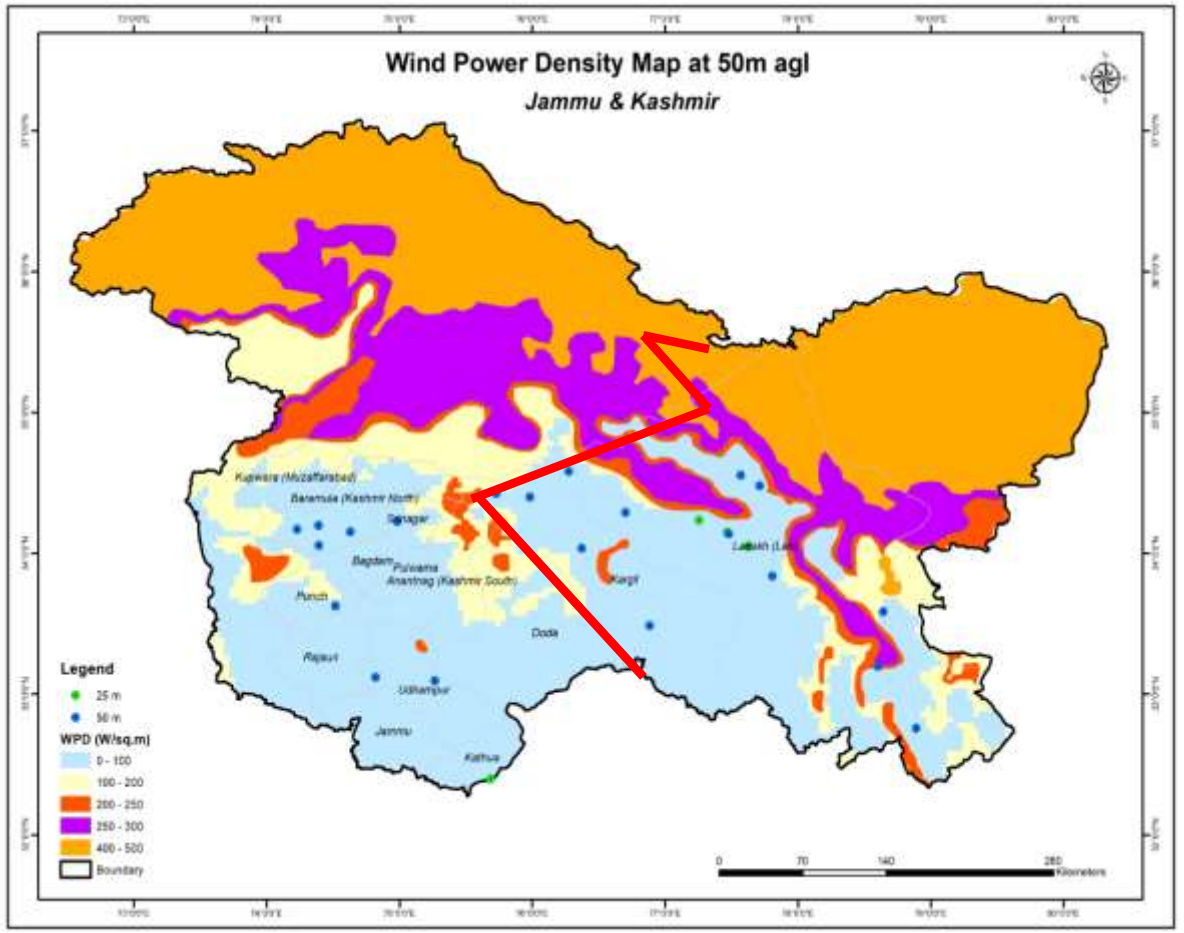
# Wind / Solar Resource Assessment studies in Leh-Ladakh UT

6th December, 2019, Leh

# Wind Potential in Leh – Ladakh UT



# Studies carried out so far

- wind resource assessment studies at 16 locations using 25 & 50 m masts

**Leh-Ladakh**

| Site Name | Height of the mast (m) | Mean Wind Speed (m/s) |
|---|---|---|
| BASGO | 25 | 3.77 |
| CHOCHOT | | 3.35 |
| PHYANG | | 4.44 |
| KHALSAR | 50 | 3.82 |
| NYOMA | | 4.08 |
| TARU | | 4.37 |
| FOTU LA | | (Non-availability of one year continuous data) |
| UPSHI | | 3.51 |
| DISKIT | | 3.12 |
| HANLEY | | 4.88 |
| CHUSHUL | | 6.60 |

