

## Storage of Solar power for Micro Grids in the Islands of Andaman & Nicobar, as well as Lakshadweep

*JOINT ELECTRICITY REGULATORY COMMISSION For the State of Goa and Union Territories*

These are Renewable Energy deficient areas (poor Capacity Utilization Factor & Low Solar Insolation). Further, these areas mostly being Coastal /Islands are tourist attraction and are having land constraint for Ground Mounted Solar Installation. Details of various areas under the jurisdiction of this Commission are:

Sl.	Location	Latitude	Longitude	Remarks
1.	<b>Andaman &amp; Nicobar</b>	<b>11.68° N</b>	<b>92.77° E</b>	<b>Islands, Not Connected to National Grid, 1000 Kms from Mainland, Tourists place. The Power is Generated by Diesel and is thus very expensive.</b>
2.	<b>Lakashadweep</b>	<b>10° 00' N</b>	<b>73.00° E</b>	<b>Islands, Not Connected to National Grid, 300 Kms. from Mainland Tourists place. The Power is Generated by Diesel and is thus very expensive.</b>
<b>Other Territories under the Jurisdiction of the Commission</b>				
3.	Goa	15.4989° N	73.8278° E	Coastal, Tourists Place
4.	Chandigarh	30.75° N	76.78° E	Non Coastal, Small Area, Pollution free area
5.	Dadra & Nagar Haveli	20.27° N	73.02° E	Highly Industrialized 95% Power Consumption by Industry, Highest Per Capita Power Consumption in India because of Industry
6.a	Daman	20° 25' N	72°.53° E	Coastal, High concentration of Industry
6.b	Diu	20° 42' N	71.01° E	Tourists Place, Coastal
7.a	Puducherry- Puducherry	11.93° N	79.83° E	Tourists, Coastal
7.b	Karaikal- Puducherry	10° 55' N	79. 52° E	Tourists, Coastal
7.c	Mahe- Puducherry	11.7011° N	75.5367° E	Tourists, Coastal
7.d	Yanam- Puducherry	16.7333° N	82.25° E	Tourists, Coastal

The Joint Electricity Regulatory Commission (JERC) is pushing for Solar Roof Tops in all the seven territories. The Islands at Sl. 1 & 2 in the above table are most challenging. Details of Sl. 1 and 2 are placed in the annexure 'A' to this document. Reaching various Islands poses problem in high tide thus providing continuous power are achieving high standards of service provisions electricity (SoP) sometime is a challenge.

The JERC looks forward to the Solutions from experts in respect of Solar Power Storage and Micro Grids.

Thanks

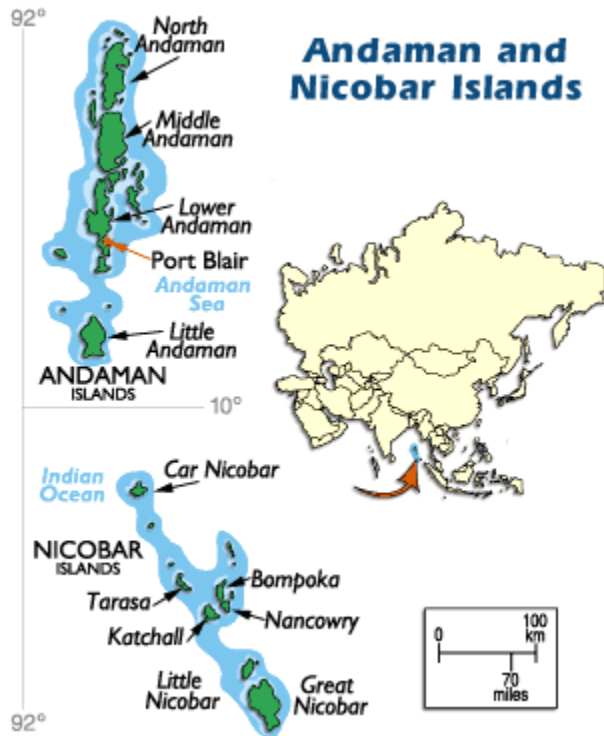
## Annexure 'A'

