NATIONAL INSTITUTE OF WIND ENERGY(NIWE)
CHENNAI

"Techno Economic Analysis of SWT for Telecom Towers – A case study"

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SOME FACTS ABOUT TELECOM TOWERS

- Telecom towers are energy intensive.
- Require non-stop power without any interruption.
- Presently, about 4,40,000 numbers of telecom towers are installed in India:
  - Out of this, about 1,93,000 towers are on the grid,
  - 1,67,000 are connected to unreliable grid and
  - balance 79,200 are off grid
  - Only 1 % of these towers are powered from two weather driven renewable sources, wind and solar.

- Mobile tower network consumes 17 billion kWh supplied intermittently from the grid/ diesel gen sets
- Annual consumption of diesel about 3 billion litres of diesel, which accounts Rs. 4,300 crore from the public exchequer towards subsidy.
- Even if, 2.5 lakh mobile towers shift to renewable power from diesel, then the cost saved could be anywhere around 6,400 crore annually.

2.1 kW SWT installed at Khuri Village District Jaisalmer

Source : Energy Next

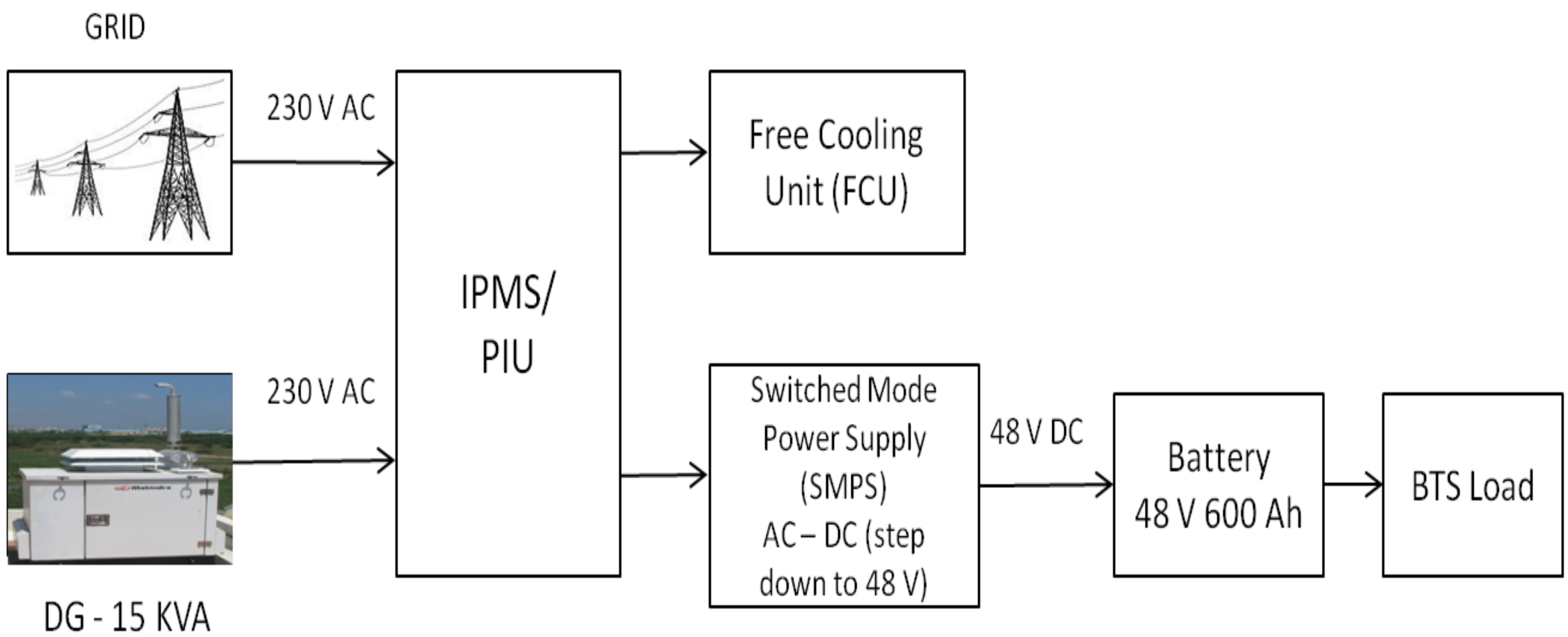
CASE STUDY ON TELECOM TOWER IN JAISALMER UNDERTAKEN BY NIWE

- SWTs are installed at 4 locations : Khuri, Mulya, Kowa, and Pithala villages.
- Telecom towers are owned by M/s Bharti Infratel and the telecom service provided is M/s Airtel
- The BTS at these locations has connected electrical load of 3 kW and consumes about 20 - 24 kWh/day.
- Prior to the installation of SWTs at these locations, the uninterrupted power was supplied from diesel generators of capacity 15 KVA installed at these locations.
- The average consumption of diesel was 8 - 10 litres/day.

