

## UPPER PART OF SATLUJ BASIN & SPITI VALLEY (SATLUJ BASIN)

The list of identified hydro projects in the Upper Part is given below:

| S.No. | Project           | MW          | Time Frame  | Developer                     | Status of Application for Access to Grid as per CERC regulations |
|-------|-------------------|-------------|-------------|-------------------------------|--|
| 1     | SHPs              | 142         | 2014        |                               |  |
| 2     | Shongtong Karcham | 450         | 2017        | HPPCL                         | Received   |
| 3     | Kashang-I         | 65          | 2013        | HPPCL                         | Received   |
| 4     | Kashang-II & III  | 65 & 65     | 2015 & 2017 | HPPCL                         | Received   |
| 5     | Kashang-IV        | 48          | -           | HPPCL                         |  |
| 6     | Tidong-I          | 100         | 2015        | Nagarjuna Constructions Group | Received   |
| 7     | Chango Yangthang  | 140         | 2017        | Bhilwara Group                | Received   |
| 8     | Yangthang Khab    | 261         |             |                               | X  |
| 9     | Ropa              | 60          |             |                               | X  |
| 10    | Khab              | 636         |             |                               | X  |
| 11    | Tidong-II         | 90          |             |                               | X  |
| 12    | Jhangi Thopan     | 480         |             |                               | X  |
| 13    | Thopan Powari     | 480         |             |                               | X  |
| 14    | Sumte Khatang     | 130         |             |                               | X  |
| 15    | Lara Sumte        | 104         |             |                               | X  |
| 16    | Mane-Nadang       | 70          |             |                               | X  |
| 17    | Lara              | 60          |             |                               | X  |
| 18    | Killing-Lara      | 40          |             |                               | X  |
|       | <b>Total</b>      | <b>3486</b> |             |                               |  |

## CHANDRABHAGA BASIN (LAHAUL & SPITI AREA)

The list of identified projects in the upper part is given below:

| S.No. | Project      | MW          | Time Line | Developer       | Status of Application for Connectivity / Access to Grid as per CERC regulations |
|-------|--------------|-------------|-----------|-----------------|---|
| 1     | Chhatru      | 120         | 2018      | DCM Sriram      | X   |
| 2     | Teling       | 94          |           |                 | X   |
| 3     | Shangling    | 44          |           | Reliance Power  | X   |
| 4     | Jispa        | 300         |           | HPPCL           | X   |
| 5     | Tandi        | 104         |           | ABG Shipyard    | X   |
| 6     | Rashil       | 130         |           | ABG Shipyard    | X   |
| 7     | Bardang      | 126         |           | ABG Shipyard    | X   |
| 8     | Tignet       | 81          |           | Amar-Mitra JV   | X   |
| 9     | Pattam       | 60          |           |                 | X   |
| 10    | Seli         | 400         | 2017-18   | Moser Baer      | Connectivity Application Received   |
| 11    | Miyar        | 120         | 2016-17   | Moser Baer      | Connectivity Application Received   |
| 12    | Reoli Dugli  | 420         | 2018      | L&T             | X   |
| 13    | Sach Khas    | 149         | 2018      | L&T             | X   |
| 14    | Purthi       | 300         |           | Reliance Power  | X   |
| 15    | Duggar       | 236         |           | Tata + SN Power | X   |
| 16    | SHPs         | 300         |           |                 |   |
| 17    | Other        | 500         |           |                 |   |
|       | <b>Total</b> | <b>3500</b> |           |                 |   |

## **Planned Transmission System alongwith phased development for upper part of Satluj Basin and Spiti Valley (Satluj Basin)**

- **SHPs** : Establishment of 66/220/400 kV GIS Pooling Station at Wangtoo by Mid 2014 to match commissioning of SHPs in Bhaba Khad (57 MW) and Sangla Valley (40 MW) + LILO of 220 kV Kashang- Bhaba D/c Line and LILO of both circuits of 400 kV Karcham Wangtoo-Abdullapur D/c line at Wangtoo. – ***Proposed Implementation through STU.***

HPPTCL proposed to implement this substation by Mid 2014 and they have tied up the funds from ADB. The switchgear rating and bus capacity etc. at Wangtoo substation should be equivalent to 4000 Amps.

