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A Case Study Report On

"ENERGY DEMAND ANALYSIS OF NCELL TOWER"

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INTRODUCTION

Ncell Pvt. Ltd. has been working in Nepal since 2004 as the first private mobile operator in the country. We are committed to being the best local mobile network for the people living in the country. We provide services of international quality with a local touch. Most of our employees are Nepali and our services are designed to meet the needs of the local society.

We are constantly working towards our goals of connecting everyone in Nepal through our Ncell network, providing high quality, modern and cost effective services and creating value for our customers and partners. Ncell is part of the Axiata Group Berhad, one of Asia's leading telecommunications group.

Axiata operates in ten countries with 25,000 employees and serves approximately 290 million subscribers. With a diverse portfolio in mobile network operations, communications infrastructure services and digital services, the Group pieces together the best in connectivity, technology and people in its vision of Advancing Asia. Together with Axiata, Ncell contributes to the development of the country's economy and infrastructure, building best-in-class networks and bringing people in the remotest areas of Nepal within the reach of communications.

PRODUCTS & SERVICES

Telecommunication service provider Ncell is introducing new services targeting business enterprises by using its network and infrastructure. With Ncell

Internet, you can enjoy range of services with which you can get access to the various services in better price.

GSM, 3G, Wireless Phone, Internet Service

Mobile

1. Postpaid
2. Prepaid
3. Roaming (Incoming & Outgoing)
4. SMS
5. 3G Service
6. 4G Service

Internet /E-mail and others

1. Fixed hour package
2. Night Surfing Package
3. Fixed hour / month package
4. Unlimited Single User Package
5. Web SMS
6. MMS
7. E-mail Alert
8. WiFi Hotspot
9. GPRS Service
10. Voice SMS
11. Online recharge
12. Video Call
13. Video Mail
14. Conference Call
15. Balance Transfer

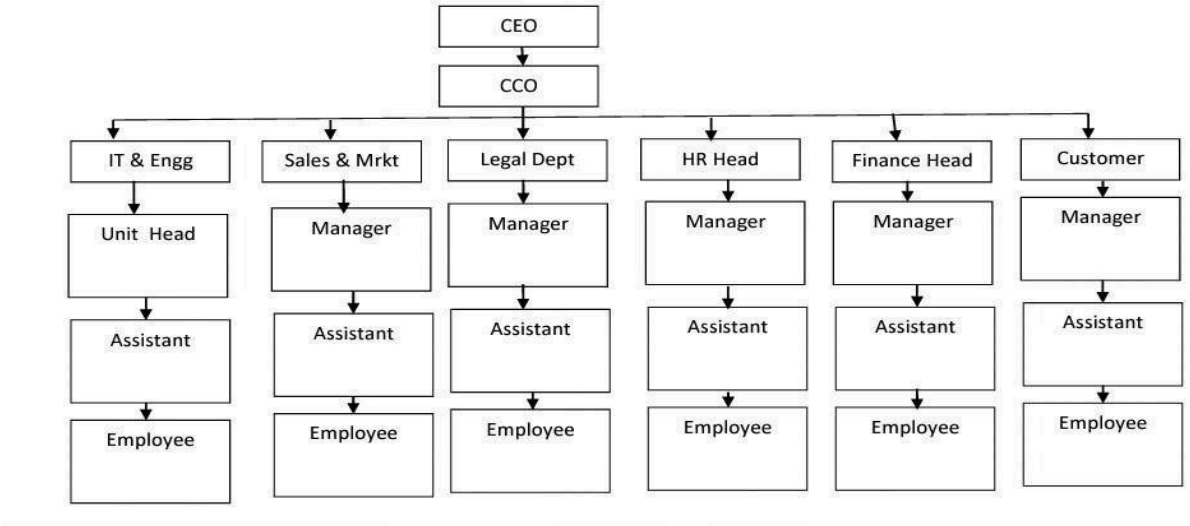
NCELL NETWORKS OVERVIEW

The categorisation of Ncell sites is as detailed below. In the first years of Ncell's start-up, it was rolling-out its network mostly in cities and due to the

scarcity of greenfield locations in the heavily populated cities and the trend of operators in the past, most sites were rolledout as indoor rooftop sites. Lately Ncell has been spreading its coverage country-wide to cover villages, suburbs, and high-ways. Moreover, Ncell has recognised the added value of outdoor installations being more energy efficient than indoor sites, therefore most new sites are being rolled-out as outdoor sites.