2.1 kW SWT installed at Phithala Village District Jaisalmer

CASE STUDY ON TELECOM TOWER IN JAISALMER

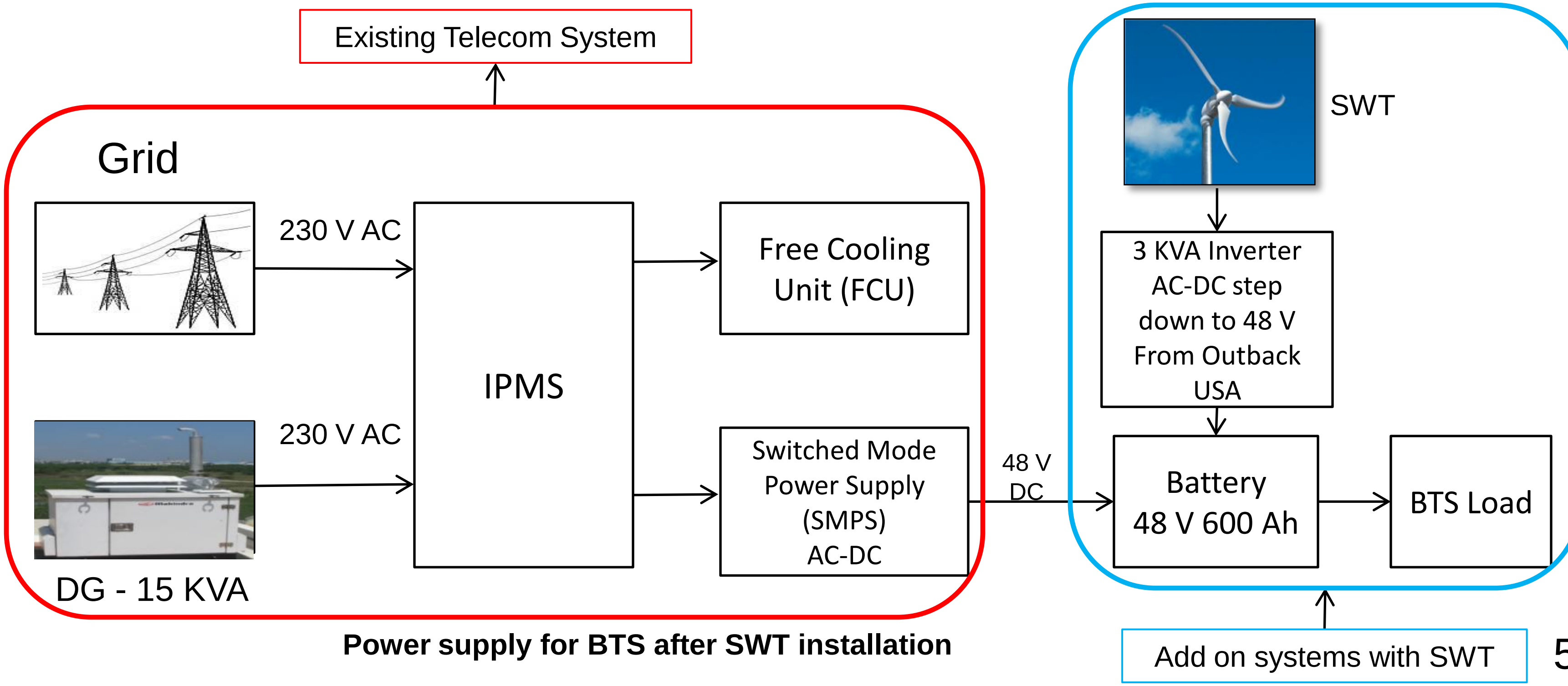
- The BTS loads : Transceiver system, IPNS load, lighting load, and Power management unit.
- Other loads: Air conditioners to the DG set/main grid where ever available



Power supply for BTS prior to SWT installation

CASE STUDY ON TELECOM TOWER IN JAISALMER

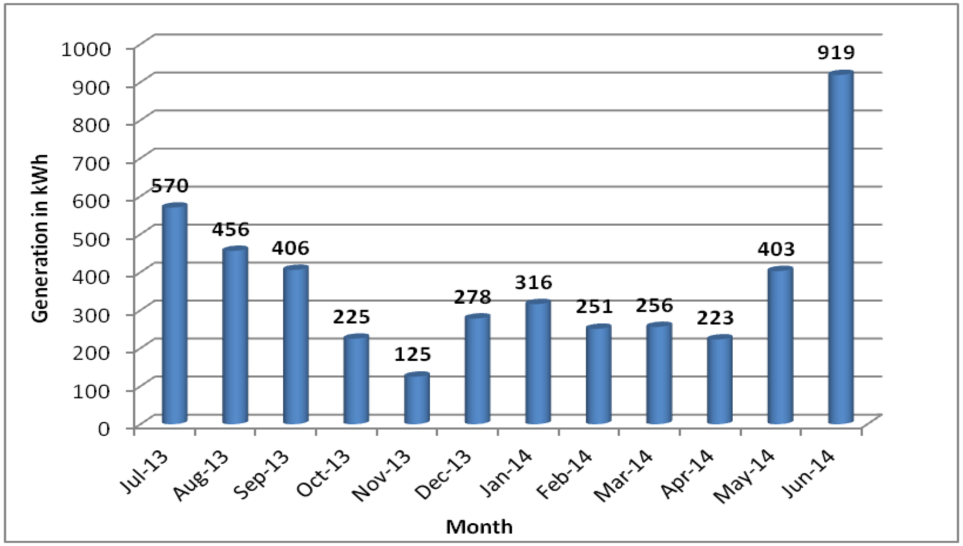
- The data from NIWE (erstwhile C-WET) 25 m mast located at 26°.94'N latitude and 70°.88'77.78"E longitude Jaisalmer district indicates annual average wind speed of 5.5 m/s at 25 m height.
- The wind power density
  - At 25 m level : 182 W/m^2
  - At 50 m level : 244 W/m^2.
- One SWT, Skystream 3.7 with a reference power of 2.1 kW @ 11 m/s was installed atop each of the telecom towers with hub height ranging from 60 - 64 m.