**Kargil**

| Site Name | Height of the mast (m) | Mean Wind Speed (m/s) |
|---|---|---|
| KHUMBUTHANG | 50 | 3.12 |
| PHOTANG | | 4.70 |
| RUNGDUM | | 3.11 |
| HAMBOTINGLA | | 4.15 |
| LAKTHANG | | 3.29 |

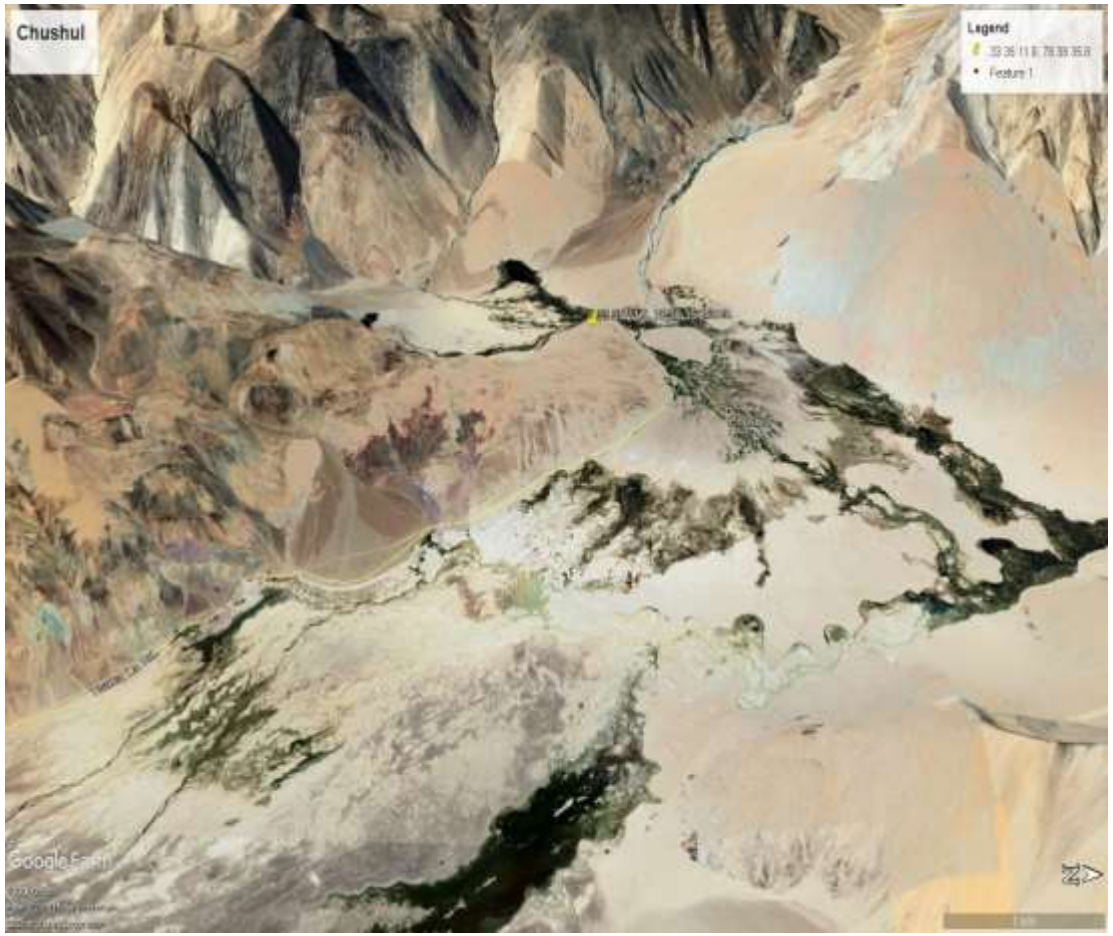
# CHUSHUL – Monthly Wind characteristics summary

