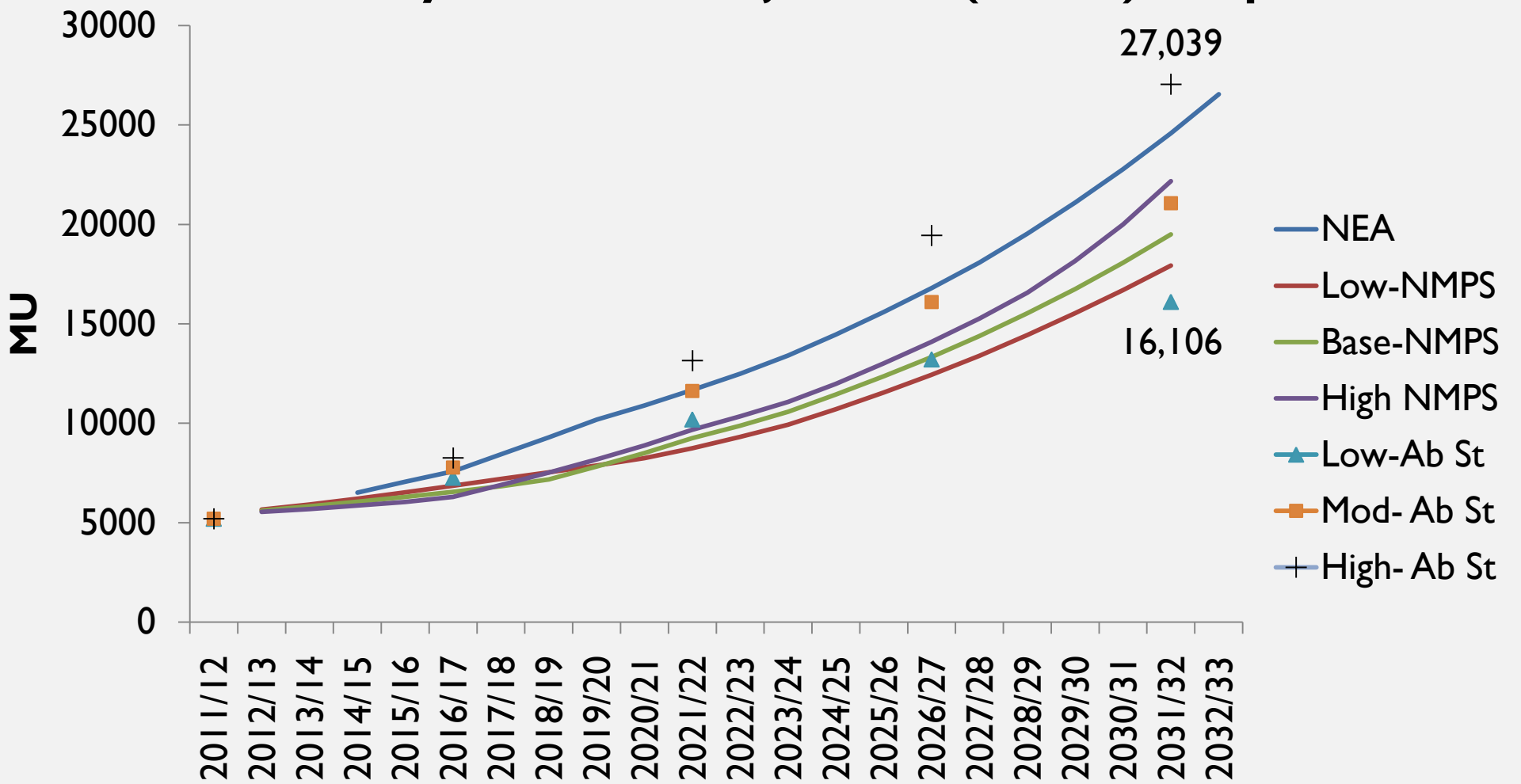
Electricity Generation Pattern for 2013-14- Nepal



