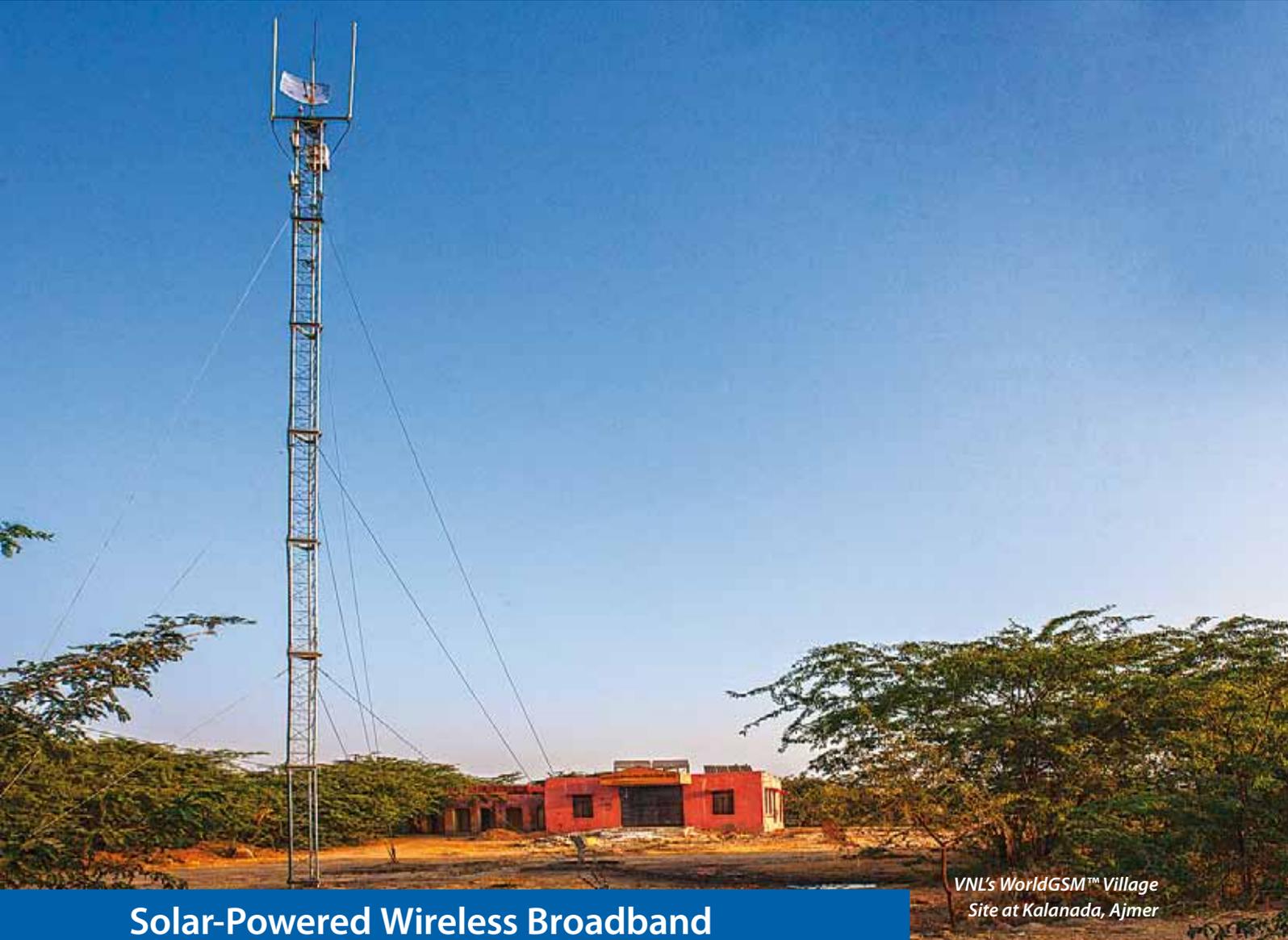**SHYAM**

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Rural BB
## Seamless Wi-Fi Access Anywhere-Anytime

VNL's WorldGSM™ Village Site at Kalanada, Ajmer

Solar-Powered Wireless Broadband
For Rural and Remote Areas

V NL's Rural Broadband Solution is a totally solar-powered & standalone wireless broadband solution that provides seamless Wi-Fi coverage anywhere. It needs no shelter, air conditioning, connection to the power grid, generator or diesel fuel, and is ready for business in days, providing fully-functional broadband.