- **Kashang-I (65 MW), Kashang-II (65 MW) and Tidong-I (100 MW)** : During the meeting HPPTCL stated that Kashang-I is likely to be commissioned by 2013. For evacuation of power from Kashang-I, HP is constructing a 220 kV D/c line from Bogtu to Kashang. Accordingly, power can be evacuated through Bogtu - Bhabha 220 kV D/c line. HPPTCL stated that Tidong-I is under construction and is likely to be commissioned by December 2014. Since, Tidong-I (100 MW) is due for commissioning in December, 2014 and Jangi Pooling station may not come up by that time, Tidong-I power shall be temporarily evacuated by LILO of one circuit of 220 kV D/C Kashang- Bhaba line at Tidong-I HEP. These works shall be carried out by HPPTCL. Later on when Jangi P.S. is commissioned, Tidong-I - Jangi line shall be constructed and also Kashang – Jangi 220 kV D/c line with inle HTLS conductor shall be established. These works are proposed to be carried out by HPPTCL.

HPPTCL further informed that works for Kashang-II (65 MW) has also been awarded and commissioning is expected by 2015. It was suggested that Kashang-II is also evacuated through 220 kV system as Jangi pooling station may not be available in that time frame, however some constraints may be faced during contingency of outage of one circuit. POWERGRID stated that establishment of Jangi Pooling station may be taken up with further stages of Kashang.

- **Shongtong Karcham** : During the meeting it was informed that Shongtong Karcham HEP (450 MW) is likely to be commissioned by 2017. For transfer of power from this project, following is proposed:
  - Shongtong Karcham – Wangtoo 400 kV D/c Line (Quad HTLS Conductor –Equivalent to about 3000MW) – 18 km - ***Proposed Implementation as ISTS***
  - Switchyard Capacity etc. must be able to handle about 2800-3000MW power planned in the upstream of the generation project. It is proposed that the GIS switchyard may be designed with 4000 Amps switchgear. However, the cable capacity from Pot head yard to GIS switchyard may be augmented with generation addition in the upstream projects.
- **Kashang-III (65 MW) & Kashang-IV (48 MW) and Tidong-II (90 MW) HEP:** Evacuation of power from Kashang –I (65 MW), Kashang –II (65 MW) and Tidong-I (100 MW) is discussed above. With the commissioning of other stages of Kashang and Tidong, the power shall be injected at Jangi pooling station. The

Jangi Pooling station shall be established by this time frame. Transmission scheme for Kashang & Tidong shall be as given as below:

- Kashang-Jangi Pooling Station 220 kV D/c line (Single HTLS- Equivalent to 300 MW capacity) - ***Proposed Implementation as STU network***
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- 2x315 MVA (7x105 MVA units) 220/400 kV GIS Pooling Station at Jangi (with 4000 Amps. switchgear) (with space provision for 3<sup>rd</sup> ICT) - ***Proposed Implementation as ISTS***
- LILO of one ckt. of Shongtong –Wangtoo 400 kV Line at Jangi - ***Proposed Implementation as ISTS***
- Tidong – Jangi Pooling Station 220 kV D/c line - ***Proposed Implementation as STU network***

**Note:** After coming up of Kashang III & Tidong-II and its inter-connection with Jangi Pooling Station, the Kashang-Bogtu 220kV line has to be kept in open condition.

- **Chango Yangthang (140 MW):** Chango Yangthang is envisaged to be commissioned by 2017. Following transmission system is proposed matching with Chango Yangthang:
  - Chango Yangthang – Proposed site of Ka Dogri Pooling Station 220 kV D/c line – 18 km - ***Proposed Implementation by developer***
  - Proposed Site of Ka Dogri – Jangi Pooling Station 400 kV D/c line (Twin Moose) to be initially charged at 220 kV – 50 km ***Proposed Implementation as ISTS***
  - Provision of 3<sup>rd</sup> 400/220 kV ICT (3 nos. of 105 MVA Single Phase units) at Jangi Pooling Station - ***Proposed Implementation as ISTS***
- **Yangthang Khab (261 MW):**
  - 220 kV Yangthang Khab- Ka Dogri D/c Line with HTLS conductor - adequate for 300 MW capacity – 4 km - ***Proposed Implementation as ISTS***
  - 2x315 MVA (7x105 MVA units) 220/400 kV GIS Pooling Station at Ka Dogri - ***Proposed Implementation as ISTS***
  - Charging of Ka Dogri – Jangi line at 400 kV level - ***Proposed Implementation as ISTS***
  - Direct termination of Chango Yangthang at Ka Dogri Pooling Station - ***Proposed Implementation by generation developer***
- **Khab (636 MW):**
  - Khab – Jangi Pooling Station 400 kV D/c line – 20 km - ***Proposed Implementation as ISTS***
- **Jangi Thopan (480 MW) & Thopan Powari (480 MW) :**
  - LILO of one circuit of Jangi Pooling Station – Wangtoo 400 kV D/c (Quad HTLS) line at generation project - ***Proposed Implementation as ISTS***
  - Switchgear Capacity at Generation switchyard must be equivalent to 4000 Amps.
- **Ropa (60 MW)**