Source: NEA

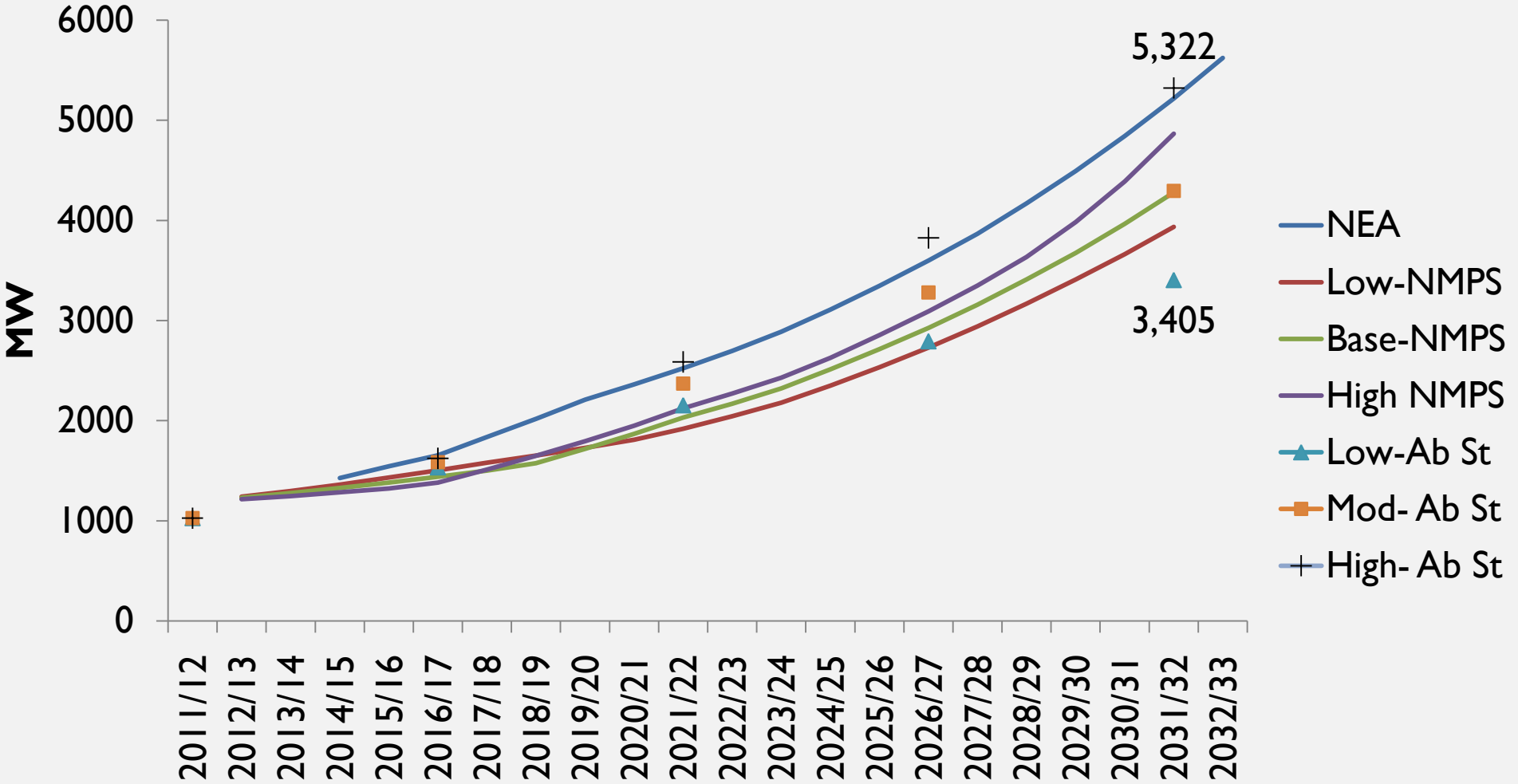
Generation from hydro dips during Jan to March and Thermal generation is increased to reduce the gap

Electricity Demand Projections (in MU)- Nepal



- **AbSt** - Nepal Hydropower Absorption Study
- **NMPS** - Nationwide Master Plan Study on Storage-type Hydroelectric Power Development in Nepal, JICA

Peak Demand Projections (in MW)- Nepal



- **AbSt** - Nepal Hydropower Absorption Study
- **NMPS** - Nationwide Master Plan Study on Storage-type Hydroelectric Power Development in Nepal, JICA

Dry Season Deficit is expected to Continue

Energy Surplus/ Deficit- All Demand Scenarios (GWh)