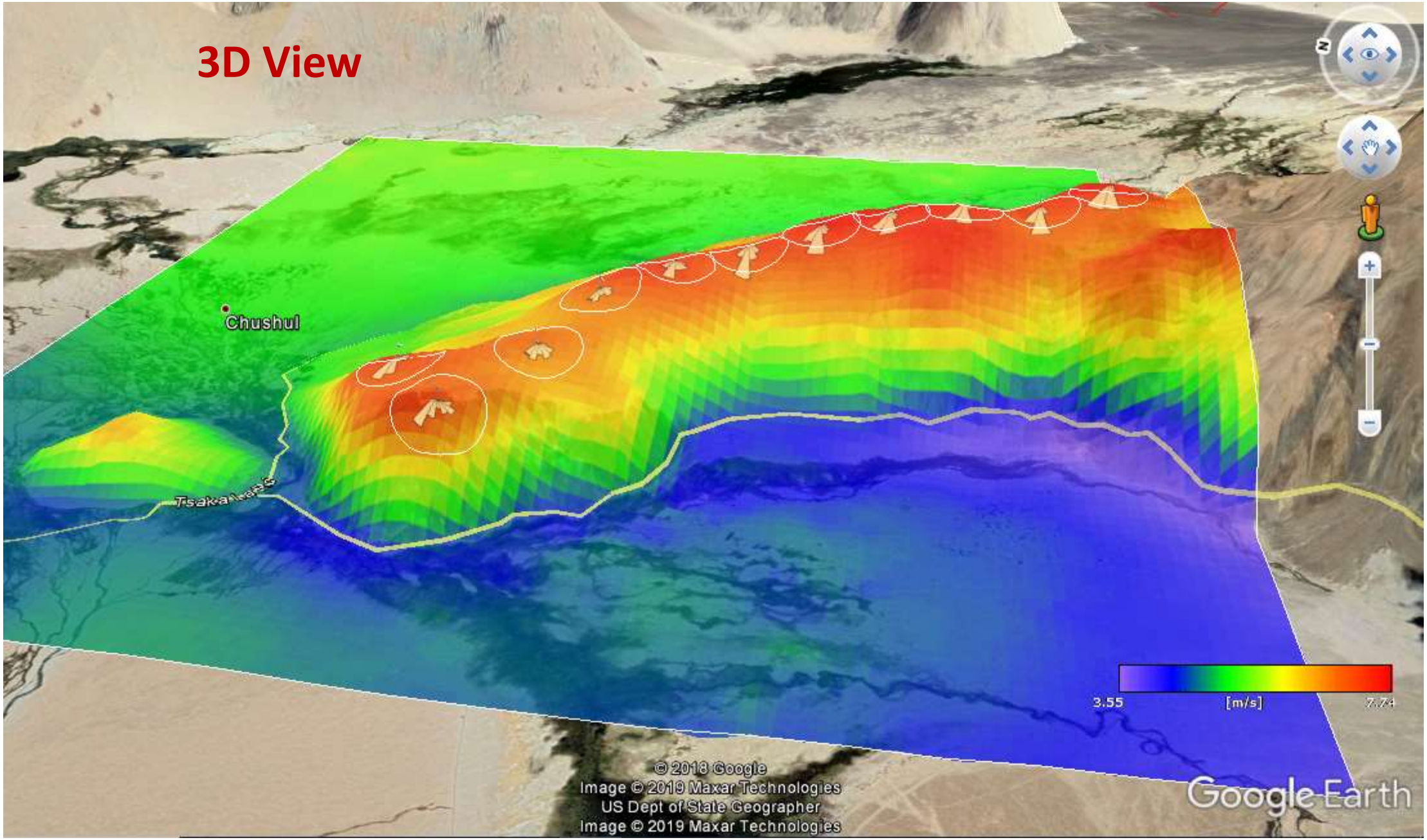
**Name of the Project : WRA in Uncovered/ New Areas (2008-2009)**
**Station: Chushul**
**State: Jammu and Kashmir**
Latitude : 33° 35' 11.9" N
Longitude: 78° 38' 35.8" E
Elevation : 4510m AMSL (based on google earth)
**Date of Commissioning :01.09.2011**

**Based on data October 2011 to September 2012**

| Month | Air Density ($kg/m^3$)* | 50m AGL | | 30m AGL | | 10m AGL | | Prevailing Wind Direction | | No. of Data Available |
|---|---|---|---|---|---|---|---|---|---|---|
| | | WS (m/s) | WPD ($W/m^2$) | WS (m/s) | WPD ($W/m^2$) | WS (m/s) | WPD ($W/m^2$) | 50m | 30m | |
| Jan-12 | 0.727 | 5.1 | 128 | 5.2 | 131 | 4.8 | 107 | SW | SW | 4464 |
| Feb-12 | 0.717 | 7.2 | 289 | 7.3 | 296 | 6.9 | 264 | SW | SW | 4176 |
| Mar-12 | 0.702 | 7.0 | 230 | 7.2 | 234 | 6.7 | 205 | SW | SW | 4464 |
| Apr-12 | 0.687 | 6.7 | 199 | 6.8 | 203 | 6.2 | 167 | W | W | 4320 |
| May-12 | 0.678 | 7.5 | 244 | 7.6 | 247 | 6.9 | 198 | W | W | 4464 |
| Jun-12 | 0.663 | 7.7 | 264 | 7.7 | 259 | 6.9 | 199 | W | NW | 4320 |
| Jul-12 | 0.655 | 8.1 | 256 | 8.0 | 244 | 7.1 | 174 | W | NW | 4464 |
| Aug-12 | 0.656 | 5.3 | 139 | 5.3 | 136 | 4.8 | 107 | W | NW | 4464 |
| Sep-12 | 0.667 | 6.0 | 183 | 6.1 | 186 | 5.5 | 147 | SW | SW | 4320 |
| Oct-11 | 0.686 | 5.9 | 160 | 5.9 | 157 | 5.2 | 118 | W | W | 4464 |
| Nov-11 | 0.705 | 6.1 | 189 | 6.1 | 187 | 5.4 | 147 | W | W | 4320 |
| Dec-11 | 0.721 | 6.6 | 252 | 6.6 | 254 | 6.0 | 216 | SW | SW | 4464 |
| **Average** | **0.689** | **6.6** | **211** | **6.6** | **211** | **6.0** | **171** | - | | **100%** |