- Direct injection to Jangi Pooling station by a 220 kV D/c line - ***Proposed Implementation by generation developer***
  - The generation of SHPs in the area may be injected at Ropa Generation Switchyard
- **Other Projects of Spiti Valley (Satluj Basin)**
    - The generation of these projects can be injected at Ka Dogri Pooling Station.
    - From Killing Lara (40 MW), Lara (60 MW) & Mane Nadang (70 MW), a combined 220 kV D/c line can be constructed upto Lara Sumte HEP. From Lara Sumte HEP(104MW), a high capacity 220 kV line (with twin Moose conductor) can be constructed upto Ka Dogri Pooling Station - ***Proposed Implementation as ISTS except for the generators below 50 MW.***
    - Augmentation of transformation capacity would be required at Ka Dogri. Space for 2 additional ICTs of 315 MVA (105 MVA single phase units) would be required. These transformers can be provided progressively matching with the generation addition. - ***Proposed Implementation as ISTS***

**NOTE :**

Present / Planned system beyond Wangtoo station would be capable of handling about 500-600 MW of power (to be confirmed with the development of the generation projects). One more additional high capacity line (400 kV Quad) from Wangtoo towards Haryana/Punjab shall be required which can be constructed through the right bank of the river.

**B**

**Planned Tr. System alongwith Phased development for Chandrabhaga Basin**

The total power in this area is about 3850 MW (considering 10% overload). Out of these projects, two projects namely, Miyar & Seli are expected to come up by 2017 and three projects Chhatru, Reoli Dugli & Sach Khas are expected by 2018. The next project expected in this area would be Jispa. The status and time frame of other projects are not yet clear.

Based on the progress of generation, availability of corridors, severe R-o-W constraints near Seli, quantum of power, it was considered prudent to develop two transmission corridors, one towards Hamirpur and the other towards J&K. It is proposed that the corridor to start from Seli HEP would go towards Hamirpur and the other corridor to start from Reoli Dugli would go towards J&K. The corridor capacity towards Hamirpur would be of the order of 2500 MW and corridor capacity towards J&K would be about 1500 MW.

Keeping above observations in view, following transmission system is proposed which is matched with the sequence of commissioning of generation projects:

**CHANDRABHAGA CORRIDOR-I**

**Seli HEP (400 MW):** Earlier the Project size was 320 MW, however with the detailed investigations, the project size is revised to 400 MW.

- 400 kV D/c Line (Twin HTLS-Adequate for about 2000 MW) from Seli to the site of 400 kV Pooling Station near Sissu /Gramphu (Pooling Station shall not be constructed during this time frame) - ***Proposed Implementation as ISTS***
- From site proposed near Sissu/Gramphu Pooling Station – Hamirpur 400 kV D/c (Triple HTLS – adequate for 2500 MW capacity) – For this line section, Rohtang Pass is to be crossed. There is about 8-10 feet of snow at Rohtang Pass during winters and working season is very less. For implementation of overhead line, SASE and some international expert would have to be involved. Special design with pole type towers may be required which can be firmed up during detailed engineering. - ***Proposed Implementation as ISTS***

**Miyar HEP(120 MW) :**

- Step up of Miyar generation at 400 kV level
- LILO of one circuit of Seli – Hamirpur (via Rohtang) 400 kV D/c line (Twin HTLS) at Miyar - ***Proposed Implementation as ISTS***

**Note :** During the meeting it was informed that Miyar would come up earlier than Seli, the line from Miyar to Hamirpur (configuration explained under Seli system) may be taken up initially and the same can be extended to Seli.

