



## Issues and Challenges Regarding Exchange of Power and Harmonization of Regulations and Policies

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## NEPAL (2013/14)

| Particulars                                  | Details      |
|----------------------------------------------|--------------|
| Energy requirement per year                  | 37.5 MTJ     |
| Contribution of electricity in energy supply | <2%          |
| Electricity consumption per capita           | 116 kWh/year |
| Access to electricity                        | 61 %         |
| Peak demand                                  | 1203 MW      |
| Annual electricity demand                    | 5800 GWh     |
|                                              |              |

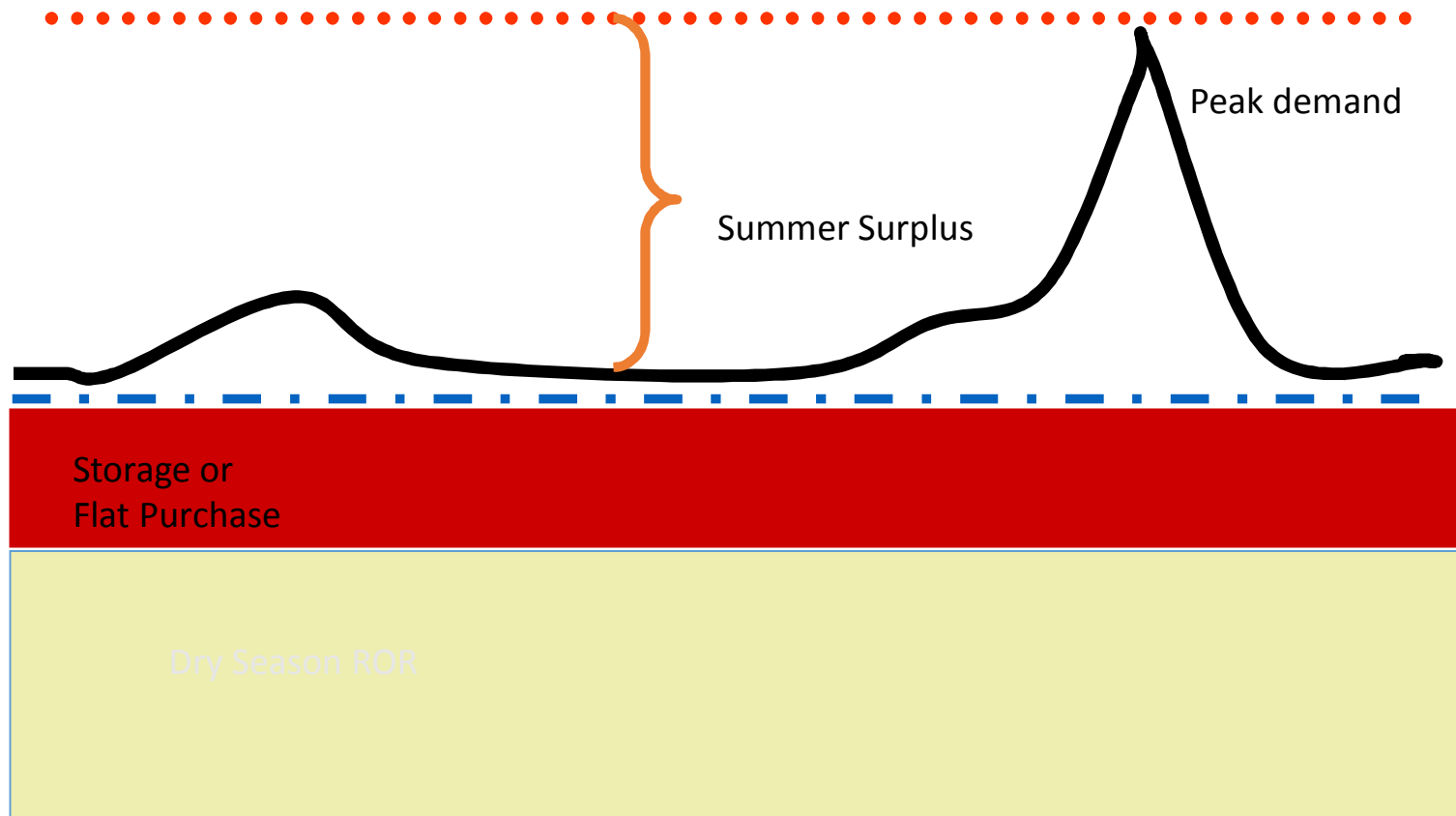
# DEMAND: CURRENT AND FUTURE

| Particulars          | Details  | Year | Peak Demand (MW) | Annual energy Demand (GWh) |
|----------------------|----------|------|------------------|----------------------------|
| Peak Demand          | 1203 MW  | 2014 | 1203             | 5800                       |
| Annual Energy Demand | 5800 GWh | 2015 | 1387.2           | 6403                       |
| Sector wise Demand   |          | 2020 | 2206             | 10300                      |
| ▪ Domestic           | 44.05 %  | 2025 | 3176             | 14971                      |
| ▪ Industrial         | 36.95%   |      |                  |                            |
| ▪ Commercial         | 7.91%    |      |                  |                            |
| ▪ Non commercial     | 7.18%    |      |                  |                            |
| ▪ Others             | 3.91%    |      |                  |                            |

# TYPICAL NATURE OF DEMAND

| Particulars                   | Details                                                                                                                                                                                                                                                       |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Load Factor                   | <ul style="list-style-type: none"><li>• 52% ( average demand only 52% of Peak Demand)</li></ul>                                                                                                                                                               |
| TOD Variations in Demand      | <ul style="list-style-type: none"><li>• 95% of total number of consumers are households</li><li>• Peak/Energy demand dominated by Household Consumers</li><li>• Demand largely varies during four shifts of a day (morning, day, evening and night)</li></ul> |
| Seasonal Variations in Demand | <ul style="list-style-type: none"><li>• Traditionally higher demand during winter</li><li>• Increased electrification improving summer load</li><li>• Winter demand is higher than immediate past summer</li></ul>                                            |
| Demand Growth                 | Energy and Capacity demand increasing @ ~ 9%                                                                                                                                                                                                                  |