Demand Scenario	Year	Total Annual Energy (GWh)		Jul/Aug	Aug/Sep	Sep/Oct	Oct/Nov	Nov/Dec	Dec/Jan	Jan/Feb	Feb/Mar	Mar/Apr	Apr/May	May/Jun	Jun/Jul
		Surplus	Deficit												
Moderate Growth	2020	6620	0	994	1014	972	769	470	167	55	11	61	267	831	1006
Moderate Growth	2023	5703	-626	995	1011	935	663	327	-14	-188	-258	-166	103	705	964
Moderate Growth	2026	3966	-2315	755	771	718	451	112	-387	-582	-648	-555	-143.6	443	717
High Demand	2020	6007	-43	939	959	922	720	420	110	1	-43	7	210	770	949
High Demand	2023	4818	-1364	880	896	831	561	224	-175	-377	-445	-352	-15	580	846
High Demand	2026	2677	-3980	555	572	537	275	-67	-725	-908	-971	-877	-432	226	512
Low Demand	2026	5863	-666	1015	1031	954	681	345	1	-207	-276	-183	123	727	985
JICA (2012 Forecast)	2023	8232	0	1,245	1,260	1,162	884	550	240	123	79	133	359	977	1,221
NEA (2008 Forecast)	2023	6361	-406	1071	1087	1004	730	395	64	-119	-189	-97	180	788	1043

Source: Nepal Hydro Power Absorption Study

- In spite of various development plans , shortage of power is expected to persist leading to power imports from India.
- These studies only focuses on domestic demand and supply
- No study so far has assessed the impacts of power sector developments on the Macro Economic aspects