**Chhatru HEP (120 MW) :** With the coming of Chhatru HEP, following is proposed:

- Establishment of 2x315 MVA (7x105 Single Phase units) 400/220 kV GIS Pooling station near Sissu / Gramphu - ***Proposed Implementation as ISTS***
- Chhatru – Sissu / Gramphu GIS Pooling Station 220 kV D/c line (HTLS adequate for 300 MW per circuit) - ***Proposed Implementation as ISTS***
- LILO of both circuits of Seli - Hamirpur line at Sissu/ Gramphu GIS Pooling Station.- ***Proposed Implementation as ISTS***

**Teling & Shangling HEP (94 & 44 MW) :** For evacuation of power from these projects, following is proposed:

- LILO of one circuit of Chhatru – Sissu / Gramphu Pooling Station 220 kV D/c (HTLS) at Teling - ***Proposed Implementation as ISTS***
- LILO of one circuit of Chhatru – Sissu / Gramphu Pooling Station 220 kV D/c (HTLS) at Shangling - ***Proposed Implementation by STU or developer***

**Note:** The capacity of generation switchyards at Chhatru, Teling & Shangling HEPs must be equal to power handling capacity of 300 MW otherwise there would be constraints during contingency of outage of one circuit.

**Jispa (300 MW):** For evacuation of power from Jispa HEP, following is proposed:

- Jispa – Sissu / Gramphu Pooling Station 400 kV D/c line - ***Proposed Implementation as ISTS***

**Bardang HEP (126 MW) :** Following is proposed for Bardang HEP

- Step up at 400 kV
- LILO of one circuit of Seli – Sissu / Gramphu Pooling Station 400 kV D/c (Twin HTLS) - ***Proposed Implementation as ISTS***

**Rasil HEP (130 MW)**

- Step up at 400 kV
- LILO of one circuit of Seli – Sissu / Gramphu Pooling Station 400 kV D/c (Twin HTLS) - ***Proposed Implementation as ISTS***

**Tandi HEP (104 MW)**

- Step up at 400 kV
- LILO of one circuit of Seli – Sissu / Gramphu Pooling Station 400 kV D/c (Twin HTLS) - ***Proposed Implementation as ISTS***

**Pattam HEP (60 MW) :**

- Step up at 220 kV
- Pattam – Miyar 220 kV D/c - ***Proposed Implementation as ISTS***
- Provision of 1x250 MVA(4 nos. of 83.3MVA Single Phase units), 220/400 kV GIS Pooling Station at Miyar. In case of space constraints at Miyar switchyard, a separate pooling station would be required.- ***Proposed Implementation as ISTS***

**Tignet HEP (81 MW)**

- Step up at 220 kV
- LILO of one circuit of Pattam – Miyar 220 kV D/c - ***Proposed Implementation as ISTS***

For Pattam & Tignet HEP transmission systems, it is assumed that Pattam would be coming up prior to Tignet. In case Tignet HEP materializes before Pattam, 220 kV D/c line and provision of ICTs shall have to be matched with Tignet HEP.

**NOTE:** (Additional system beyond Hamirpur would be planned based on the requirement / commissioning of new projects.) - ***Proposed Implementation as ISTS***

**CHANDRABHAGA CORRIDOR-II**

It was proposed that the generation projects in the downstream of Seli HEP i.e. Reoli Dugli (420 MW), Sach Khas (149 MW), Purthi (300 MW) and Duggar (236 MW) may be evacuated through Jammu region as these projects are close to that region, there are severe R-o-W constraints from Seli to Reoli Dugli and it may not be feasible / reliable to evacuate full 3850 MW through single corridor.