**Mast Height: 50m**




3D View
Chushul
3.55
[m/s]
7.74
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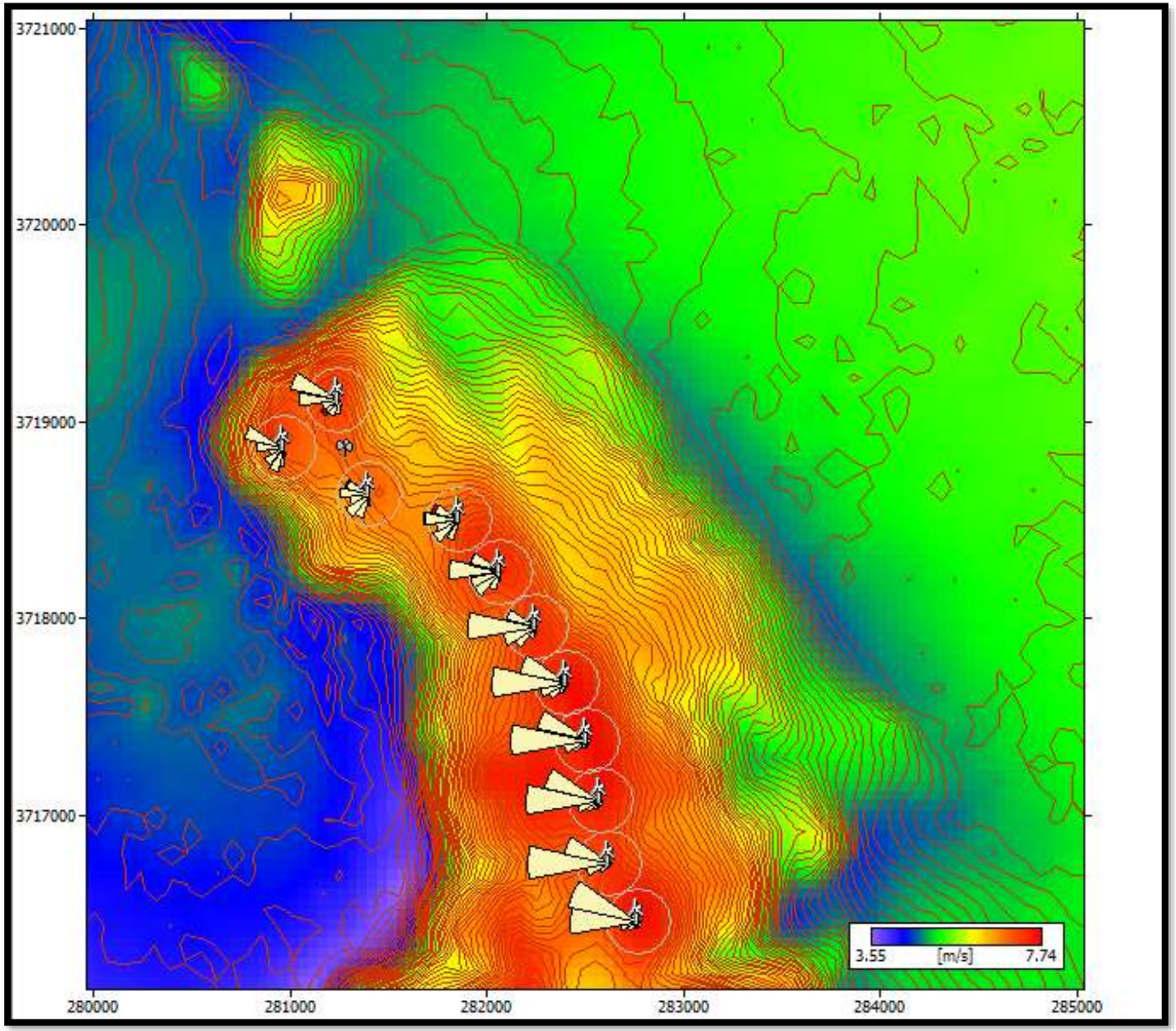
US Dept of State Geographer
Image © 2019 Maxar Technologies
Google Earth

