Applied Solar Technologies (AST)

Greening Telecom since 2009



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□ Industry Challenge

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Applied Solar Technologies

- Market leader in providing Renewable Energy Service to Telecom industry in India. Our solution runs at 3 out of 4 Telecom Towers that are on Solar in India today.
- ✓ Experienced and knowledgeable leadership team.
- ✓ We understand the technology, operations and management in distributed Renewable Energy Solutions for various applications.
- Provide Renewable Energy Service to customers on Build-Own Operate-Lease (BOOL) basis.
- We lower energy costs for our customers and reduce carbon footprint.
- New Focus selected countries in SAARC, AFRICA and ASEAN,
 Bangladesh, Nigeria, Kenya, Tanzania, Uganda, Indonesia

Key Management



Vinod K Agarwal Chairman and Managing Director



Kapil Kathpalia CEO



Ashok Juneja Sr Strategic Advisor



Avinash Mehrotra Chief Financial and Legal Advisor



Sushil Agarwal Chief Operating Officer



Sanjay Deshmukh President International Operations



Renewable Energy-As-A-Service





Build-own-operate, annuity model Innovative, hybrid, distributed, power generation



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Attractive Value Proposition - Telecom Customers



In return for 10-year, take or pay, annuity contracts



CAPEX by AST O&M by AST



Reduction in energy cost up to 20% from current



Reduction in diesel consumption up to 60% reduces exposure to diesel price volatility

Improvement in site up-time - 99.8% and above



Benefits of "Green" technology / energy deployment to AST customers



Annual GSMA Green Mobile Award for Best Green Product/Service or Performance : **Bharti Infratel** – Green Towers P7 Project



Voice & Data Magazine Awards 2011: Green Company of the Year--Indus Towers



Other Verticals and Geographies



Petrol Stations (Retail Outlets)

Actively engaged in Proof-Of-Concept with two of the largest Petroleum Companies In India: Bharat Petroleum Corporation and Indian Oil Corporation



Three petrol stations running on AST solution with diesel consumption reduced significantly



Expecting to close orders for 50-100 petrol stations by March 2013



Community Electrification

Pilot of "Energy Center" concept at each point of presence (Towers and Petrol Stations) – started last week – response has been good



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High Network Opex in Rural Areas



- 20% of the sites (largely in rural areas) contribute to 80% of the total energy spend
- Off grid or poor grid sites have high OPEX needs
- Costs and uptime are unpredictable
- Revenues/site are lower on

rural sites

AST enables its customers to **Reduce Cost** and **Improve Reliability**

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Typical Site Installations done by us







AST Solution: Energy-As-A-Service Model

Tower Components and Functionality









Securely mounted 3-10 kW high-efficiency crystalline panels maximize solar power



Existing 7.5-25 kVA Diesel Generator supports and recharges the Battery Bank



600-1500 AH Battery Bank, sheltered from the weather, powers the BTS

A smart and proprietary charge controller which is remotely managed



End-To-End Single Service Provider

Current Model

Services F	From different	Vendors					
Energy	А						
O&M	В						
Battery	С						
Manageme	ent D						
Diesel Fillir	ng E						
Security	F	Issues					
•High / unpredictable energy cost							
•Fuel Adulteration							
•High Maintena	nce Costs						

Proposed								
Services			Single					
Energy	AST		Provider					
O&M	AST							
Battery	AST		Fixed					
Management	AST		annuity based model					
Diesel Filling	AST							
Security	AST	lssu Reso	ues lved					
•Fixed cost and comprehensive Service								

Key differentiator - Comprehensive Solution

□ In-house 2nd Level Maintenance

- Diesel Generators
- SMPS
- Air-conditioning
- □ Trained & Certified team of technicians
- □ Tie-up with Authorized dealers for spares
- Regular training & refresher program







Superior Network Monitoring system

- ✓ All the alarms of all the operational sites (2K) are monitored at centralized NOC on 24x7 basis.
- Intelligent & Proprietary Power Management Module to optimize in real time the source of power.
- Smart Battery Management to increase battery life of standard
 VRLA batteries
- Provides dashboard reports to analyze and enhance efficiency of operation and reduction in cost continually.