Power supply for BTS after SWT installation

Case study of 2.1 kW SWT installed at Khrui

Monthly energy generation for July 2013- June 2014



2.1 kW SWT installed in Khuri

Parameters	Values
Total annual generation	4428 kWh
Average monthly generation	369 kWh
Daily average generation	12.3 kWh
Capacity factor with a load of 3 kW	24.07%
Diesel consumption before installation of the SWT	8 litres
Diesel consumption after installation of the SWT	Nil
Saving in Diesel per annum (litres)	2920 litres
Saving per annum (in Rs assuming 52 Rs/ l of diesel)	Rs. 1.5 lakhs
Reduction in carbon emission (1 l of diesel emits 0.7 kg)	2045 kg

Assumptions for cash flow Analysis

Sl.No.	Assumptions / descriptions	Cost of generation without MNRE subsidy	Cost of generation with MNRE subsidy	Avoided cost of generation with MNRE subsidy
1	System capacity	2.1 kW	2.1 kW	2.1 kW
2	Cost of the project	Rs. 7.00 lakhs / 2.1 kW	Rs. 7.00 lakhs	Rs. 7.00 lakhs
3	Promoters equity	Rs. 2.10 lakhs (30% of the project cost)	--	Rs 4.90 lakhs (70% of the project cost)
4	Return on Equity	18%	--	18%
5	Loan Amount	Rs. 4.90 lakhs (70% of the project cost)	Rs. 4.90 lakhs (70% of the project cost)	--
6	Rate of interest for the loan	11%	11%	--
7	Loan repayment	Assumed that loan repayment is equivalent to the depreciation of the SWT and associated equipments so that the loan can be repaid in 10 years.	Assumed that loan repayment is equivalent to the depreciation of the SWT and associated equipments so that the loan can be repaid in 10 years.	--
8	Subsidy	--	Rs. 2.1 lakhs as subsidy from MNRE	Rs. 2.1 lakhs as subsidy from MNRE

Assumptions for cash flow Analysis

Sl. No.	Assumptions / descriptions	Cost of generation without MNRE subsidy	Cost of generation with MNRE subsidy	Avoided cost of generation with MNRE subsidy
9	Levelized cost of Diesel power	--	--	Rs. 30/- per kWh for the first year and thereafter increase of 5% for subsequent years until 20 years.
10	O&M cost	2% of the project cost from 6th year. Increased by 5% per annum. Assuming 5 years free warranty.	2% of the project cost from 6th year. Increased by 5% per annum. Assuming 5 years free warranty.	2% of the project cost from 6th year. Increased by 5% per annum. Assuming 5 years free warranty.
11	Insurance	Assuming 1% of the project cost to be paid for year uniformly for 20 years.	Assuming 1% of the project cost to be paid for year uniformly for 20 years.	Assuming 1% of the project cost to be paid for year uniformly for 20 years.
12	Discount Rate	11%	11%	--

Results of Cash flow Analysis*

Sl.N.	Description	Mulya	Khuri	Pithala	Kowa
1	Average daily generation (kWh)	14	12	15	15
2	Levelized cost of generation without MNRE subsidy (Rs. / kWh)	21.80	25.43	20.34	20.34
3	Levelized cost of generation with MNRE subsidy (Rs. / kWh)	14.40	16.80	13.44	13.44
4	Equity IRR (in %) assuming avoided cost with MNRE subsidy (cash flow with subsidy)	34.22	29.48	36.52	36.52

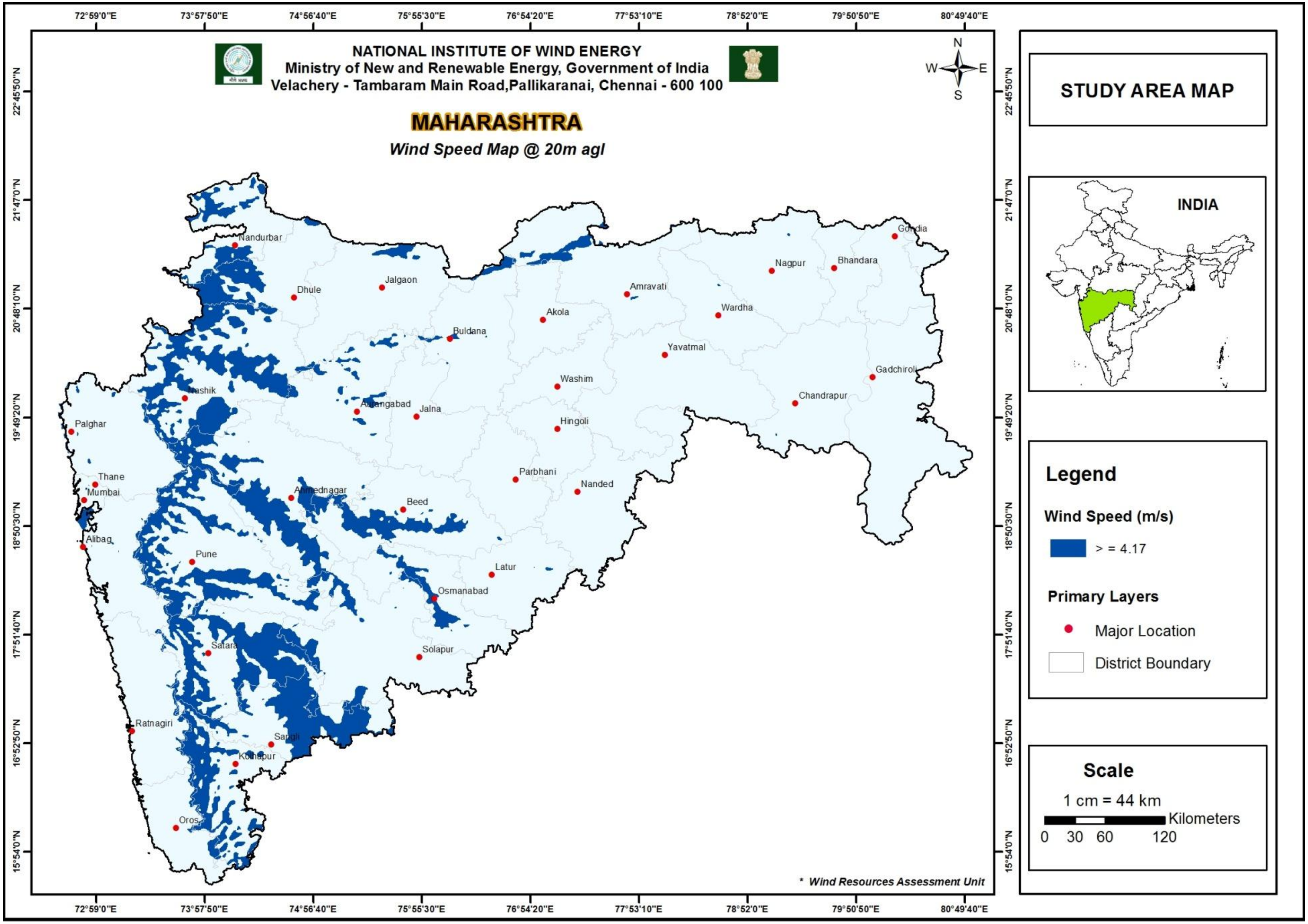
CONCLUSION of Case Study on SWT for Telecom Towers at 4 sites in Jaisalmer