Additionally, Ncell has taken a lead in green deployments within the region that from the planning stage, Ncell acquires additional land space whilst doing their site acquisition for new roll-outs to allow for the possibility of implementing renewable solutions.

ORGANIZATIONAL STRUCTURE



FINANCIAL ANALYSIS & SITE MODELING

The financial analysis or business case for renewable energy deployment in operational telecommunication networks aims at comparing Existing CAPEX & OPEX vs.

Renewable CAPEX & OPEX. Additionally, if a network experiences severe site outages due to grid power unavailability, the mobile network suffers losses in all the following:

1. Revenue: outgoing calls & SMS
2. Revenue: incoming calls & SMS interconnection charges
3. Revenue: VAS services
4. Revenue: subscriber churn
5. Brand Image: subscriber dissatisfaction

This lost revenue from severe site outages would not be incurred if correctly dimensioned renewable energy systems were deployed on these sites. For networks with severe site outages – primarily due to power unavailability – the business cases for renewable deployment have to include a value for the lost revenue i.e. comparing existing CAPEX, OPEX & lost revenue with renewable CAPEX & OPEX. Since the primary source of revenue for most mobile networks comes from outgoing calls and SMS, only this will be taken into account while calculating revenue losses for a mobile network.

In order to come up with a value for the lost revenue, a dollar value for a minute of outgoing voice traffic and SMS on that network needs to be computed. For that purpose, the following was explored:

1. Actual outage time of sites
2. Actual traffic volumes of Sites
3. Calling charging rates
4. Estimate revenue model for sites throughout project life

Information and communication technology has grown at most exponential rate worldwide. With increasing demand for services, the energy consumption has also increased and poses an environment challenge in terms of larger carbons.

A typically cellular network consists of core network that takes care of switching, base stations providing radio frequency interface and the mobile terminals in order to makevoice or data communications and the power consumption is disturbed in them with their functionalities. Tower is technically known as BTS (Base Transceiver stations). BTS are the most energy intensive part of cellular network

architecture and contribute up to 60 to 80 % of total cellular power consumption and varies in response to the real traffic demand throughout the day and night.

Ultimately, this value was calculated for Ncell, and a project lifetime of 15 years was considered for renewable energy projects. Furthermore, the discount rate considered for this project in Nepal was taken as 12% (provided by the finance team at Ncell), and the average running hours per diesel generator was considered to be 75 hrs a month. Whilst doing the dimensioning of renewable systems for Ncell sites, the following was taken into account:

1. A Free Cooling Unit (FCU) OR DC Fan should be used for each indoor site to compensate the need for an air condition. Therefore an additional loading of about 300W was considered whilst modelling indoor sites, and the price for the unit was considered in the business cases.
2. A battery cooler should be used in indoor sites to maintain the batteries in good condition (extending / doubling its lifetime) and reduce heat dissipation in the room/shelter.
3. Additional new batteries were included as CAPEX for all sites
4. Additional new 200A rectifiers were included as CAPEX for all sites
5. Average transportation & warehousing cost of US$850 were considered in all business cases (airport to W/H + W/H to reachable site.

PROPOSED MODEL

The decision to implement renewable energy as a means of reducing OPEX by a mobile network is best done by prioritising which sites the operator wishes to start with. Similar to rolling out a network, the operator may choose to expand coverage in rural areas, or focus on increasing capacity in highly urbanised cities.

An operator may choose to prioritise their renewable rollout based on one or more variables. GSMA was keen on presenting different variables to Ncell management based on which they could ultimately come up with an informed decision on the way forward for renewable implementation. The base station sites were hence analysed and prioritised based on the following factors:

- (P1) Priority 1 sites have 40 or more sites linked to them – Total 9+10+7 =26 sites. Out of these, 2 sites already having renewable energy implemented

and 15 sites not producing a viable business case for renewable energy hence are recommended for Deep Cycle Batteries (DCB).

- (P2) Priority 2 sites have between 10 and 40 sites linked to them – Total 27+48 =

  75 sites. Out of these, 7 sites already having renewable energy implemented and

  26 sites not producing a business case for renewable energy, hence are recommended for Deep Cycle Batteries (DCB).