1. **Andaman & Nicobar Islands** are a cluster of islands scattered in the Bay of Bengal. These islands are truncated from rest of India by more than 1000 kms. The total area of the territory is 8249 sq. kms having population of 379,944 as per 2011 Census provisional records & average growth rate is 6.68%. The tempo of economic development has tremendously accelerated along with all-round expansion in the areas/sectors viz. (i) Shipping Services, (ii) Civil Supplies, (iii) Education, (iv) Fisheries, (v) Tourism & Information Technology, (vi) Health, (vii) Industries, (viii) Rural Development, (ix) Social Welfare, (x) Transport, (xi) Increase in District Headquarters (xii) Central Government Department, (xiii) Public Undertaking & other offices, (xiv) Services & Utilities, (xv) Defense Establishment (xvi) Commercial Organisations/Business Centres etc. Thus, these islands have reached at the take-off stage of total economic transformation. All these economic and infrastructure developments requires power as a vital input & to play a key role for achieving overall transformations.

Due to the geographical & topographical peculiarities of these islands including separation by sea over great distances there is no single power grid for the entire electrified island and instead a power house caters independently to the power requirements of area/islands.

The consumer base of EDA&N consists of Domestic, Commercial and Industry, consumers. Sales mix is primarily dominated by Domestic consumers, followed by Commercial consumers. The total consumption of Domestic consumers is approximate 49 percent and Commercial consumers contribute to around 27 percent of total sales.





Source of Power Generation in Andaman & Nicobar

S. No.	Source	Location	Power Station Derated Capacity (in MW)
1	IPP – SPCL	South Andaman	15.000
2	HPP-I	South Andaman	0.600
3	HPP-II	South Andaman	10.000
4	HPP-III	North Andaman	1.000
5	G/Ch. SPV	South Andaman	5.000
6	Chatham	South Andaman	9.600
7	Phoneix Bay	South Andaman	6.600
8	Raj Niwas	South Andaman	1.024
9	Medical	South Andaman	
10	Secretariat	South Andaman	
11	RutLand	Rutland	0.024
12	45 Acre	Rutland	
13	Neil Island	Neil Island	0.371
14	Havelock	Havelock	1.101
15	Hutbay	Little Andaman	2.595
16	Dugong Creek	Little Andaman	0.025
17	Strait Island	Strait Island	0.028
18	Baratang	Middle Andaman	0.512
19	Rangat Bay	Middle Andaman	6.710
20	Bangaon	Middle Andaman	
21	Hanspuri	Middle Andaman	
22	Long Island	Middle Andaman	0.270

S. No.	Source	Location	Power Station Derated Capacity (in MW)
23	Gandhi Nagar	North Andaman	0.230
24	Ganesh Nagar		
25	Shanti Nagar		
26	Smith Island		1.520
27	Sita Nagar		4.800
28	KHEP** Hydro		
29	Kinyuka NPH		
30	Head Quarters		
31	Kamorta	Kamorta	0.770
32	Bunderkhari		
33	Derring		
34	Alukheak		
35	Changua		
36	Manak		
37	Pillpillow		
38	Kakana		
39	Champion	Nancowry	0.080
40	Hitoi		
41	Katchal NTPC Hydro	Katchal	0.690
42	Katchal NPH		
43	Upper Katchal		
44	Teressa	Teressa	0.468
45	Chukmachi		
46	Minyuk		

*Electricity Consumption Pattern in Andaman & Nicobar*

S. No.	Consumption in Mn. Units Category wise	FY 2014-15
1	Domestic	114.03
2	Commercial	61.29
3	Industry	12.98
4	Bulk	30.54
5	Public Lighting	8.76
6	Irrigation Pumps & Agriculture	1.02
	<b>Total</b>	<b>228.62</b>

## 2. Lakshadweep

The Union Territory (UT) of Lakshadweep is an archipelago consisting of 12 atolls, three reefs and five submerged banks. It is a uni-district Union Territory with an area of 32 Sq. Kms and is comprised of eleven inhabited islands, 17 uninhabited islands attached islets, four newly formed