- Annual average wind speed :5.5 m/s at 25 m height and extrapolated at 65 m level (using a power law index as 0.2) is about 6.65 m/s.
- Capacity utilization factor for all the four sites is about 25%.
- Daily average generation ranges from 12 to 15 kWh
- Levelized cost of the generation without MNRE subsidy ranges : Rs. 20.34/ kWh to Rs. 25.45/kWh (for daily generation between 15-12 kWh)
- Levelized cost of the generation with MNRE subsidy ranges : from Rs. 13.44/ kWh to Rs. 16.80/kWh (for daily generation between 15-12 kWh)
- The Equity IRR (in %) assuming the avoided cost of Rs. 30/kWh with MNRE subsidy ranges : from 29.48 to 36.52% (for daily generation between 12-15 kWh)
- Project seems to be viable even without the MNRE subsidy as the cost of generation ranges from: Rs. 20.34/kWh to Rs. 25.45/kWh as against Rs 35/ KWh diesel cost (inclusive of fuel, transportation and filling charges)
- Project would be viable with MNRE subsidy support only ,in areas where the capacity utilization factors are lesser than 16%

THANKS

STATUS OF TESTING CARRIED OUT

COMPLETED (12 Nos.)		SHORT CLOSED (on request by client) (3 Nos.)	
1.	WHISPER 200, 570 W – LRES	1.	SnW Vaayu, 1 kW – Sun N Wind
2.	SNT 5, 550 W – Supernova	2.	E-300i, 1 kW – E-hands
3.	SNT 6, 600 W – Supernova	3.	Altem 10 kW – Altem Energy
4.	Genie 5000, 2.7 kW – Auroville		
5.	Passaat 1 kW – Spitzen	**ONGOING (3 Nos.)**	
6.	LRES WHISPER 500, 2 kW – LRES	1.	Windistar 4500, 4.5 kW – LRES
7.	UE 42, 3.6 kW - Unitron	2.	VAATA SMART, 15 kW – VAATA
8.	UE 33, 2.3 kW – Unitron	3.	NALWIN, 600 W – Aparna Energy
9.	UE 42+, 3.8 kW – Unitron		
10.	SPV WT1, 70 W – Sun Air power		
11.	Montana 3 kW – Spitzen		
12.	E-400i, 1.9 kW - E-Hands		



