



# **Study on Development of Roadmap for Implementation of Smart Grid: Concepts, Practices and Technologies in SAARC**

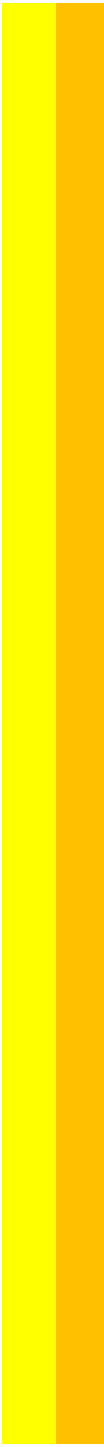
**Department of Hydropower & Power Systems  
Ministry of Economic Affairs  
Royal Government of Bhutan**

**[www.moea.gov.bt](http://www.moea.gov.bt)**

## His Majesty 's Address during 106<sup>th</sup> National Day Dec 17, 2013

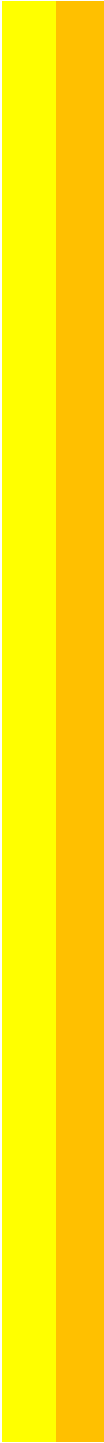
“Hydropower is considered as the nation’s most precious resource that belongs to all the people. Our focus has been to establish as many hydropower projects as possible, to generate enough revenue to become self-reliant”