## Daily demand curve



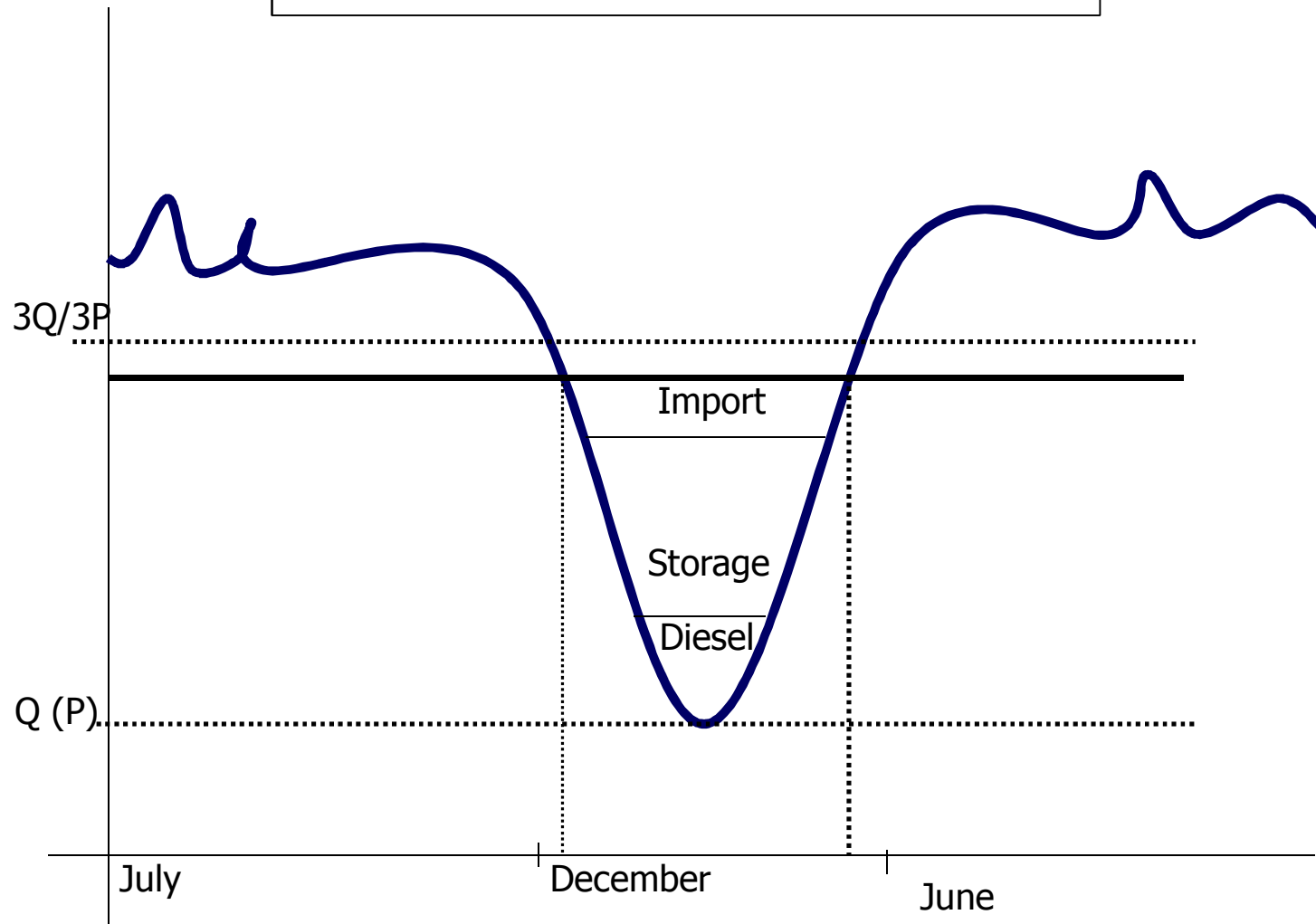
# SUPPLY SOURCES

| Category | Sector                   | Sub title             | Details |
|----------|--------------------------|-----------------------|---------|
| Domestic | Public                   | Hydro ROR             | 381     |
|          |                          | Hydro Storage         | 92      |
|          |                          | Thermal ( Diesel/ FO) | 53      |
|          | Private                  | Hydro ROR             | 244     |
|          |                          | Hydro Storage         | -       |
|          |                          | Thermal ( Diesel/ FO) | -       |
| Import   | Treaties/ Public/ Market | mix                   | 190     |
| Total    |                          |                       | 910     |

# TYPICAL NATURE OF SUPPLY

| Particulars                   | Details                                                                                                                                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source Dominance              | <ul style="list-style-type: none"><li>• Hydro above 90% ( harnesses only 1% of available potential)</li></ul>                                                                                                    |
| TOD Variations in Supply      | <ul style="list-style-type: none"><li>• Not significant</li><li>• Storage and thermal used to address TOD variation in demand</li><li>• ROR used basically for base load</li></ul>                               |
| Seasonal Variations in Demand | <ul style="list-style-type: none"><li>• Significant and severe</li><li>• ROR availability drops down to less than one third in dry season</li><li>• Winter demand is higher than immediate past summer</li></ul> |
| Import Limitations            | Import limited due to transmission constraints                                                                                                                                                                   |
| Other Sources                 | Availability of mineral sources of energy in country insignificant                                                                                                                                               |

# NATURE OF DOMESTIC SUPPLY



# TYPICAL NATURE OF THE SYSTEM

- **Summer and rainy season**

- Assume installed capacity enough to meet the peak demand
- Supply availability equal to installed capacity
- Huge off peak surplus for almost 20 hours a day
- Challenge of marketing this seasonal off peak surplus

## **Winter and Dry Season**

- Supply availability lowers down to very low extent
- Round the clock supply deficit including the base load, Load shedding

- **Inherent nature of supply system**

- Surplus in Rainy season and deficit in dry season

- **Solution:**

- a. Appropriate mix of ROR+PROR+ seasonal storage as well as
- b. Cross border trade for Wet Export and Dry Import