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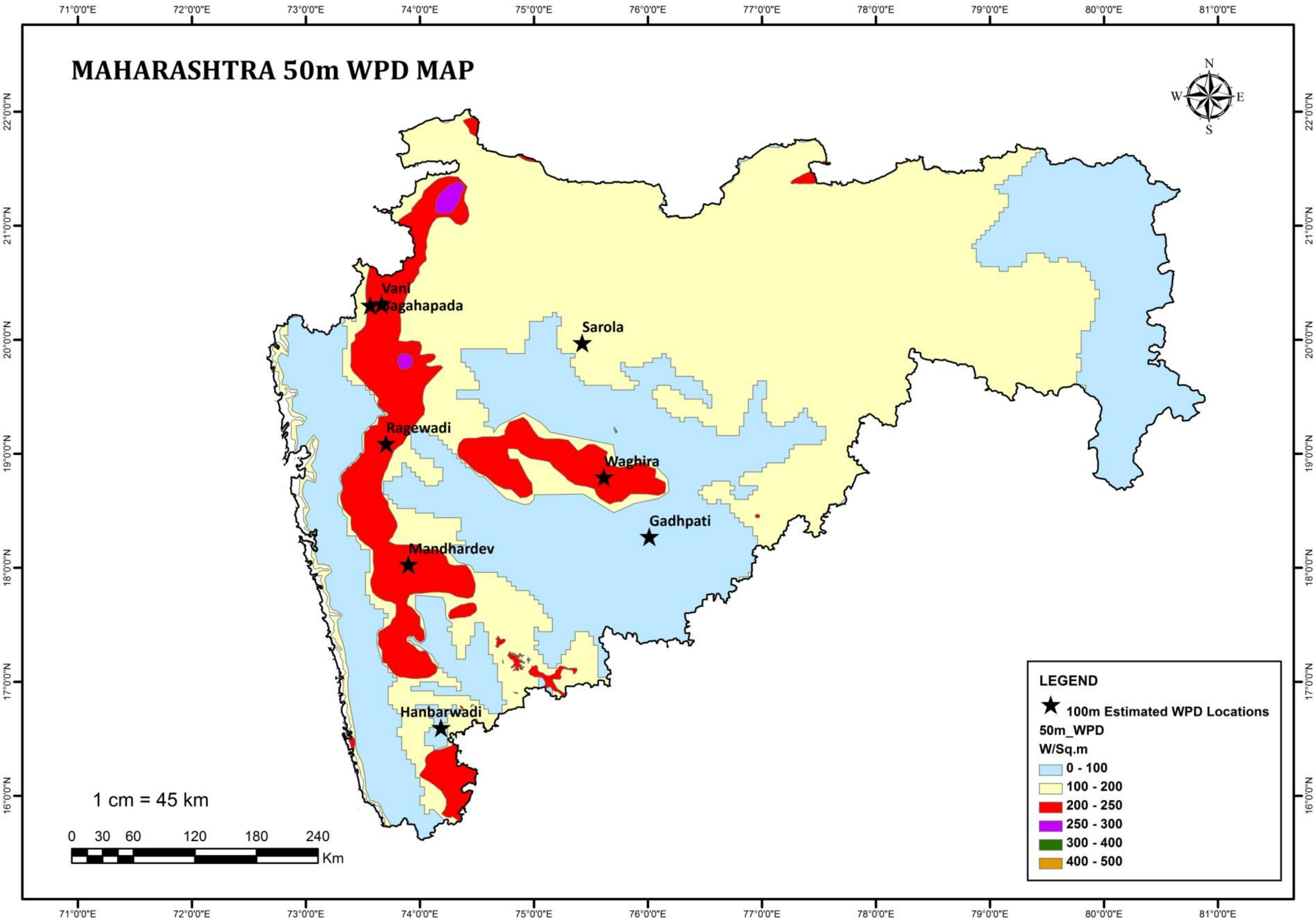
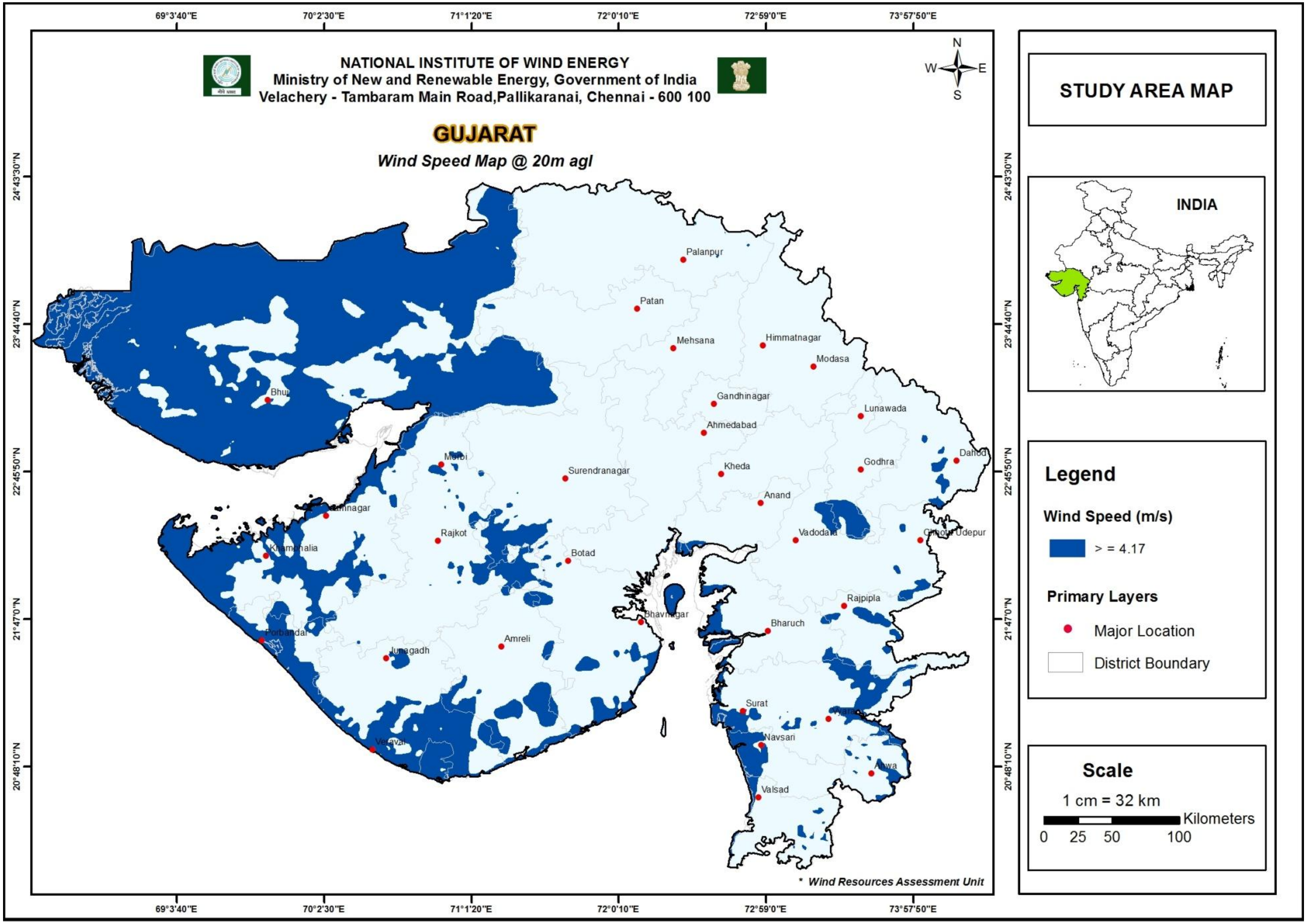
Velachery - Tambaram Main Road,Pallikaranai, Chennai - 600 100
MAHARASHTRA
Wind Speed Map @ 20m agl
STUDY AREA MAP
INDIA
Legend
Wind Speed (m/s)
> = 4.17
Primary Layers
Major Location
District Boundary
Scale
1 cm = 44 km
Kilometers
0 30 60 120
* Wind Resources Assessment Unit
Nandurbar
Jalgaon
Dhule
Buldana
Amravati
Akola
Nagpur
Bhandara
Gondia
Wardha
Yavatmal
Washim
Gadchiroli
Chandrapur
Hingoli
Jalna
Nashik
Palghar
Thane
Mumbai
Alibag
Pune
Beed
Parbhani
Nanded
Latur
Osmanabad
Solapur
Satara
Ratnagiri
Sangli
Kolhapur
Oros