# Chushul Micrositing & AEP




| Anemometer location | | |
|---|---|---|
| Height a.g.l. | 50.0 | m |
| X co-ordinate | 281289.0 | m |
| Y co-ordinate | 3718814.0 | m |
| Elevation a.s.l. | 4510.4 | m |
| Net altitude a.s.l. | 4560.4 | m |
| Mean air density | 0.758 | kg/m³ |
| Geographical: | 33°35'11.90"N 78°38'35.78"E (33.58664, 78.64327) | |

Using 850 kW WTG
Rotor Diameter : 58m (Blade length 29m)
Hub Height : 65m

AEP results:
11 WTG can be accommodated

Mean Wake loss : 1.51%

Net AEP (p50) : minimum 18.1 Lakhs Units/WTG (850kW)

CUF (%) >25%

# WTG (850kW) Wise AEP details at Chushul site

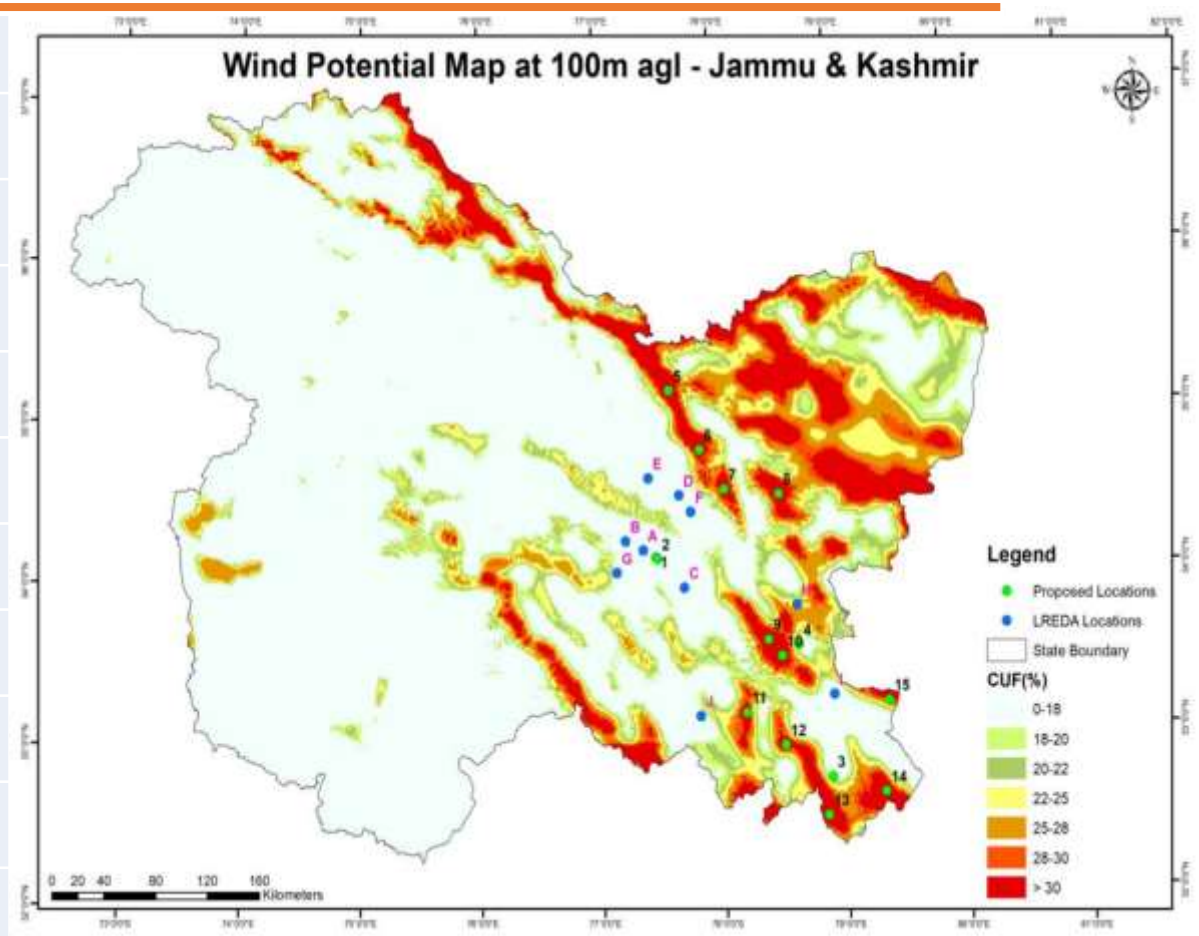
| Site ID | X-location [m] | Y-location [m] | Elev. [m] | Grs [GWh] | Net. [GWh] | Wake Loss [%] | P50 (GWH) | p90 (GWH) |
|---|---|---|---|---|---|---|---|---|
| 1 | 282249 | 3717959 | 4546.8 | 2.529 | 2.495 | 1.35 | 2.03 | 1.84 |
| 2 | 282069.1 | 3718240 | 4545 | 2.554 | 2.503 | 2.02 | 2.04 | 1.85 |
| 3 | 282400.1 | 3717671 | 4568.3 | 2.67 | 2.632 | 1.42 | 2.14 | 1.95 |
| 4 | 282508 | 3717383 | 4576.8 | 2.652 | 2.612 | 1.52 | 2.13 | 1.94 |
| 5 | 282572.8 | 3717074 | 4588.1 | 2.636 | 2.599 | 1.43 | 2.12 | 1.92 |
| 6 | 282623.2 | 3716757 | 4585.3 | 2.493 | 2.473 | 0.78 | 2.01 | 1.82 |
| 7 | 282767.1 | 3716462 | 4605 | 2.647 | 2.632 | 0.57 | 2.14 | 1.95 |
| 8 | 281855.2 | 3718505 | 4523.2 | 2.297 | 2.226 | 3.08 | 1.81 | 1.62 |
| 9 | 280964.7 | 3718869 | 4502.7 | 2.346 | 2.341 | 0.22 | 1.91 | 1.71 |
| 10 | 281245.3 | 3719114 | 4507.7 | 2.45 | 2.392 | 2.38 | 1.95 | 1.76 |
| 11 | 281401.5 | 3718634 | 4511.5 | 2.202 | 2.158 | 1.99 | 1.76 | 1.57 |
| | | | Average AEP | | | | 2.00 | 1.81 |
| | | | Average CUF % | | | | 27 | 24 |