**Reoli Dugli HEP (420 MW) & Sach Khas (149 MW):** Both these projects are allocated to L&T and investigations for preparation of DPR are in progress. As per preliminary discussions, these projects are expected to come up by 2018. Following transmission scheme is proposed for evacuation of power from these projects:

- Generation step up at 400 kV level (for both projects)
- Reoli Dugli– Kishtwar 400 kV D/c (Twin HTLS-Adequate for 1500 MW) - ***Proposed Implementation as ISTS***
- Establishment of 400 kV switching station at Kishtwar - ***Proposed Implementation as ISTS***

- LILO of Dulhasti / Ratle – Kishenpur 400 D/c (Quad) line at Kishtwar - ***Proposed Implementation as ISTS***
- LILO of one circuit of Reoli – Kishtwar at Sach Khas - ***Proposed Implementation as ISTS***
- Generating Switchyard capacity to be kept for 1500 MW at each Power House.

**Purthi HEP (300 MW) :** Following transmission system is proposed with Purthi HEP

- Generation step up at 400 kV level
- LILO of one circuit of Reoli – Kishtwar 400 kV D/c at Generating station - ***Proposed Implementation as ISTS***
- Generating Switchyard capacity to be kept for 1500 MW at Power House.

**Duggar HEP (236 MW):** Following is proposed for transfer of power from Duggar

- Generation step up at 400 kV level
- LILO of one circuit of Reoli – Kishtwar 400 kV D/c at Generating station - ***Proposed Implementation as ISTS***
- Generating Switchyard capacity to be kept for 1500 MW at Power House.

**Note:** Initially some margins may be available beyond Kishtwar, however system strengthening would be required depending on the generation addition. - ***Proposed Implementation as ISTS***

### **Rabi basin**

Major projects existing in Rabi Basin are Chamera-I (540MW) and Chamera-II (300MW). For evacuation of power 400 kV D/C line from Chamera-I to Jullendher and 400kV S/C from Chamera-I to Kishenpur LILOed to Chamera-II are existing. Chamera-III (231MW) and Budhil (70MW) are under construction and Kuthar (260 MW), Bijoli holi (200 MW), Bara Bengal (200 MW), Burmur (45 MW), Hudsar (60 MW) and Kugti (45 MW) are planned.

For evacuation of power from the projects upstream of Chamera-II, a 400/220kV pooling station is planned near Chamera-II which is required matching with Budhil HEP which would be the next project in the valley. This pooling station would be connected to Chamera-II through a 400kV S/C line and to Jullundhar through 400kV D/C line. The line to Jullundhar would be needed with the next generation project which is Chamera-III.

A 220kV pooling station at a suitable location upstream of Chamera III is also proposed where power is proposed to be pooled and transmitted to Chamera-II 400/220kV pooling station through three numbers of 220kV D/C lines with 1xMoose conductors. These would be optimum solution for phased development. However, if there are physical constraints in constructing three of 220 kV D/C lines through the valley, it may be required to built two nos. of 220 D.C lines with 2x Moose conductors



## **Beas Basin**

The existing major projects in Beas basin are Malana-I (87MW) and Larji (126 MW). Power from both these projects is being evacuated through 132 kV HPSEB system. The other major projects in Beas/Parbati basin are Allain Duhangan (192 MW), Malana-II(100MW), Koldam (800MW) Parbati-II (800 MW), Parbati III (501 MW) and Sainj (100 MW).Evacuation from Koldam, Parbati-II and Parbati-III is planned through 400kV system. The transmission lines are:

Koldam-Nalagarh 400kV D/C Quad conductor  
Parbati-II-Koldam 400kV 2xS/C Quad conductor  
Koldam-Ludhiana 400kV D/C Triple conductor

With Parbati-III, a pooling station at Panarsa is proposed and Panarsa-Amritsar 400kV D/C twin Moose line has been planned.

The Panarsa 400/220kV pooling station was required in the time frame of Allain Duhangan and Malana-II. However, as the time schedule did not match, a direct 220kV D/C line from Allain Duhangan to Nalagarh has been taken-up for construction by ADHPL. This line with 1xZebra conductor has a capacity of 400 MW through which Malana-II power can also be evacuated.

Power from Sainj is proposed to be evacuated through 400kV via Parbati-III. For this, either Sainj may adopt direct step-up to 400kV or have its own 400/132kV substation.

The 400/220kV pooling station at Panarsa would still be needed to pool the power to be received from Tandi 220kV pooling station proposed in Chenab basin. As the line from Tandi would be at high altitude, and there may also be need of cables in some portion,220kV line would be a better option rather than 400kV. The 220kV lines would have to be with higher conductor specification say 220kV D/C line with quad Moose conductors.