## CONCLUSION

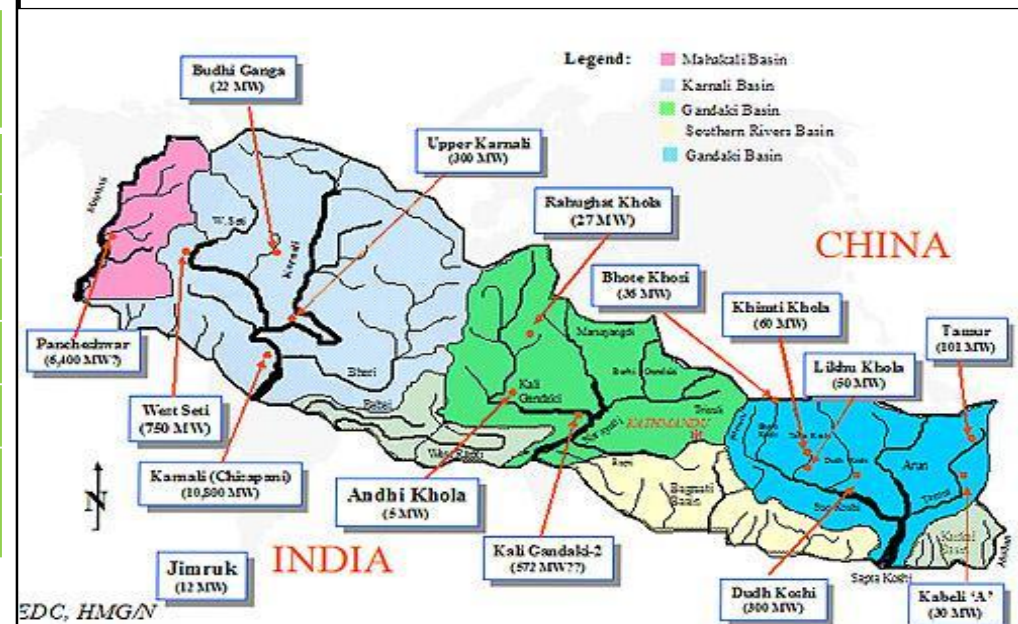
*Economic development of our hydro potential is contingent to system and market coupling across the border to blend cheap rainy season hydro power with cheaper dry season generation from mineral sources.*

# HYDROPOTENTIAL

- Hydrological and other Advantages
  - Huge annual run off
  - Steep gradient of rivers, significant head
  - Most major rivers are snow and glacier fed
  - Estimated basin wise hydro potential

| Basin           | Estimated Hydro potential (MW)              |
|-----------------|---------------------------------------------|
| Koshi           | 22350 MW                                    |
| Gandak          | 20650 MW                                    |
| Karnali         | 32010 MW                                    |
| Mahakali        | 4160 MW                                     |
| Southern Rivers | 4110 MW                                     |
| Total           | 83280 MW<br>( 40,000 commercially feasible) |

- Harnessed potential <1%
- May be harnessed for and regional requirements



## X-BORDER EXCHANGE OF POWER NEED RATHER THAN CHOICE

- Hydropotential is a blessing in disguise to us
- This may be harnessed for our own as well as regional requirements
- It is clean energy and hence a concern for the whole world also
- We should harness and use every drop of water for energy generation
- That makes the energy cheaper, very high quantum during Wet season
- We should market this huge Wet energy quantum in X- border market
- Import deficit, if any, during Dry season
- Seasonal exchange ( Wet export and Dry import) makes it feasible
- Optimal development of our hydro-potential:
  - contingent to seasonal exchange of power
- **Hence, X-Border exchange of power is our need not the choice**

# HARMONIZATION OF REGULATIONS FOR X-BORDER EXCHANGE OF POWER



- **Licensing**
- **Standards**
- **Tariff**

## NEED OF HARMONIZATION: SYSTEM COUPLING

- Planned and coordinated development of cross border tie lines interconnecting two systems with requisite system studies s.a.:
  - Common Planning and design criterion
  - Common technical standards
  - Common construction standards
  - Type of interconnection
  - Mode of development
  - Commercial arrangements.
- Planned and coordinated expansion of internal transmission system of respective grids with requisite system studies s.a.:
  - Common Planning and design criterion
  - Common technical standards
  - Construction standards
- Planned and coordinated operation of interconnected grid systems:
  - During normal hours
  - During contingency periods
  - Common performance standards
- In brief, harmonized policies/regulations on expansion /operation for coupled systems.
- Common forum for system related issues.