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To sustain a continuous pace of economic growth and development, voice and broadband needs to be accessible seamlessly throughout the nation. Spreading voice and broadband beyond urban areas ensures the efficient delivery of basic communication, remote education, healthcare, and government services.

VNL's sustainable rural broadband solution demonstrates how affordable broadband can be delivered to enable communities in rural and remote locations.
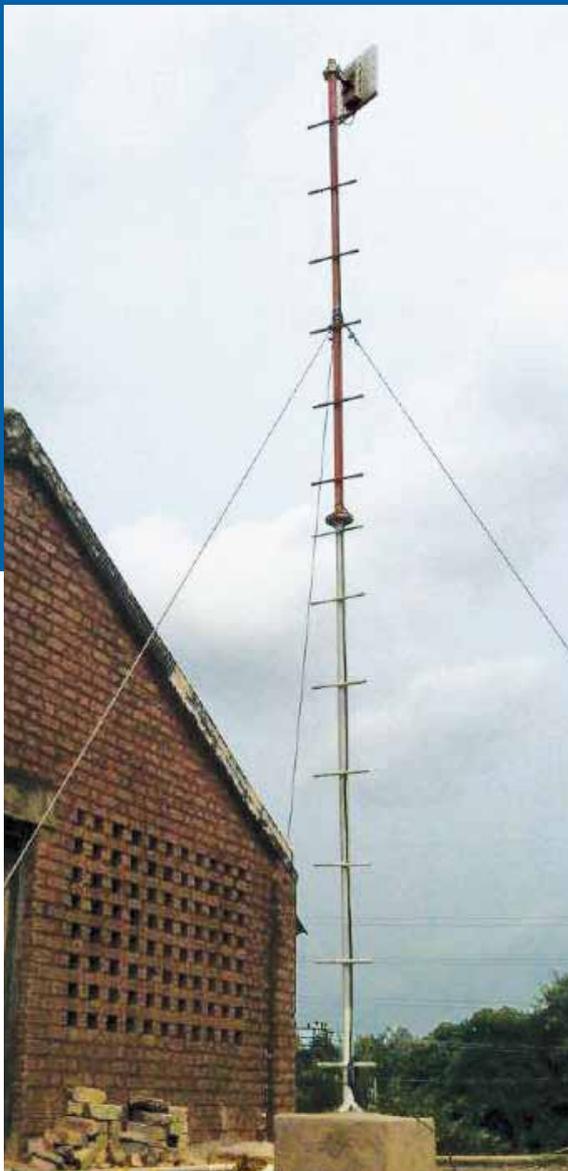
Typical VNL Wi-Fi Access Point

INTRODUCTION

Amid emerging 3G/4G networks and much hyped advanced technologies like LTE/WIMAX, Wi-Fi broadband still remains the low cost leader due to its massive footprint and universal presence on smart phones. Promotion and adoption of Wi-Fi broadband makes real sense for operators to ensure retention and cost-effective scaling in rural areas. There are many potential markets where people can't access even basic telephony services, let alone high-speed internet access. Traditional broadband services, as deployed in urban areas, is an expensive investment for any Internet Service Provider (ISP). With high capital expenditures and considerable operating costs per user, the revenue found in rural areas cannot justify these costs. In keeping with this view, VNL worked on a new way to build out broadband infrastructure in remote areas by re-engineering traditional broadband for a whole new purpose.