LEAP

LEAP (Long range energy alternative planning system) is chosen as a research tool for this study. It is an integrated modeling tool based on the bottom up approach, used to track energy consumption, production and resource extraction in all sectors of economy. To this particular study , it takes energy intensity values with activities data of Ncell towards in its current amount and demonstrate base year(2016) energy consumption and also forecast future energy demand of tower of Ncell up to 2025(End year) with strategic scenario development which is shown in figure1.

Collection and analysis of data:

*Figure SEQ Figure * ARABIC 1: Average final Energy Consumption pattern*

It is necessary to know, how big is the energy demand of Ncell tower before going through any other alternative measures. Hence, a strategic measure of energy need of Ncell towers and growing energy demand are primarily analyzed through LEAP. With the reference to available data corresponding to the base year and other official source of information, some sort of assumptions are made to calculate an average energy intensities of different power categories. Most of

the energy is supplied by the solar energy with the help of Solar panel followed by electricity and wind energy.

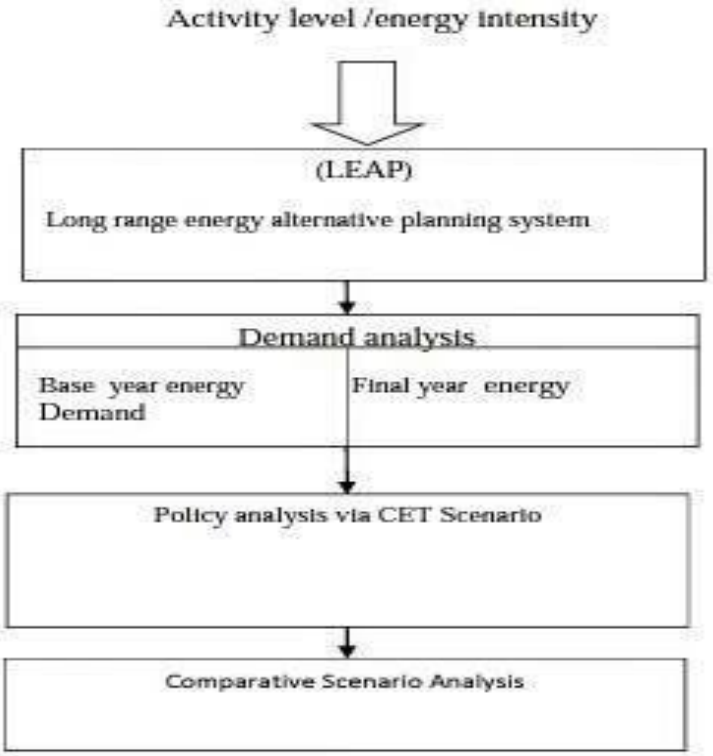


Figure 1

Genera

Base transceiver station

Information and communication technology has grown at most exponential rate worldwide. With increasing demand for services, the energy consumption has also increased and poses an environment challenge in terms of larger carbons. A typically cellular network consist of core network that takes care of switching, base stations providing radio frequency interface and the mobile terminals in order to make voice or data communications and the power consumption is disturbed in them with their functionalities. Tower is technically known as BTS (Base Transceiver stations). BTS are the most energy intensive part of cellular network architecture and contribute up to 60 to
80 % of total cellular power consumption and varies in response to the real traffic demand throughout the day and night.

A **base transceiver station** (BTS) is a piece of equipment that facilitates wireless communication between user equipment (UE) and a network. UEs are devices like mobile phones (handsets), WLL phones, computers with wireless

Internet connectivity. The network can be that of any of the wireless communication technologies like GSM, CDMA, wireless local loop, Wi-Fi, WiMAX or other wide area network (WAN) technology.

BTS is also referred to as the radio base station (RBS), node B (in 3G Networks) or, simply, the base station (BS). For discussion of the LTE standard the abbreviation eNB for evolved node B is widely used.

Though the term BTS can be applicable to any of the wireless communication standards, it is generally associated with mobile communication technologies like GSM and CDMA. In this regard, a BTS forms part of the base station subsystem (BSS) developments for system management. It may also have equipment for encrypting and decrypting communications, spectrum filtering tools (band pass filters), etc. Antennas may also be considered as components of BTS in general sense as they facilitate the functioning of BTS. Typically a BTS will have several transceivers (TRXs) which allow it to serve several different frequencies and different sectors of the cell (in the case of sectored base stations). A BTS is controlled by a parent base station controller via the base station control function (BCF). The BCF is implemented as a discrete unit or even incorporated in a TRX in compact base stations. The BCF provides an operations and maintenance (O&M) connection to the network management system (NMS), and manages operational states of each TRX, as well as software handling and alarm collection. The basic structure and functions of the BTS remains the same regardless of the wireless technologies.