## NEED OF HARMONIZATION: MARKET COUPLING

- To the extent possible, similar level of market development
- Uniform policies, guidelines and rules of market
- Uniform policies, guide lines and rules for market accessibility
- Uniform pricing and access principles for natural monopolies
- Established settlement procedures
- Common principle of Balancing market
- In brief harmonized policies and regulations related to market
- Common forum for market related issues

# REGULATORY FRAME WORK

|                             |                                                                                                                                                                                                                                                                                         |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Related to Expansion</b> | <ul style="list-style-type: none"><li>▪ Licensing to Generators, transmission providers, distributors and traders</li><li>▪ Market Development</li></ul>                                                                                                                                |
| <b>Related to Operation</b> | <ul style="list-style-type: none"><li>▪ Grid Code</li><li>▪ Granting Open access</li><li>▪ Procurement of Power and Transmission service from market</li><li>▪ Regulation for performance standards</li><li>▪ Scheduling, dispatching, restoration and contingency procedures</li></ul> |
| <b>Related to Tariff</b>    | <ul style="list-style-type: none"><li>▪ Regulation on Tariff determination for generation/transmission</li><li>▪ Trading Margin</li><li>▪ Capex</li></ul>                                                                                                                               |

# HARMONIZATION OF POLICIES

| AREA                                                    | PARTICULARS                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Internal Market Regulations</b>                      | Should allow the industry to grow.                                                                                                                                                                                                                                                                                                                           |
| <b>Cost of Service</b>                                  | <ul style="list-style-type: none"> <li>▪ Cost reflecting tariff as corner stone</li> <li>▪ Price signal from market</li> </ul>                                                                                                                                                                                                                               |
| <b>Financial Planning</b>                               | Dire need to bring the international accounting practices by generators and off takers                                                                                                                                                                                                                                                                       |
| <b>Cross Border Energy Trade</b>                        | <ul style="list-style-type: none"> <li>▪ Guidelines should increase competitiveness of the electricity industry within the Region</li> <li>▪ This should increase the market options for producers to export their produce across the borders</li> </ul>                                                                                                     |
| <b>T and D Utilities Benchmarking &amp; Performance</b> | <ul style="list-style-type: none"> <li>▪ Mechanism for monitoring technical, financial, economic performance of natural monopolies of T&amp;D</li> <li>▪ Performance measurement mechanism to guarantee a minimum service level</li> <li>▪ Incentive regulation mechanism to allow the gains of improved performance to pass through to customer.</li> </ul> |

# TARIFF REGULATION

| Single or Two Part ?             | <ul style="list-style-type: none"><li>▪ Usually Two Part</li><li>▪ Capacity charge and Energy Charge</li></ul>                                                                                                              |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Variability of Charges           | <ul style="list-style-type: none"><li>▪ Both charges might be variable</li><li>▪ Might have escalable and non-escalable components</li></ul>                                                                                |
| Capacity Charge Factors          | <ul style="list-style-type: none"><li>▪ ROE, Interest, Depreciation, O&amp;M, IWC</li></ul>                                                                                                                                 |
| Tariff Norms                     | <ul style="list-style-type: none"><li>▪ ROE, Tax, Depreciation Rate (SLM, Declining balance)</li><li>▪ Capex</li><li>▪ O&amp;M Expenses</li><li>▪ Efficiency</li><li>▪ Direct pass through items (fuel surcharge)</li></ul> |
| What value is regulated tariff ? | <ul style="list-style-type: none"><li>▪ Levelized</li><li>▪ Can be front or back loaded for same levelized value</li></ul>                                                                                                  |

Harmonization of policies, regulations, codes, standards, procedures etc. makes the cross border power trade seamless.



THANKS