VNL delivers self sustainable wireless broadband network infrastructure solutions that are profitable for ISPs through substantial reductions in the cost of acquiring, deploying, and operating its network. VNL's Rural Broadband Solution enables ISPs to deliver high speed data and voice access cost-effectively to masses in remote areas. It combines Wi-Fi and backhaul in a single unit. This platform deploys consistent, high-speed and secure wireless connections between multiple remote locations through high capacity Point-to-Point and Point-to-Multipoint links and provides a reliable and robust last mile transmission.

Rural BB: Seamless Wi-Fi Access Anywhere-Anytime

VNL's Solar Powered 3 Sector Wi-Fi BTS Deployed at DEI, Agra, India

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RURAL BROADBAND REQUIREMENTS

Depending on the characteristics of the rural or remote region where the ISP has to provide service, the broadband network architecture and rollout strategy may vary immensely.

Challenges often faced in rural rollouts range from poor infrastructure, and poor road access to non availability of grid power and absence of skilled manpower. Poor socio-economic conditions (and hence low ability to pay) add to the challenge. In the context of India's rural areas, it is very difficult for ISPs to anticipate a viable business case that is affordable for the subscriber and profitable for themselves. Therefore, in order to consider deployment of broadband services in rural and remote areas, the points to focus on are:

- *Availability of existing infrastructure for telecom services i.e. optical fiber, copper, mobile towers, fixed and mobile services.*
- *Availability of grid power.*
- *Assessment of geographical aspects such as rural landscape, terrain and climate planning*
- *Rural area demographics such as age, population density, poverty and literacy rate*
- *Economic conditions such as GNP per capita, economic growth, civic amenities, and willingness and ability to pay for communication services.*
- *Availability and usability of frequency bands i.e. ISM/licensed band for creating broadband backhaul.*
- *Availability of trained teachers to ensure that the right quality of education is imparted.*

VNL'S VISION

VNL sees communication amongst the masses as an affordable necessity and not a luxury. VNL has envisaged the real need of provisioning a complete end-to-end sustainable solution which includes a wireless broadband network and an internet kiosk.

VNL'S RURAL BROADBAND SOLUTION

VNL's Rural Broadband Solution is a completely solar powered and standalone wireless broadband solution which can be deployed to provide seamless Wi-Fi coverage anywhere. The solution is based on VNL's innovative product design which combines Wi-Fi and backhaul in a single unit. It is based on VNL's Cascading Star Architecture™, which can provide coverage up to 125 kms in multiple hops depending on the terrain.