# Wind Potential in Leh – Ladakh UT

- Ladakh has good wind resource due its valley terrain and temporal variation
- At 50m hub height, the estimated installable wind power potential considering sloping and land constraints is around 5311 MW @ 50 m (J&K)
- At 120m hub height, by removing slopes, high altitudes and other land constraints, the potential is more than 100,000 MW

# Proposed locations for carrying out fresh measurements

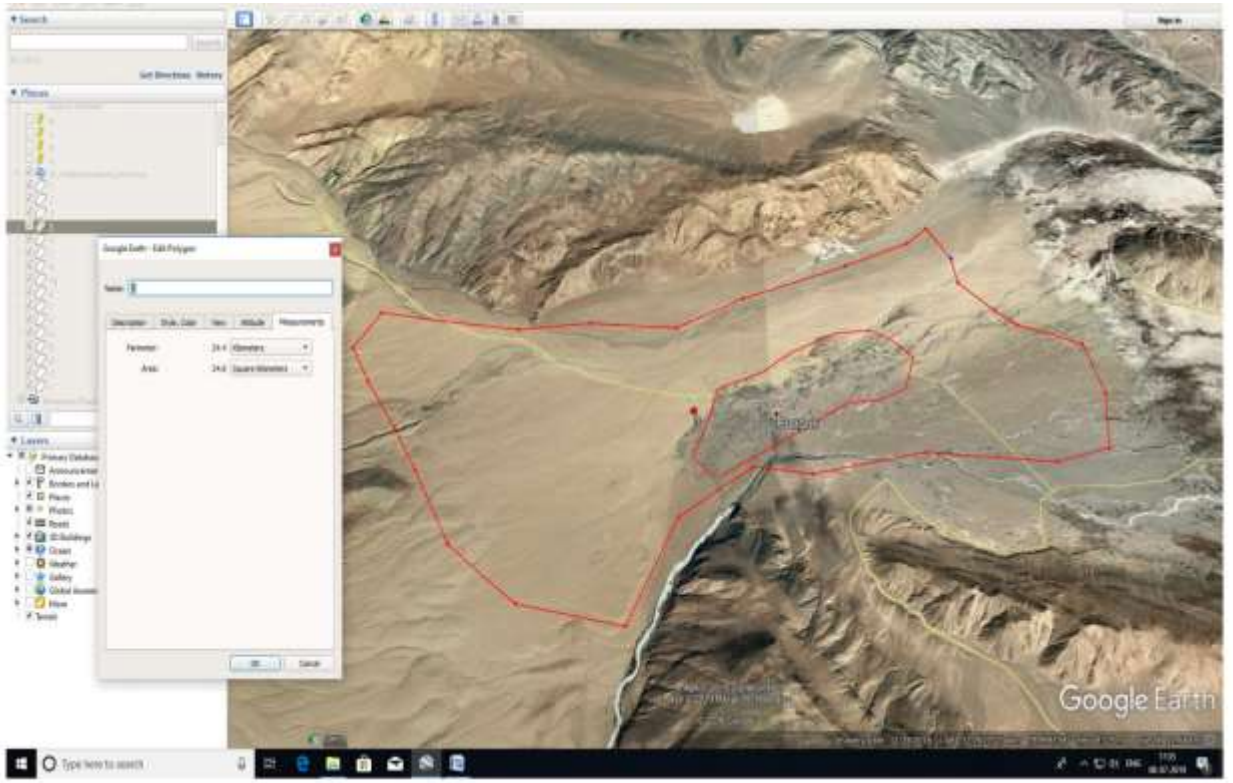
| Sl.no | Site id | Latitude | Longitude |
|---|---|---|---|
| 1 | 1 | 34° 9' 4.43" | 77° 27' 56.92" |
| 2 | 2 | 34° 8' 23.86" | 77° 28' 51.1" |
| 3 | 3 | 32° 45' 32.15" | 78° 53' 24.68" |
| 4 | 4 | 33° 35' 11.94" | 78° 38' 35.77" |
| 5 | 5 | 34° 50' 11.98" | 77° 30' 25.49" |
| 6 | 9 | 33° 44' 3.37" | 78° 26' 51.86" |
| 7 | A | 34° 11' 42.72" | 77° 22' 12.43" |
| 8 | B | 34° 15' 17.39" | 77° 13' 26.47" |
| 9 | C | 33° 59' 23.82" | 77° 41' 1.75" |
| 10 | I | 33° 15' 15.7" | 78° 54' 28.01" |



