

Tending Towards More Energy Efficient Cellular Network with Picocell Deployments

¹Ajayi J.O. and ²Olaobaju O.O.

^{1,2}Physics Department, Federal University of Technology, Akure.

Abstract

This research work investigated the energy efficiency of mobile wireless network by deploying pico cells to the hotspots in the network. The performance of the proposed network – macro cell overlaid by pico cells was studied and compared with the conventional network using some energy metrics; Area Power Consumption(APC), Energy Consumption Ratio (ECR) and Energy Consumption Gain (ECG). The simulation result showed that APC and ECR of the proposed network were reduced at pico deployments, indicating an improvement in the energy of the network. While, the result from ECG affirmed that there was energy gained and this was maximum when three pico cells were deployed. This also confirms that deploying pico cells makes mobile network greener.

1.0 Introduction

The rate at which cellular networks consume energy is increasing very fast. The reason for this high energy consumption can be traced down to the increase in demand for more data by mobile users especially with the invention of smart phones, eBook readers, different social networks and the likes. This has been of great concern to cellular operators as it negatively affects the environment and operators expenditure (OPEX). The need to reduce the negative effect of the increasing energy consumption rate motivated academia and researchers to study more on “green cellular network”. Green cellular network or green networking as defined by Altman *et al*[1] is the practice of selecting energy-efficient networking technologies and products, and minimizing resource use whenever possible

There have been efforts to increase energy efficiency in all components of cellular networks, including mobile devices, base stations, and core (backhaul) networks [2]. It has therefore been discovered that the key source of energy usage in cellular networks is the operation of base station equipment. It has been estimated that base stations contribute up to 60–80 percent of the total energy consumption [2] as each base station serving mobile users consumes an average of 25MWh per year [3]. In order to put a check to the challenge of increasing power efficiency in future wireless networks and also to maintain profitability, it is necessary to consider various paradigm-shifting technologies such as energy efficient wireless architectures and protocols, efficient BS redesign, smart grids, opportunistic network access or cognitive radio, cooperative relaying and heterogeneous network deployment based on smaller cells [3].

One obvious way to make the cellular networks more power efficient in order to sustain high speed data-traffic is by decreasing the propagation distance between nodes, hence reducing the transmission power [3]. Heterogeneous network (HetNet) therefore, deploys small cells and low power base stations into macro cells, bringing the mobile units closer to the base station and providing a better network performance [4]. In this work, heterogeneous network in which pico cells were deployed on a conventional macro cell was considered.

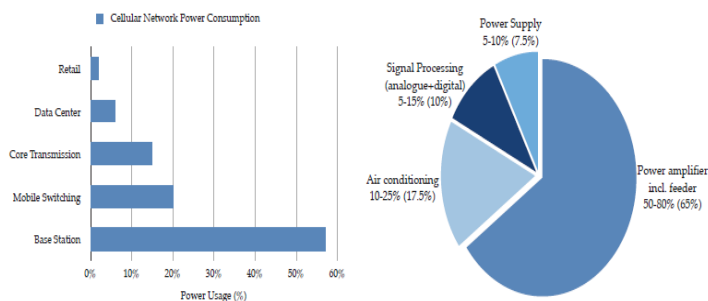


Fig 1(a): Power consumption of a typical wireless cellular network (b) Power consumption distribution in radio base stations

Corresponding author: Ajayi J.O., E-mail: oajayi@futa.edu.ng, Tel.: +2348169315472