VNL's Rural Broadband Solution comprises a tower supporting a Multi Sector Wi-Fi BTS and Backhaul Transmission Equipment. It requires no shelter, air conditioning, availability of grid power or diesel generator.
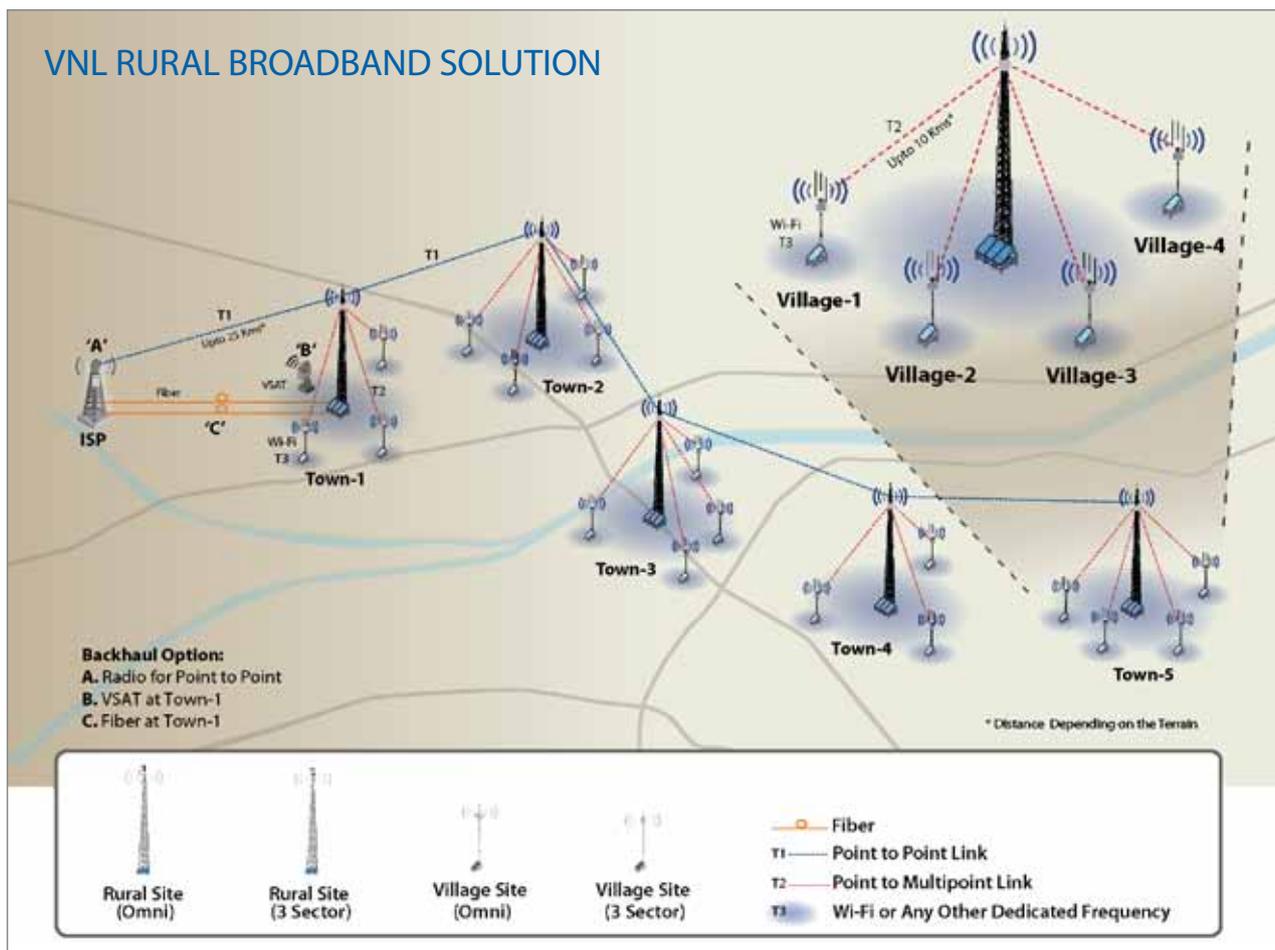

Wi-Fi Access Point at DEI College Campus, Agra, India

CASCADING STAR ARCHITECTURE™

VNL's Cascading Star Architecture™ is an incremental rollout solution that separates the macro coverage layer from spotted coverage. It poses low risk to ISPs in areas where traditional broadband cannot offer a solution to the problem with an acceptable return on investment. It features an adapted hub-and-spoke design, optimized for rural deployments. It provides an extremely low-cost approach to enter a new rural market, and then scales up as demand grows.

KEY ELEMENTS

- **High speed, high capacity backhaul Products** for connecting remote locations through Point-to-Point and Point-to-Multipoint links. This provides connectivity to remote sites in the cascading architecture
- **Wi-Fi BTS** provides extensive 360° coverage in last mile
- **CPE** to extend Wi-Fi coverage
- **Solar powered,** low CAPEX and near zero OPEX solution provides up to 72 hours of power backup
- **All outdoor units are IP67 compliant** enabling their operation even in harsh environmental conditions
- **Supports multiple frequency bands (1.5 GHz to 6 GHz)** for flexible radio planning and complies with various radio and safety regulations including ETSI, FCC, IC and WPC (India)

VNL RURAL BROADBAND SOLUTION

Backhaul Option:
A. Radio for Point to Point
B. VSAT at Town-1
C. Fiber at Town-1