Energy Demand

Energy is a property of objects which can be transferred to other objects or converted into different forms, but cannot be created or destroyed. The "ability of a system to perform work" is a common description, but it is difficult to give one single comprehensive definition of energy because of its many forms. For instance, in SI units, energy is measured in joules, and one joule is defined "mechanically", being the energy transferred to an object by the mechanical work of moving it a distance of 1 meter against a force of 1 Newton. However, there are many other definitions of energy, depending on the context, such as

thermal energy, radiant energy, electromagnetic, nuclear, etc., where definitions are derived that are the most convenient.

Common energy forms include the kinetic energy of a moving object, the potential energy stored by an object's position in a force field (gravitational, electric or magnetic), the elastic energy stored by stretching solid objects, the chemical energy released when a fuel burns, the radiant energy carried by light, and the thermal energy due to an object's temperature. All of the many forms of energy are convertible to other kinds of energy, and obey the law of conservation of energy which says that energy can be neither created nor be destroyed; however, it can change from one form to another.

Ncell, the country's largest private GSM mobile service provider, has started using solar power to operate its Base Transceiver Station (BTS) towers under its 'Going Green' scheme.

According to the company, it launched this initiative to offer uninterrupted service to customers even during load-shedding hours. "The system provides back-up for three consecutive days," said Aigars Benders, chief technical officer of Ncell.

Ncell started providing services through BTS towers two months ago. It launched the new scheme keeping in mind increasing power shortage in the country. The company also plans to expand the scheme in rural areas.

Recently, Ncell constructed carbon towers in Kailash Hill, Makwanpur, and Ayodhya Puri, Chitwan. According to the company, carbon towers are low in weight and earthquake resistant. "Moreover, construction and operating costs of such towers are low compared to traditional towers," said Benders.

The company also declared that it will develop BTS towers as green sites henceforth. It has so far constructed 25 green sites in different places including Thari of Parsa, Bagauda of Nepalgunj, Ratanpur of Dhangadhi and Gorakcha of Sagarmatha. Of the total green sites, eight are operating without generators.

According to a source, the company will construct 50 percent of the proposed green sites within the next two years. A green site requires less energy

compared to a traditional BTS tower. “A green site requires 260 watts of electricity, whereas a traditional one requires over 700 watts,” said Benders. He added that the system is popular in many countries including India.

Table 5: Potential Energy cum Cost Savings

Energy Demand					Potential Energy/Cost Saving	
Scenario	BAU		CET			
Year	$x10^7$ kWh	$x10^7$ NPR	$x10^7$ kWh`	$x10^7$ NPR	$x10^7$ kWh	$x10^7$ NPR
2012	9.5	85.5	9.50	85.46	0.0	0.0
2014	13.53	121.8	8.94	80.46	4.6	41.3
2016	14.21	127.9	8.10	72.90	6.1	55.0
2018	14.87	133.8	7.12	64.08	7.8	69.8
2020	15.56	140.0	6.97	62.73	8.6	77.3
2022	16.28	146.5	7.31	65.79	9.0	80.7
2024	17.11	153.9	7.73	69.57	9.4	84.4
2025	17.5	157.5	7.93	71.37	9.6	86.1

In Nepal, if we can contribute current energy demand of telecom towers with 40% renewable energy

CONCLUSION

Hence we would like to say that the demand of energy is not fulfilled so the organization should have to think for alternative source of energy and indeed for unusual circumstances like natural disaster, earthquake, etc. BTS should also be launched in every nook and crook of Nepal for its better service and organization should provide the better quality of service to the customer and it should also provide its best throughput. Upon analysis of the entire network, the following summarises the results that were outputted: Green solution can be

implemented for 1116 on-grid sites, Green solution will be not feasible for 111 on-grid sites, Deep battery cycling recommended for 111 sites above Total CAPEX for Green solution implementation US$65.3 million.After Green solution implementation, CO2 emission will be reduced by > 33,300 tonnes / yr (>70%).