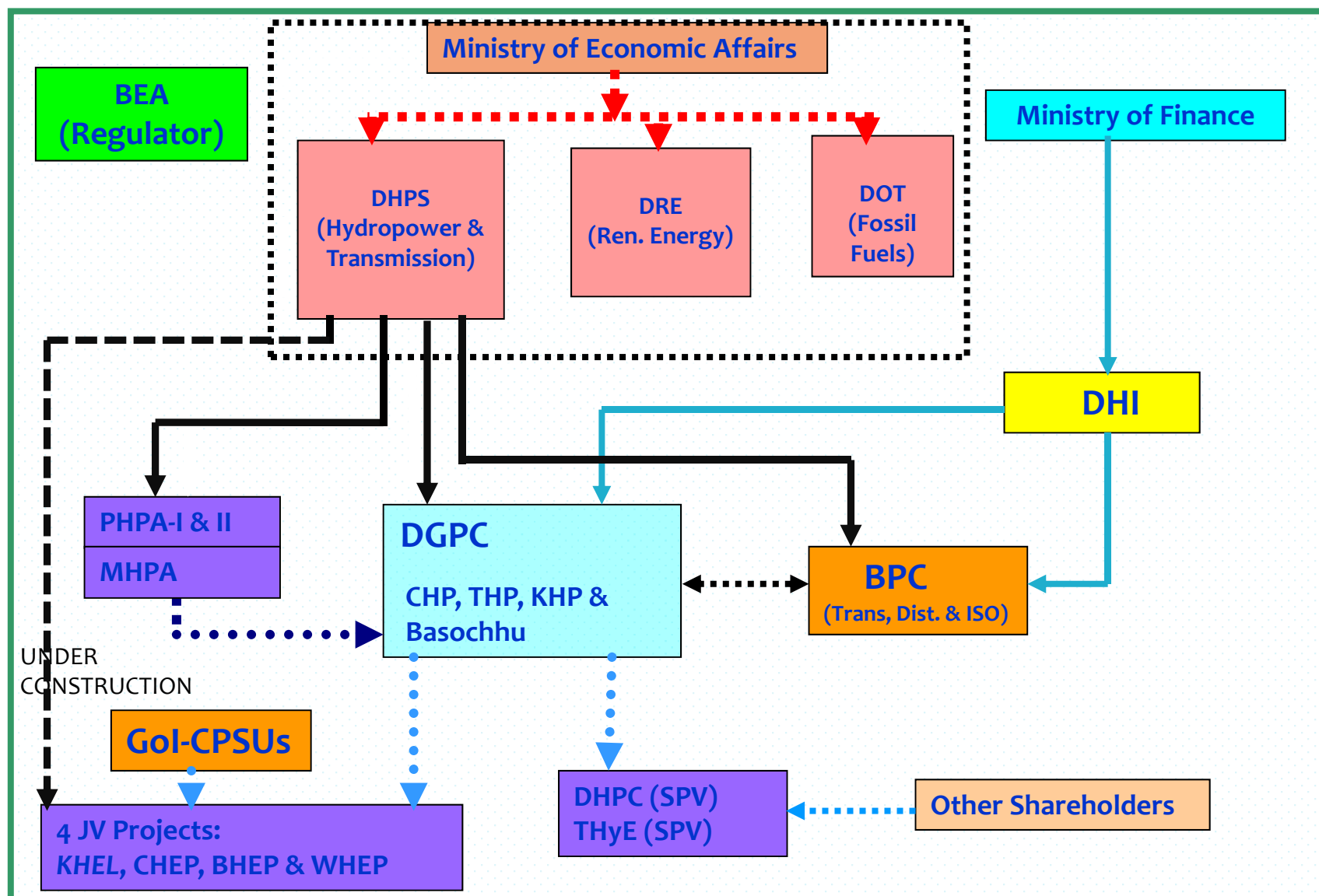
# Presentation Outline

- Institutional Arrangements
- Hydropower Potential
- Hydropower Development Status
  - Existing Project
  - Projects under construction
- Projects outside 10,000 MW
- Other initiatives



# Institutional Set-up

# Institutional Arrangement



# Power Sector

## Department of Hydropower & Power Systems

- ❖ A dynamic and efficient Government agency committed to promoting sustainable hydropower for socio-economic development in pursuit of Gross National Happiness.

## Bhutan Electricity Authority

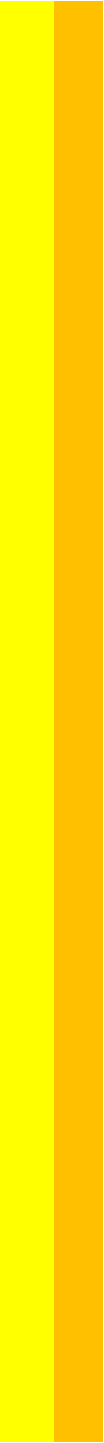
- ❖ Functional autonomous agency as per Section 7 of the Electricity Act of Bhutan, 2001
- ❖ To develop regulations, standards, codes, principles and procedures
- ❖ Licences for generation, transmission, system operation, export, import, distribution and sale of electricity.
- ❖ To determine, or approve tariffs proposed by the Licensees, and review existing tariffs

## Bhutan Power Corporation Limited (2002)

- ❖ Distributing electricity throughout the Country and also providing transmission access for generating stations for domestic supply as well as export

## Druk Green Power Corporation Limited (2008)

- ❖ Operates and maintains hydropower assets of Bhutan (1,480 MW).

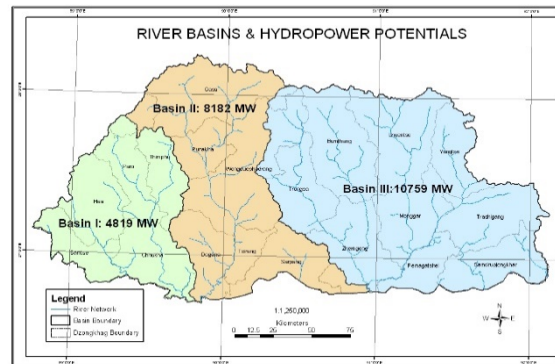


# Hydropower Potential

# Hydropower Potential

The steep and rugged Himalayan terrain and its fast flowing rivers promise abundance of hydropower:

- ❑ 30,000 MW potential
- ❑ 23,760 MW (76 sites of >10 MW) techno-economically viable for development