* Distance Depending on the Terrain

Rural Site (Omni)	
Rural Site (3 Sector)	
Village Site (Omni)	
Village Site (3 Sector)	

- Fiber
- T1 — Point to Point Link
- T2 — Point to Multipoint Link
- T3 — Wi-Fi or Any Other Dedicated Frequency

VNL's Cascading Star Architecture™: Separating Macro Coverage from Spotted Coverage

Rural BB: Seamless Wi-Fi Access Anywhere-Anytime

HIGHLIGHTS

Distinctively for Rural Markets
- *License-exempt 2.4 or 5.8 GHz Bands*
- *All Weather: Ruggedized Outdoor Packing*
- *Tower Mounted Electronics*
- *Fast and Easy Installation*
- *Integrated VoIP Technology*

Solar Power Option
- *Very Little Complexity*
- *Low Carbon Footprint*

Low CAPEX and Near Zero OPEX
- *Integrated Backhaul*
- *Low Power Consumption*
- *Centralized Management: Dramatically Low System Maintenance*
- *Small Site Footprint*
- *Incremental Growth: Low Entry Cost*

Carrier Grade
- *Fault Tolerant, Reliable, Secure and*
- *Robust*
- *Complete Remote Management*
- *Long Range and High Net Throughput*
- *Low Latency*
- *Reliable Last Mile Access*

KEY BENEFITS

- ***Rapid Deployment:*** *This solution is provided as a Plug-and-Play solution for rapid deployment. Dismantling and redeployment of the unit is speedy as well.*
- ***Optimized Transmission Spending:*** *This solution helps control transmission cost by avoiding the use of fiber and leased lines.*
- ***Sensible Business Case:*** *Contributes directly to your bottom line as it offers the most cost-effective way to provide high bandwidth.*
- ***All-Weather Reliability:*** *The solution is outdoor capable and rugged enough to withstand extreme weather conditions. It is maintenance free.*
- ***License Exempt Frequencies with Security:*** *The 2.4 and 5.8 GHz solution is regulation friendly as it operates only in the license-exempt frequency bands with secure encryption.*
- ***Extends Broadband Access to Rural Areas***
- ***Equipped with Advanced MIMO Technology:*** *Provides enhanced wireless range for higher throughput and coverage.*
- ***Small Form Factor with No Moving Parts***
- ***Simplified Set-up:*** *SSID & VLAN configuration flexibility to control access to network resources and segment user traffic.*

Wi-Fi Access Point on Roof of Center of Leather Footwear Technology, DEI Campus Agra, India

SOLUTION DEPLOYMENT SCENARIOS

BROADBAND FOR REMOTE COLLEGE CAMPUS, DEI, AGRA, INDIA

In September 2010, VNL began the task of providing a standalone, sustainable and eco friendly broadband solution to bring seamless internet connectivity in Dayalbagh - Eco Village under the project "Village Community Networks".

The Dayalbagh Educational Institute (DEI) is located on the outskirts of the historic city of Agra, India, in an isolated campus situated in garden settings, away from the city. Created with the vision of a truly sustainable eco-village in harmony with nature, DEI is spread across 3,500 acres with extensive green belt and fields between the buildings. VNL's Rural Broadband Solution was used to cover key locations across the campus with using sustainable solar-powered infrastructure that blended beautifully with the eco-friendly outlook of the campus and caused no damage to the environment.

The project started with the complete assessment of the rural site at DEI campus premises. A site survey was conducted to gather:

- Average Traffic Profile
- Peak Traffic Requirement
- Cluster of Inhabited/Uninhabited Areas
- Erlang Requirement

The network planning was done to cover the complete area by using minimum RF equipment with no compromise on service. Based on the survey done by VNL, 3 Residential Colonies, Hostels, Dairy and Tannery areas were identified to deploy VNL's Wireless Broadband Solution.