MAHARASHTRA 50m WPD MAP
71°0'0"E
72°0'0"E
73°0'0"E
74°0'0"E
75°0'0"E
76°0'0"E
77°0'0"E
78°0'0"E
79°0'0"E
80°0'0"E
81°0'0"E
22°0'0"N
21°0'0"N
20°0'0"N
19°0'0"N
18°0'0"N
17°0'0"N
16°0'0"N
N
W
E
S
Vani
Sagahapada
Sarola
Ragewadi
Waghira
Gadhpati
Mandhardev
Hanbarwadi
1 cm = 45 km
0 30 60 120 180 240
Km
LEGEND
100m Estimated WPD Locations
50m_WPD
W/Sq.m
0 - 100
100 - 200
200 - 250
250 - 300
300 - 400
400 - 500



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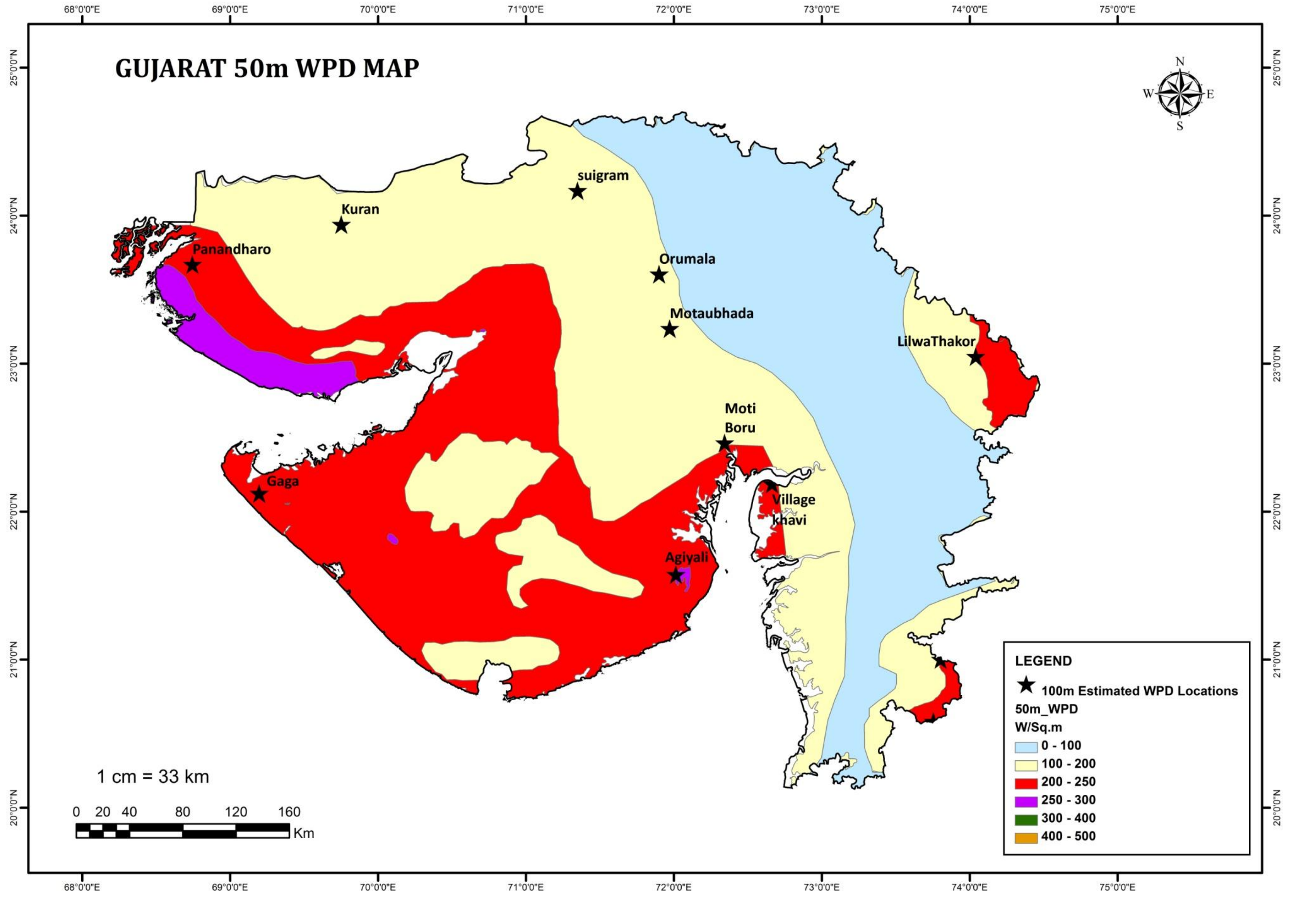
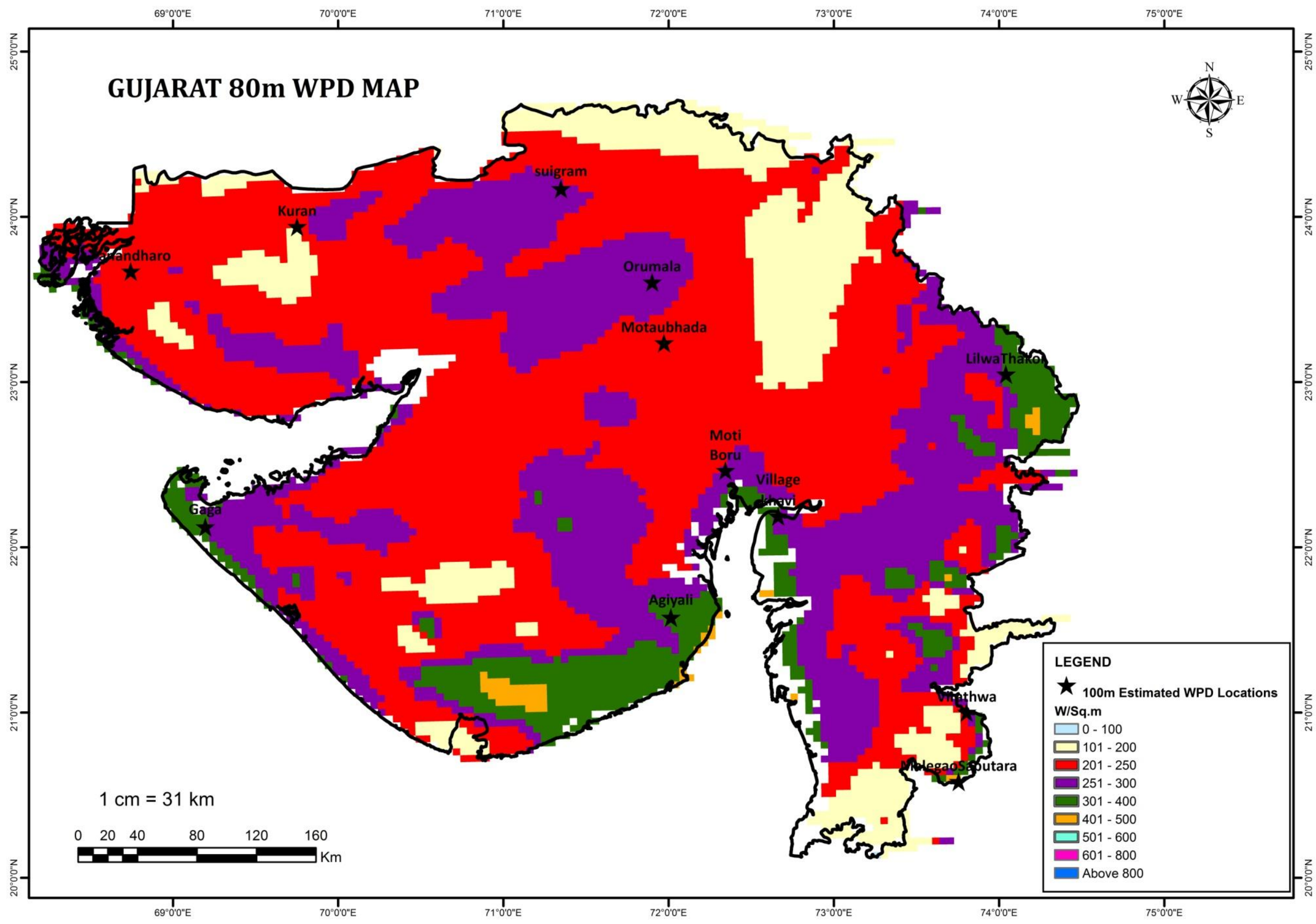
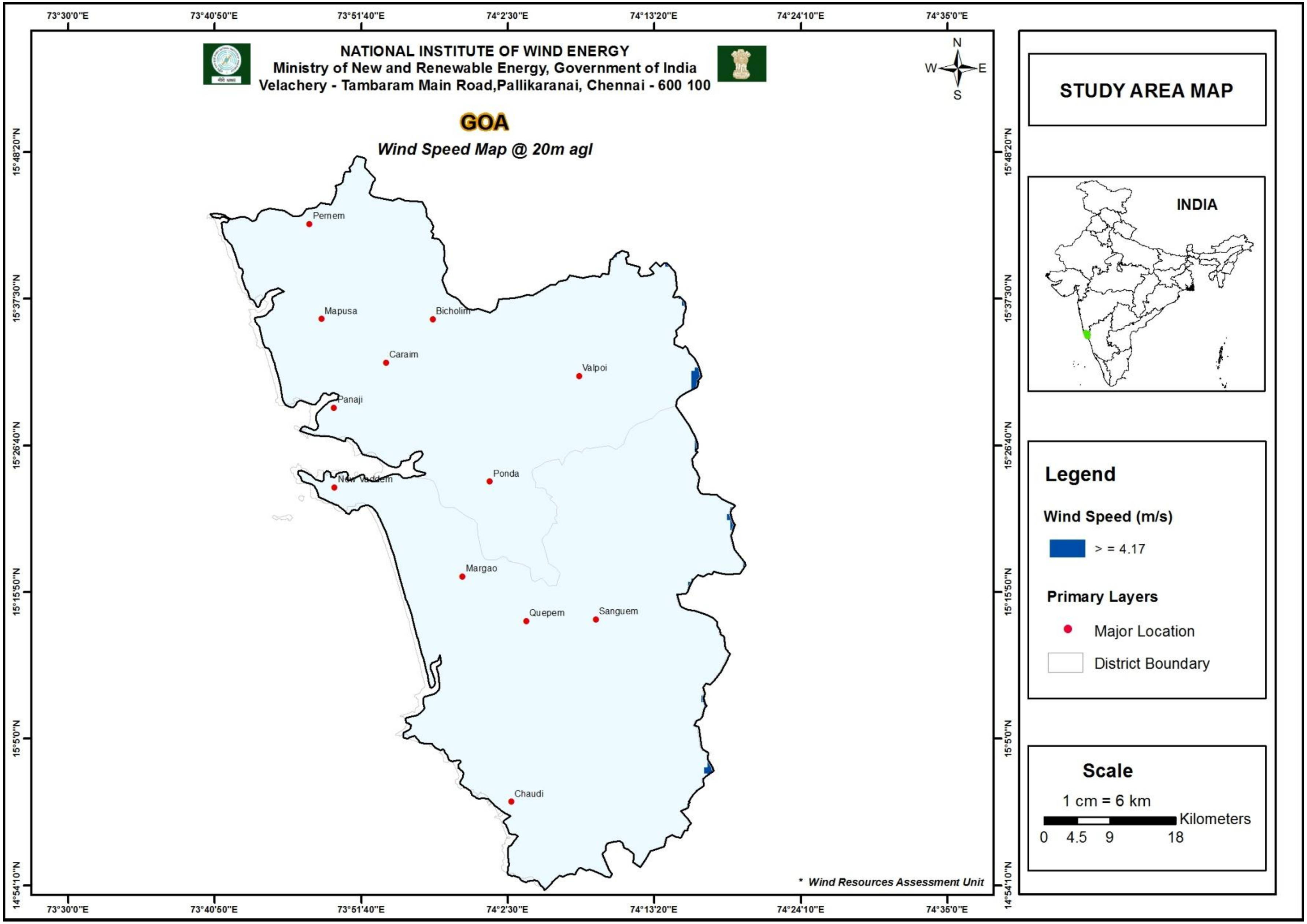
GUJARAT
Wind Speed Map @ 20m agl
STUDY AREA MAP
INDIA
Legend
Wind Speed (m/s)
> = 4.17
Primary Layers
Major Location
District Boundary
Scale
1 cm = 32 km
Kilometers
0 25 50 100
* Wind Resources Assessment Unit
Palanpur
Patan
Mehsana
Himmatnagar
Modasa
Gandhinagar
Ahmedabad
Lunawada
Bhuj
Morbi
Surendranagar
Kheda
Godhra
Dahod
Anand
Vadodara
Rajkot
Botad
Rajpipla
Bhavnagar
Bharuch
Porbandar
Junagadh
Amreli
Surat
Navsari
Veraval
Valsad
69°3'40"E
70°2'30"E
71°1'20"E
72°0'10"E
72°59'0"E
73°57'50"E
24°43'30"N
23°44'40"N
22°45'50"N
21°47'0"N
20°48'10"N