*Ref: Power system master plan-2004, DHPS, MoEA*

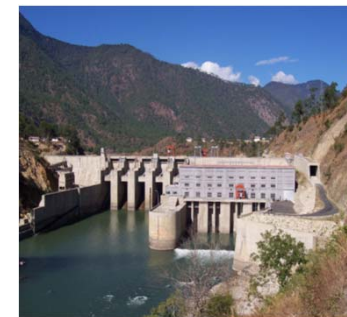


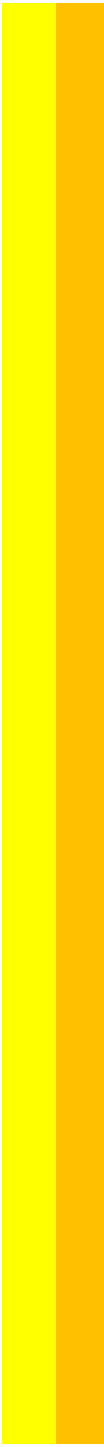


# Existing Power Plants

# Existing Power Plants

| Sl. No | Plant Name                       | Capacity (MW) | Design Energy (MU) |
|--------|----------------------------------|---------------|--------------------|
| 1      | Chhukha Hydropower Plant         | 336           | 1800               |
| 2      | Kurichhu Hydropower Plant        | 60            | 400                |
| 3      | Basochhu Hydropower Plant        | 64            | 105+186            |
| 4      | Tala Hydropower Plant            | 1020          | 4865               |
| 5      | Dagachhu Hydropower Plant        | 126           | 360                |
| 5      | Mangdechhu Hydroelectric Project | 720           | 3008               |
| 6      | Small/Mini/Micro                 | 8             |                    |
|        | Total                            | 2334          | 10,724             |





# Project Under construction

# Inter-Governmental Mode

| SN | Project          | Capacity (MW) | Implem'n Mode | Status                                                                |
|----|------------------|---------------|---------------|-----------------------------------------------------------------------|
| 1  | Punatsangchhu-I  | 1200          | IG            | Under construction since Nov 2008. To be commissioned by Nov 2023/24. |
| 2  | Punatsangchhu-II | 1020          | IG            | Under construction since Dec 2010. To be commissioned by 2022/23.     |
| 3  | Sankosh          | 2585          | IG            | Implementation under discussion                                       |
| 4  | Kuri Gongri      | 2640          | IG            | At DPR stage                                                          |
|    | Total            | 7445          |               |                                                                       |



**Diversion Tunnel- Inlet end ( PHPA-I)**



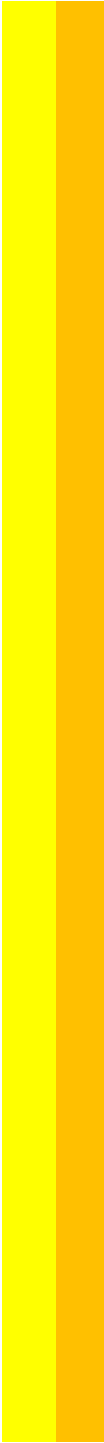
**Surge Shaft (PHPA-II)**

# JV Implementation Mode

| SN | Project        | Capacity (MW) | Implem'n Mode | Status                                                                         |
|----|----------------|---------------|---------------|--------------------------------------------------------------------------------|
| 6  | Kholongchhu    | 600           | JV            | Construction initiated (2015/16) but CA signing kept on hold due to CBTE issue |
| 7  | Bunakha        | 180           | JV            | Implementation under discussion                                                |
| 8  | Wangchhu       | 570           | JV            |                                                                                |
| 9  | Chamkharchhu-I | 770           | JV            |                                                                                |
|    | Total          | 2,120         |               |                                                                                |