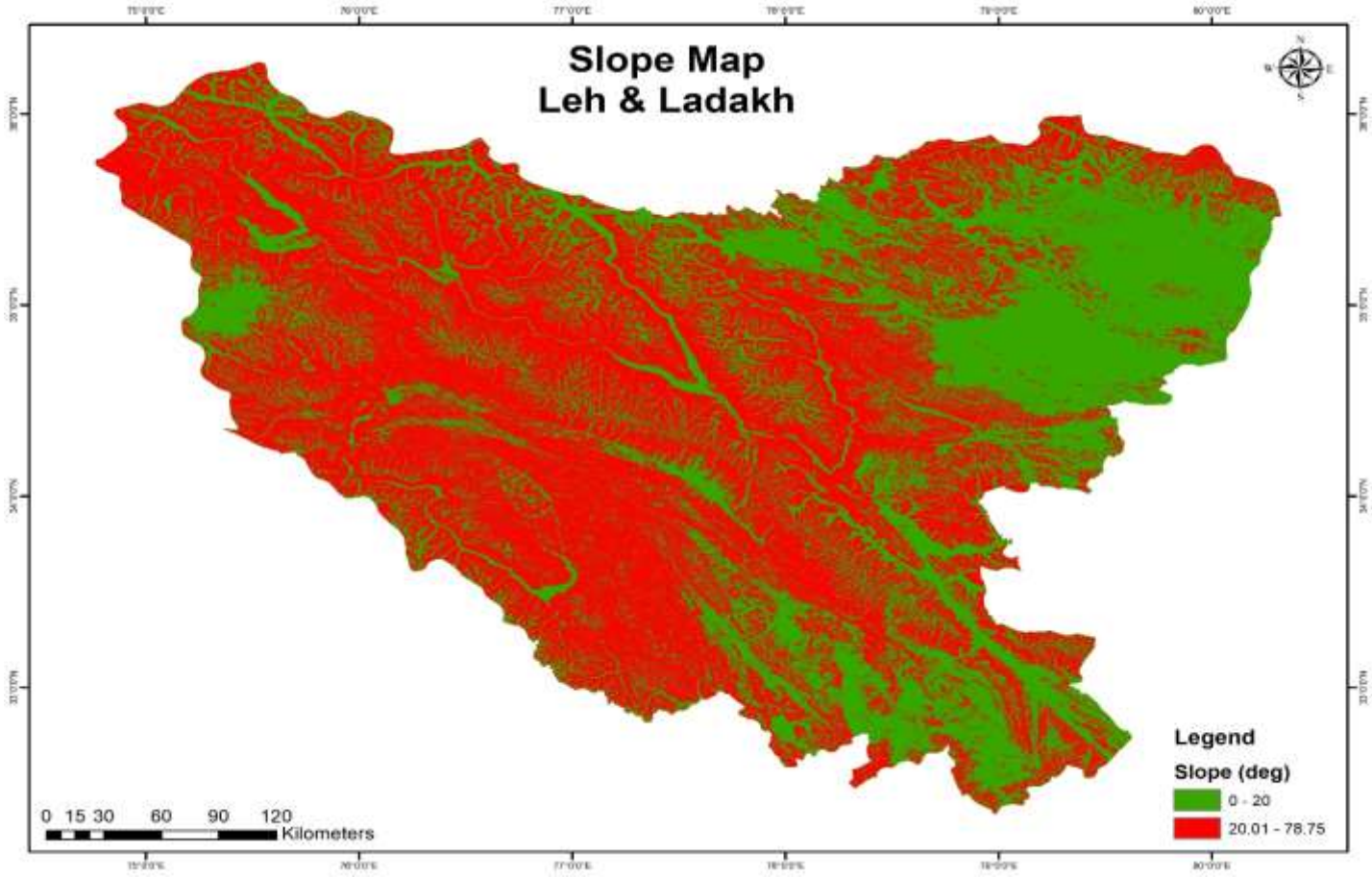
# Criteria considered for the selection of the sites