Seamless Internet Connectivity at Computer Lab, Leather School, DEI Agra

VNL deployed 3 Access Points (APs) with 120° integrated sector antenna at the International Hostel. Integrated Wireless Backhaul was demonstrated through Point-to-Point and Point-to-Multipoint Radio link based on unlicensed ISM band. The main backhaul connectivity was provided from Computer Center to International Hostel through a 100 Mbps Point-to-Point Link. The International Hostel connects the residential colonies on main backhaul link through Point-to-Point Radio.

Point-to-Multipoint Radio link of 5.8 GHz provides backhaul connectivity to Access Points installed at the dairy and two other colonies. The International Hostel also connects locations at Girls Hostel, Boys Hostel, and Tannery providing Ethernet drop at each site. (see diagram below)

The compact footprint of mast with 8 solar panels runs the entire system on solar energy with a battery backup of 72 hours. It requires no air conditioning, shelter, cooling or diesel generator. The total power consumption including radio network backhaul is less than 150 W for the entire system. The first phase of the project provided 100 Mbps of backhaul with high speed internet connectivity to the users up to 3 Km of area surrounding the DEI college campus premises.

VNL's solution saved the entire expense on grid power and diesel that would have been incurred if a traditional solution had been deployed. In addition, the savings on the operations and maintenance cost is substantial.
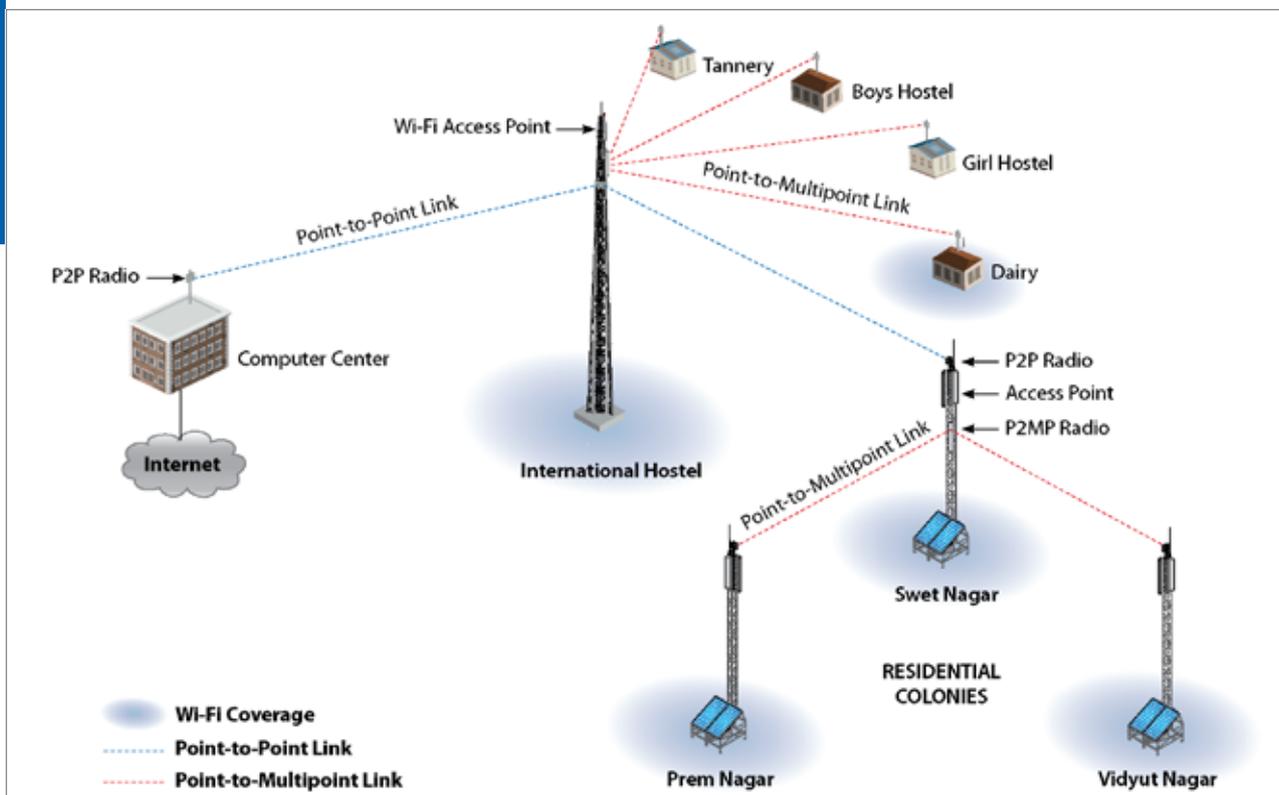
VNL's Wi-Fi BTS Solar Solution - Logical Connectivity Diagram DEI, Agra, India