## Other Mode of Implementation

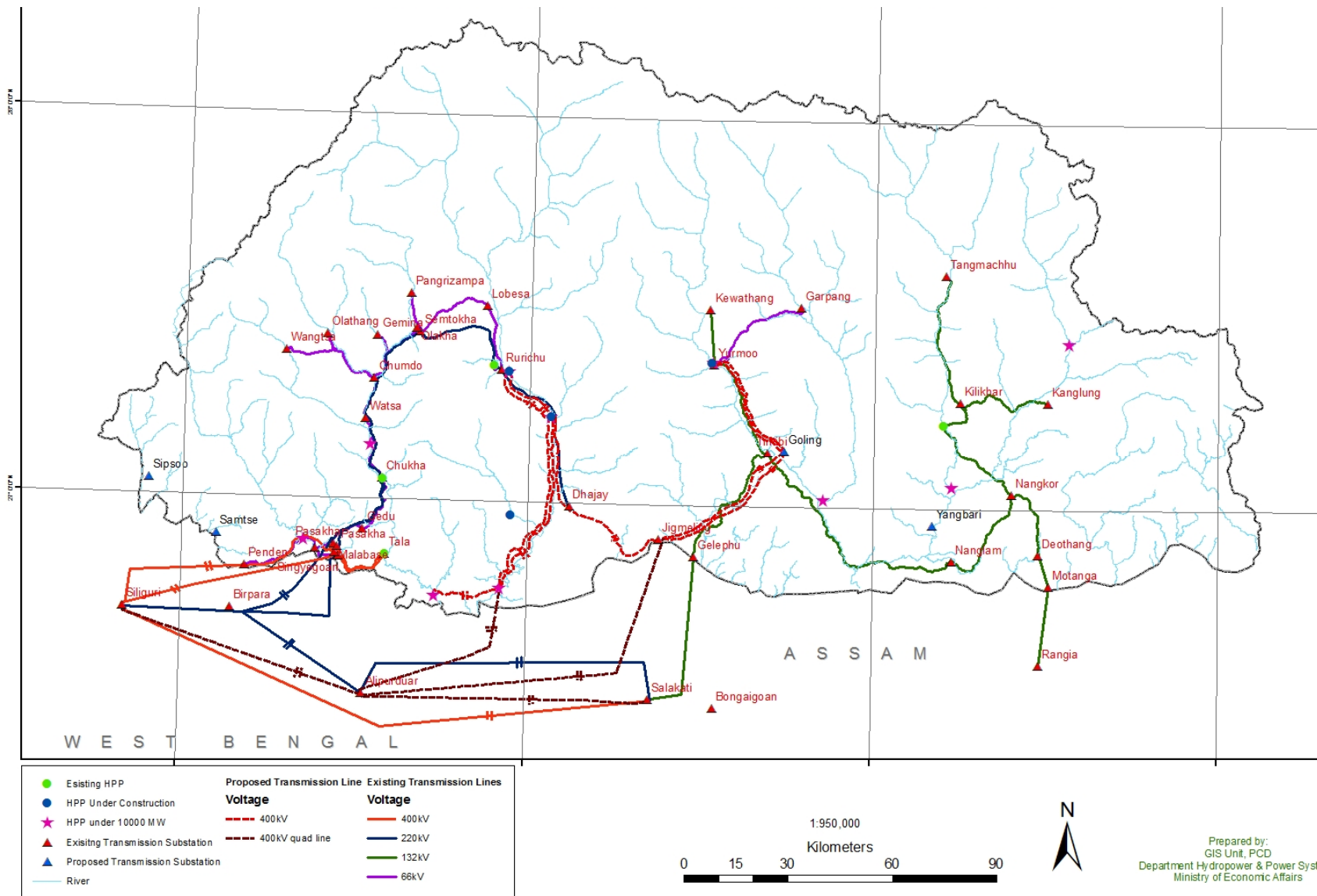
| SN | Project                                                         | Capacity (MW) | Implem'n Mode | Status                                                           |
|----|-----------------------------------------------------------------|---------------|---------------|------------------------------------------------------------------|
| 10 | Nikachhu Hydroelectric Project (Tangsibji Hydro Energy Limited) | 118           | PPP           | Under construction since April 2016. To be commissioned by 2021. |
|    | Total                                                           | 118           |               |                                                                  |



# **Transmission Lines and Associated Substations**

# Transmission Lines and Associated Substations

| Voltage Level            | Length/Nos. | Remarks                                                                                                                                                          |
|--------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 400 kV                   | 74.143 km   | Two Double Circuits (D/C)                                                                                                                                        |
| 220 kV                   | 255.299 km  | Mix of D/C & S/C                                                                                                                                                 |
| 132 kV                   | 348.917 km  | S/C                                                                                                                                                              |
| 66 kV                    | 296.732 km  | S/C                                                                                                                                                              |
| 400/220/66 kV substation | 1 No.       | Malbase, 200 MVA                                                                                                                                                 |
| 220/66/33 kV substation  | 4 Nos.      | <ul style="list-style-type: none"> <li>- Malbase, 3x50/63 MVA</li> <li>- Singhigaon, 120 MVA</li> <li>- Simtokha, 40 MVA</li> <li>- Rurichu, 2x30 MVA</li> </ul> |
| 132/66/33 kV substation  | 7 Nos.      | 102 MVA                                                                                                                                                          |





# Electricity Trade

- Hydropower Export – 70%
- LT PPAs
- Market access – a challenge
- SARI/EI Study: SARPEX

# Hydro Development

| Opportunities                                                                                                                                                                                                                                                              | Challenges                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Renewable, Clean form of Energy</li><li>• CDM &amp; Substitution to fossil fuels/reduction in GHG emission</li><li>• Growing demand in India and South Asia (peaking energy)</li><li>• Opportunities from huge RE growth</li></ul> | <ul style="list-style-type: none"><li>• Resources constraints (capital intensive &amp; skills &amp; technology !)</li><li>• Strict Environment laws !</li><li>• Risks (geology, long gestation, weather – floods, GLOF)</li><li>• Market (pricing, competition)</li><li>• Transport cost (land locked !)</li></ul> |



10/8/2019

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