- Unexplored/ new areas
- Availability of wind potential based on the meso scale wind potential by NIWE (most of the potential locations as per MESO-Scale data falls at highly elevated region in Leh, which are inaccessible and does not have sufficient space for subsequent wind farm developments, crane movements etc.,)
- Few of the locations are identified at valleys, so as to capture the wind characteristics in that region. (preference is given to the locations having sufficient land for the subsequent developments)
- Availability of Obstacles/ free land area so as to capture the free flow wind.
- Nearest accessibility to the existing approach roads / logistics.
- Possibility of future extension for wind farm development.

# Availability of land in the valleys

# Slope Map of Leh -Ladakh



# M/s. Airtel Telecom Tower Locations at Leh

| Site ID | Site Name | Site address | lat | Long | Tower Type | Tower Height | District |
|---|---|---|---|---|---|---|---|
| BSG959 | Basgo | Basgo Welfare Society, C/O- Bsewang Moruk, Near Bsnl Tower, Ph-9419269809 | 34.2193 | 77.26865 | GBT | 60 | Leh(Ladakh) |
| CHT015 | Chichot | Mr Zaiya S/O Hussain Ali, R/O Chichot Gongma, Opp. Medical Centre. 9419372960 | 34.0291 | 77.65056 | GBT | 50 | Leh(Ladakh) |
| STG009 | Stagna | Tsering Chorol, Vill. Stagna Near Stagna monastery Leh Ladakh | 33.9878 | 77.68827 | GBT | 60 | Leh(Ladakh) |
| LEH756 | Changa-1 | Thundel Tsogspa Igo Village Igo Tehsil Kharu District Leh | 33.8857 | 77.77170 | GBT | 50 | Leh(Ladakh) |

*These telecom towers were majorly located at the valley and were located at new/ unexplored areas of Leh.*

# Solar Radiation Resource Assessment Studies

- NIWE had established a SRRA stations at Energy Park, Ladakh Renewable Energy Development Agency

| Data_for_Monthly_Long_Term_Aver | | | |
|---|---|---|---|
| Latitude | | Longitude | |
| 34.1288986 | | 77.4600983 | |
| Month | GHI(W/m2) | DNI(W/m2) | DHI(W/m2) |
| Jan | 118.5859985 | 142.0879974 | 50.3863983 |
| Feb | 149.602005 | 140.5379944 | 68.7937012 |
| March | 216.0440063 | 196.5769958 | 88.2347031 |
| April | 259.3080139 | 222.7149963 | 101.4690018 |
| May | 297.6369934 | 276.0780029 | 100.1269989 |
| June | 308.8980103 | 281.25 | 99.5090027 |
| July | 298.428009 | 267.1950073 | 94.4094009 |
| Aug | 280.3819885 | 277.3479919 | 77.1785965 |
| SEP | 246.5769958 | 293.3210144 | 53.0651016 |
| Oct | 206.2740021 | 303.6459961 | 31.3568993 |
| Nov | 152.2489929 | 229.1679993 | 43.4403992 |
| Dec | 121.5400009 | 181.0800018 | 42.9454002 |

# Conclusion

- Ladakh has very good solar resource and also wind resource.
- With low temperature, the solar energy CUF is more than 22%
- The identified wind CUF with sub-class MW turbine is more than 25%
- With right mix of hybrid of wind and solar, the combined CUF could be more than 45% and this would optimize the transmission system also.

Thank you