KEY FEATURE OF VNL'S WIRELESS BROADBAND SOLUTION DEPLOYED AT DEI

Seamless Hotspot Wi-Fi: Faculty members, students, staff and other residents of the DEI Campus can access wireless broadband independently, while on the move anywhere on the campus, using laptops and handheld devices such as phones and tablets. CPE is installed for effective indoor coverage. Installation process is easy, simple and user friendly.

Shared Access: Faculty members and students can access all their important information through wireless broadband, without being tied to a specific desktop computed location. All they have to do is use a Wi-Fi enabled device.

Security: VNL's Wireless network utilizes encryption technology like WEP or WPA2 for security purposes while browsing the Internet or video streaming.

Range: VNL's Wireless network can be accessed anywhere depending upon the signal strength available. This is a function of the distance from the access point. Range varies from 500 meters for direct connectivity to a couple of kilometers using a customer premise equipment (CPE).

This deployment in a remotely located college campus proves the effectiveness of VNL's solution on the following parameters:

- Wi-Fi Broadband Competency
- Low Power Consumption
- Distributed Capacity, Coverage and Connectivity Architecture
- Environment Friendliness
- Outdoor Mast Mounted Rural Wi-Fi BTS Site Operating Exclusively on Solar Energy
- Viability Based on Substantial OPEX Savings

VNL's Solar Powered Wi-Fi BTS at DEI, Agra, India

CONNECTING SCHOOLS IN RAJASTHAN, INDIA

Computer literacy and familiarity with ICT are critical for skilled human resources. The difference between urban and rural children is the toys they play with. For urban children, familiarity with computers begins at an early age. Rural children lack these opportunities because of the lack of access. VNL has realized this and has created a complete end-to-end sustainable broadband solution to connect village schools.

The Wi-Fi based broadband solution is fairly simple as described below:

- *Connect Villages with Solar Powered Wi-Fi Base Stations that Deliver Broadband.*
- *Access the Broadband Signal through Outdoor Wi-Fi Access Point on the Roof of the School.*
- *Inside the School is a CPE.*
- *Children Access Broadband on the Village Internet Kiosk - "Gurukul".*

VNL has solved the biggest challenge of power to this centre by creating an independent solar powered module to run all of the devices simultaneously. No connectivity to the power grid is required for the network base station or the kiosk.