USAID
FROM THE AMERICAN PEOPLE

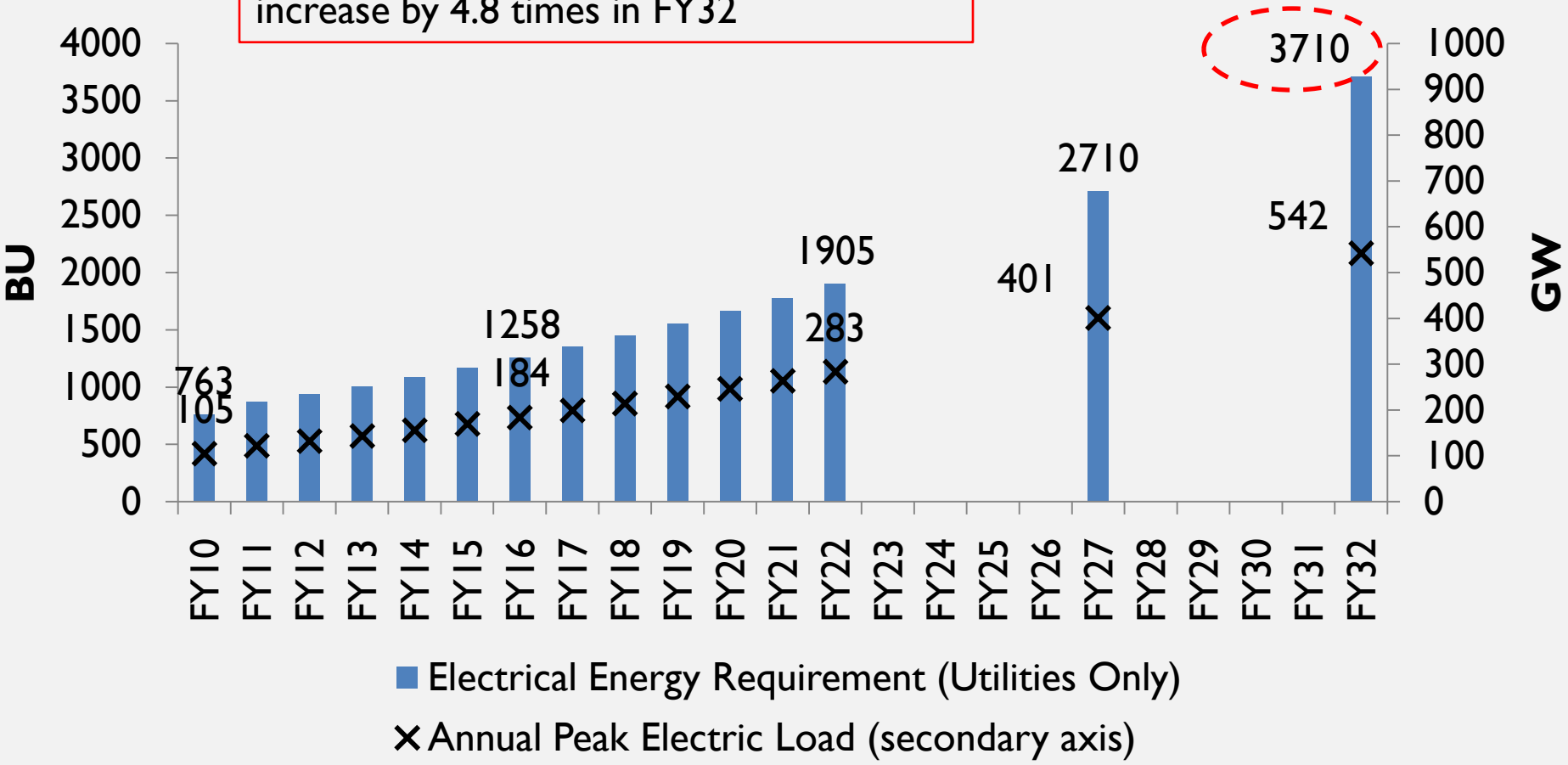
SARI/EI

Integrated Research and Action for Development
IRADe

INDIA- Power Sector

Electricity Demand and Peak Load Projection*- India

India's electricity demand is expected to increase by 4.8 times in FY32



* *Electrical Energy Requirement and Annual Peak Electric Load is at Power Station Bus Bars for Utilities only*

Source: 18th EPS Report, CEA

Future Installed Generation Mix- India

Plan Year	Units	Coal	Nuclear	Gas	Hydro	Renewable	Total
End of XIII Plan year (2021-22)	In MW	286663	13180	30202	73832	65143	469020
	In %	61%	3%	6%	16%	14%	100%
End of XIV Plan Year (2026-27)							
SC-1 (More Gas)	In MW	354009	21680	68199	87330	135918	667136
	In %	53%	3%	10%	13%	20%	100%
SC-2 (Less Gas)	In MW	373009	21680	49200	87330	135918	667137
	In %	56%	3%	7%	13%	20%	100%
End of XV Plan Year (2031-32)							
SC-1 (more gas)	In MW	426747	35580	118882	109945	210821	901975
	In %	47%	4%	13%	12%	23%	100%
SC-2 (Less gas)	In MW	470880	35580	74516	109945	210821	901742
	In %	52%	4%	8%	12%	23%	100%

Source: Perspective Transmission Plan for Twenty Years, Ministry of Power

THANK YOU



Upcoming Generation Capacities- Nepal

- **By Nepal Electricity Authority**

Under Construction	1,044 MW
Under Planning & Proposed Stage	1,852 MW

- **Independent Power Producers (IPP)***

Under Construction	1,023 MW
Under Various Stages of Development	733 MW
Total PPA Concluded	1,998 MW

* *Projects (having PPA with NEA as on April 2014)*

***** Excludes export oriented projects such as Arun 3, Upper Karnali, Upper Marsyangdi, Likhu IV, etc.***

Indo- Nepal Cooperation in Hydro Sector

- **Mutual Interest Projects under Discussions:**

Project	Capacity
Pancheshwar with Rupaligad	5600 + 240 MW
Sapta Kosi High Dam and Sunkosi Diversion cum Storage	3300 MW
Karnali (Not being pursued at this stage)	10800 MW
Naumure	225 MW

- **Projects under Development (awarded by GoN):**

Project (Developer)	Capacity
Arun-3 Project (SJVNL)	900 MW
Upper Karnali Hydropower Project*	300 MW
Upper Marsyangdi*	600 MW
Tamakoshi-3 (Tata Power & SN Power)	690 MW

** Awarded to Consortium consisting of GMR Group companies and Italian-Thai Development Project Co of Thailand*

In addition, survey licenses have also been issued by the GoN to a number of Indian companies/ joint ventures for the hydropower projects in Nepal.

Cross Border Transmission Interconnect- India & Nepal

CBET between India and Nepal dates back to 1970's

Present CBET Interconnect:

- Through three 132 kV and fourteen 33 kV transmission interconnections

India-Nepal existing 132 kV level cross border interconnection

Transmission Link	Evacuation Capacity (in MW)	Traded (in MW)	Voltage Level
Kusaha (Nepal)- Kataiya (India)	130	80	132 kV
Gandak (Nepal)- Rampur (India)	50	25	132 kV
Mahendranagar (Nepal)- Tanakpur (India)	50	30	132 kV

Source: NEA

Upcoming Cross Border Transmission Interconnection between India and Nepal

Transmission Link	Transfer Capacity (MW)	Voltage Level (kV)	Status
Dhalkebar (Nepal)- Muzafarpur (India)	1,200	400	Under construction
Bardaghat (Nepal)- Gorakhpur (India) HVDC	2,500	400	Planned
Duhabi (Nepal)- Jogbani (India)	1,800	400	Identified & Proposed
Duhabi (Nepal) –Purnea (India)	-	-	Identified
Dhalkebar (Nepal) – Muzaffarpur (India)	-	-	Identified
Butwal (Nepal)- Gorakhpur (India)	-	-	Identified
Anarmani (Nepal) – Siligurhi (India)	-	-	Identified

Source: NEA