GUJARAT 50m WPD MAP
N
W
E
S
suigram
Kuran
Panandharo
Orumala
Motaubhada
LilwaThakor
Moti
Boru
Gaga
Village
khavi
Agiyali
68°0'0"E
69°0'0"E
70°0'0"E
71°0'0"E
72°0'0"E
73°0'0"E
74°0'0"E
75°0'0"E
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
21°0'0"N
20°0'0"N
LEGEND
100m Estimated WPD Locations
50m_WPD
W/Sq.m
0 - 100
100 - 200
200 - 250
250 - 300
300 - 400
400 - 500
1 cm = 33 km
0 20 40 80 120 160
Km


GUJARAT 80m WPD MAP
suigram
Kuran
Orumala
Motaubhada
LilwaThakor
Moti
Boru
Village
Gaga
Agiyali
LEGEND
100m Estimated WPD Locations
W/Sq.m
0 - 100
101 - 200
201 - 250
251 - 300
301 - 400
401 - 500
501 - 600
601 - 800
Above 800
1 cm = 31 km
0 20 40 80 120 160
Km
N
S
W
E
69°0'0"E
70°0'0"E
71°0'0"E
72°0'0"E
73°0'0"E
74°0'0"E
75°0'0"E
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
21°0'0"N
20°0'0"N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GOA
Wind Speed Map @ 20m agl
N
W
E
S
73°30'0"E
73°40'50"E
73°51'40"E
74°2'30"E
74°13'20"E
74°24'10"E
74°35'0"E
15°48'20"N
15°37'30"N
15°26'40"N
15°15'50"N
15°5'0"N
14°54'10"N
Pernem
Mapusa
Bicholim
Caraim
Valpoi
Panaji
Ponda
New Vaddem
Margao
Quepem
Sanguem
Chaudi
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0
4.5
9
18