"GURUKUL" VILLAGE INTERNET KIOSK

"Gurukul" - VNL's Village Internet Kiosk is a one-stop solution for rural development through broadband. The kiosk is contained in a rugged, tamper-proof metal housing, keeping all the components secure and intact. It contains a computer, webcam and other peripheral devices.
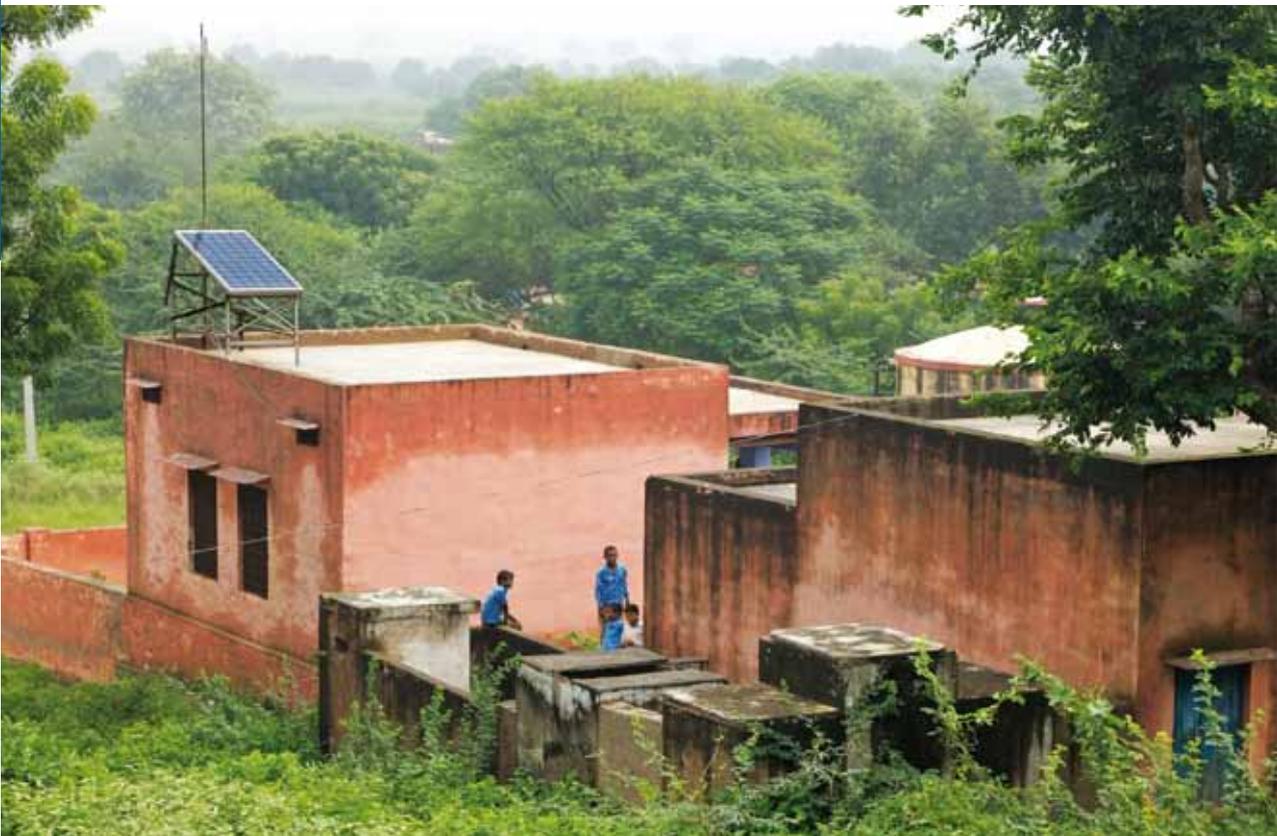
Broadband for Village School in Rajasthan, India – Solar Powered Access Point on Roof of primary School

Gurukul allows village school teachers to share skills and resources by using webcams and audio communication. They also have instant access to materials such as multimedia presentations and can interact in real time with other teachers. For pupils, it promotes cultural exchange, assistance through study groups, the development of communication skills and interactive project work.

The introduction of multimedia into the learning environment and collaboration with learners from other schools provides a much higher level of interaction and makes the learning experiences more dynamic. While children use "Gurukul" for education, the village community can utilize the system for e-finance and e-governance initiatives.

Village Internet Kiosk: E-Learning in a Village Primary School in India

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CONCLUSION

To enable educational learning opportunities through broadband in remote areas, an affordable and sustainable network infrastructure solution is required. VNL has combined state-of-the-art technology with renewable energy to produce an optimised alternative that overcomes the limitations of traditional methods. The result is an affordable and reliable wireless broadband connectivity solution for subscribers in rural and remote areas. The green solution provides huge OPEX savings on fuel and maintenance costs.

VNL's deployments of wireless broadband at DEI, Agra (a remote college campus) and village schools in Rajasthan has shown the viability of this new approach. These deployments show the way for bringing rural and remote populations within the ambit of mainstream development through access to the Internet.

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