Proprietary IPR Technology Modules



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AST Proprietary Monitoring System

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Site Operat	tional Data	1	Time 29/08/2011 18:19	Time 29/08/2011 18:19	123.98	52.40		Timestart	DG	29/08/2011 17:41	5.40	3.30	KWH 4.00	5.20	9.40	кwн 0.00	0.00	0.00	0.00	0.00	46.60
		2	29/08/2011 18:09	29/08/2011 18:09	123.81	52.40			DG	29/08/2011 17:41	5.30	2.90	3.50	5.20	8.10	0.00	0.00	0.00	0.00	0.00	45.60
₩ MIS		3	29/08/2011 17:59	29/08/2011 17:59	123.64	52.30			DG	29/08/2011 17:41	5.30	2.50	3.10	5.20	6.70	0.00	0.00	0.00	0.00	0.00	46.30
		4	29/08/2011 17:49	29/08/2011 17:49	123.47	52.30			DG	29/08/2011 17:41	5.20	2.10	2.60	5.20	5.20	0.00	0.00	0.00	0.00	0.00	48.60
		5	29/08/2011 17:42	29/08/2011 17:41	123.35	52.20	DG on Manual	29/08/2011 17:42	DG	29/08/2011 17:41	5.20	1.70	2.20	5.20	4.10	0.00	0.00	0.00	0.00	0.00	62.50
		6	29/08/2011 17:39	29/08/2011 17:39	123.30	49.90			SB	29/08/2011 17:34	5.20	1.60	2.10	5.20	4.00	0.00	0.00	0.00	0.00	0.00	0.00
		7	29/08/2011 17:35	29/08/2011 17:34	123.23	50.40	DG Off Auto	29/08/2011 17:35	SB	29/08/2011 17:34	5.10	1.60	2.10	4.80	4.00	0.00	0.00	0.00	0.00	0.00	0.00
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Typical Site performance



Pre solar DGRH was 22 hours/day Diesel consumption was 36 LPD Post Solar Diesel consumption reduced to 12 LPD



Typical fuel saving at off-grid sites

BTS/site	Estimated DC Load (AVG KW/hr)	Present Diesel Consumption (LPD)	Diesel consumption in AST solution (LPD)	Savings in diesel (LPD)
1	0.7-1.0	26	9	17
2	1.4-2.0	36	15	21
3	2.4-3.6	45	22	23
4	2.7-4.0	55	32	23

40% to 60% reduction in diesel consumption

Actual System Performance – sampled from Bakhri



Stable site operations even during the monsoon

AST minimizes diesel, increases battery life



AST Presence: Bihar Circle



- Presence across all districts in Bihar (more than 1400 sites)
- Rollout started in Jharkhand (100 sites)
- Circle office at Patna
- Separate warehouses in Bihar & Jharkhand
- Approx.300 people team, excluding care taker



AST Presence: UPE Circle



- Presence in 15 districts in UPE (300+ sites)
- Circle office & Warehouse in Lucknow
- Operating in tough areas viz Balia, Azamgarh, Jaunpur, Ghazipur
- Approx.60 people team, excluding care taker

AST Presence: UPW Circle



- Presence in 10 districts in UPW (200 sites)
- Circle office in NOIDA
- Established warehouse at Meerut
- Operating in tough areas viz Etah, Mainpuri, Auraiya
- Approx. 40 people team, excluding care taker



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Alternate Energy Solutions- Other options

<u>Solution</u>	<u>Benefit</u>	<u>Issues</u>	<u>AST</u>
Use of Smarter battery	 Reduces DG Run Hours leading reduction in pilferage Improves DG efficiency Suitable where other forms of renewable energy technologies may not be easily usable Needs at least 4 hours of grid power 	 Battery is only a storage device & not source of energy Requires sophisticated control of charging and discharging to safeguard battery life Current technology is prone to early failure due to misuse in field. 	\checkmark
Wind	1. Cheap source of Renewable Energy	 Most Tower sites do not have adequate wind speed Mounting windmills on a tower is still a challenge Uncertain power generation Difficult to estimate cost / KWh as output is not known at the location 	
Fuel Cells	 Clean Source of Power Can replace diesel in Solar-Diesel hybrid to benefit overall Solar Solution 	Logistics.High cost of fuel cells but declining	\checkmark
Biomass	1. Cheaper source than diesel	 Large space requirement Raw material pricing & consistent availability High Maintenance and logistics costs 	

AST Focus: SolarFuel Cell Hybrid to replace Diesel Genset



Hydrogen Distribution is Key



Saving in OPEX

Savings in OPEX is dependent upon-

- ✓ Type of site (Indoor/ Outdoor)
- ✓ No of tenant (i.e. DC load)
- ✓ Grid availability hours
- Type of RET solution deployed,
 based on site feasibility
- ✓ Price of Diesel
- ✓ Price of Electricity





Customer offering - Fixed Energy Model

- Offer based on OPEX model
- Fixed Cost indexed to
 - DC load or BTS on site
 - diesel price
 - EB rate
 - Present Min Wages
 - Any escalation on the diesel and EB as pass through.
 - Annual Escalation to cover inflation
- Long term Lease period 10 years
 - Better visibility of cost to customer
 - Lower value of recovery of CAPEX spent by AST





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Bangladesh





- ✓ Estimated to have over 20000 telecom towers.
- ✓ Wireless ARPUs among the lowest in the world (BDT 165*)
- ✓ 80% population in rural areas, where cost of operations are high.
- Need for cost optimization and environment protection.

AST partnership with operators can substantially reduce fuel cost and protect environment