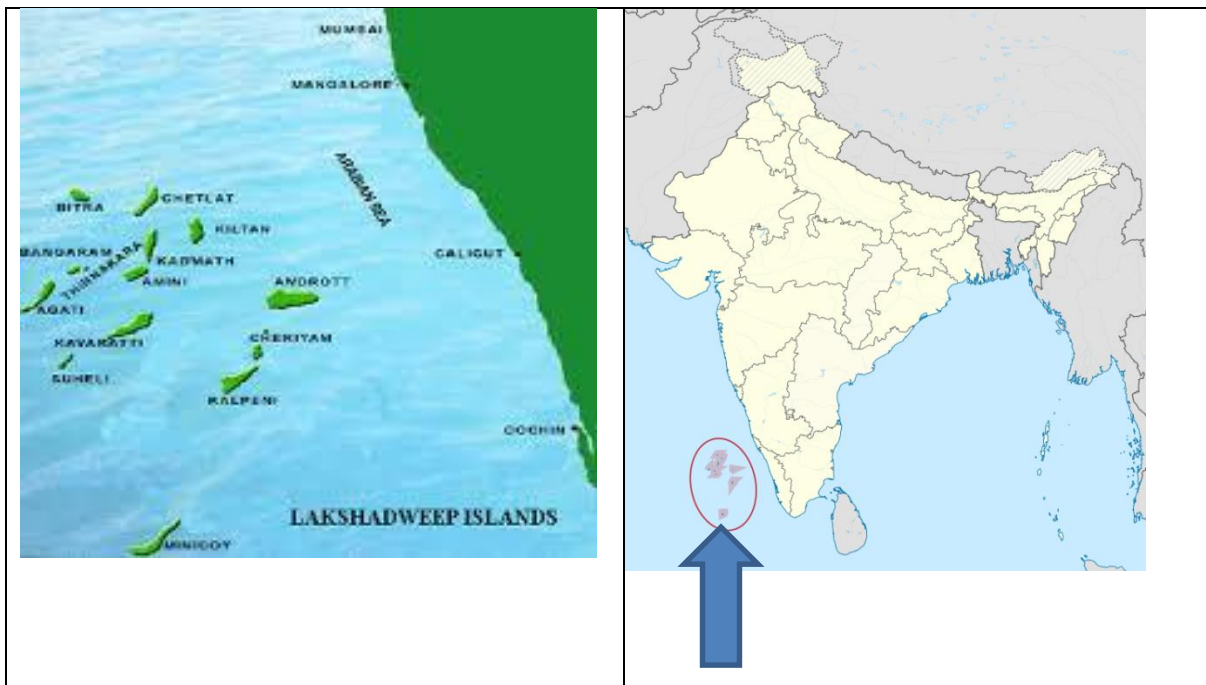
islets and 5 submerged reefs. The inhabited islands are Kavaratti, Agatti, Amini, Kadmat, Kiltan, Chetlat, Bitra, Andrott, Kalpeni, Bangaram and Minicoy. As the UT is an archipelago consisting of 11 inhabited islands and located far from the mainland of India, Lakshadweep is entirely dependent on its own generation for supply of power. The power in the UT of Lakshadweep is generated mainly from its Diesel Generating (DG) sets and a very few Solar Power sets.

Atoll/Reef/Bank (alternate name)	type	Land Area (km <sup>2</sup> )	Lagoon Area (km <sup>2</sup> )	No. of islets	Pop. Census 2001	Location
<b>Aminidivi Islands</b>						
Cora Divh	bank	-	339.45	-	-	13°42'N 72°11'E
Sesostris Bank	bank	-	388.53	-	-	13°08'N 72°00'E
Bassas de Pedro (Munyal Par, Padua Bank)	bank	-	2474.33	-	-	13°07'N 72°25'E
Cherbaniani Reef (Beleapani Reef)	reef	0.01	172.59	2	-	12°18'N 71°53'E
Byramgore Reef (Chereapani)	reef	0.01	57.46	1	-	11°54'N 71°49'E
Chetlat Island	atoll	1.14	1.60	1	2,289	11°42'N 72°42'E
Bitrā Island	atoll	0.10	45.61	2	264	11°33'N 72°09'E
Kiltān Island	atoll	2.20	1.76	1	3,664	11°29'N 73°00'E
Kadmat Island (Cardamom)	atoll	3.20	37.50	1	5,319	11°14'N 72°47'E
Elikalpeni Bank	bank	-	95.91	-	-	11°12'N 73°58'E
Perumal Par	reef	0.01	83.02	1	-	11°10'N 72°04'E
Amini Island <sup>1)</sup>	atoll	2.59	155.09 <sup>1)</sup>	1	7,340	11°06'N 72°45'E
<b>Laccadive Islands</b>						
Agatti Island (Agatti)	atoll	2.70	4.84	1	8,000	10°50'N 73°41'E

Atoll/Reef/Bank (alternate name)	type	Land Area (km <sup>2</sup> )	Lagoon Area (km <sup>2</sup> )	No. of islets	Pop. Census 2001	Location
Bangaram Island ( <i>Bangaram</i> )	atoll	2.30	4.84	1	61	10°50'N 73°41'E
Pitti Island <sup>1)</sup>	islet <sup>1)</sup>	0.01	155.09 <sup>1)</sup>	1	-	10°50'N 72°38'E
Androth Island ( <i>Andrott</i> )	atoll	4.90	4.84	1	10,720	10°50'N 73°41'E
Kavaratti Island	atoll	4.22	4.96	1	10,113	10°33'N 72°38'E
Kalpeni Island	atoll	2.79	25.60	7	4,319	10°05'N 73°38'E
Suheli Par	atoll	0.57	78.76	2	-	10°05'N 72°17'E
<b>Minicoy</b>						
Investigator Bank	bank	-	141.78	-	-	08°32'N 73°17'E
Minicoy Island	atoll	4.80	30.60	2	9,495	08°17'N 73°02'E
<b>Lakshadweep</b>		32.69	4203.14	32	60,595	08°16'-13°58'N, 71°44°-74°24'E

<sup>1)</sup> Amini Island and Pitti Island are both on **Pitti Bank**, a largely sunken atoll with a lagoon area of 155.09 km<sup>2</sup>

<sup>2)</sup> Bangaram and Agatti Islands are connected by a shallow submarine ridge



S. No.	Category	F 2013-14 Consumption in Mn. Units	Growth rate for FY 2014- 15
1	Domestic	30.37	14%
2	Commercial	9.27	12%
3	HT Industrial		-
4	Industrial	0.38	0%
5	Public (Street Light)	0.82	0%
6	Temporary Connections	0.05	27%
	<b>Total</b>	<b>40.89</b>	

#### Power Generation Capacity in Lakshdweep

Islands of the UT	Gross generation In MUs	Net generation in MUs ( after Auxiliary Consumption)
Minicoy	8.45	8.37
Kavaratti	10.90	10.77
Amini	5.52	5.45
Andrott	7.46	7.20
Kalpeni	3.80	3.75
Agatti	6.06	5.94
Kadmat	4.53	4.31
Kiltan	2.63	2.60
Chetlat	1.96	1.92
Bitra	0.392	0.386
Bangaram	0.079	0.069
<b>Subtotal 1</b>	<b>51.78</b>	<b>50.77</b>
210 kWp Minicoy SPV		0.178
760 kWp Kavaratti SPV		0.716
100 kWp Amini SPV		0.000
320 kWp Andrott SPV		0.245
100 kWp Kalpeni SPV		0.178
100 kWp Agatti SPV		0.105
260 kWp Kadmat SPV		0.159
100 kWp Kiltan SPV		0.004
100 kWp Chetlath SPV		0.000
50 kWp Bitra SPV		0

Islands of the UT	Gross generation In MUs	Net generation in MUs ( after Auxiliary Consumption)
50 kWp Bangaram SPV Solar		0
<b>Subtotal 2</b>		<b>1.585</b>
<b>Total Net Generation</b>		<b>52.36</b>

S. No.	Name of Island	Existing installed capacity – Diesel Generating Sets in Kw			
		New		Old	Total
1.	Minicoy	2X1000	2000	800	4400
		1X1600	1600		
2.	Kavaratti	2X1000	2000	0	3200
		2X600	1200	0	
3.	Amini	3x750	2250	400	2650
4.	Andrott	3X750			3250
		1X1000			
5.	Kalpeni	2X250	500	750	1250
6.	Agatti	3X400	1200	400	2350
		1X750	750		
7.	Kadmat	1X400	1900	250	2150
		3X250			
8.	Kiltan	2X400	800	200	1000
9.	Chetlat	2X250	900	0	900
		1X400			
10.	Bitra	1 X 100	100	330	430
11.	Bangaram	1X60	60	120	180
<b>12.</b>	<b>Total</b>		<b>18510</b>	<b>3250</b>	<b>21760</b>

***Experts to advice on Solar Storage on Islands with Mini Grids***

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