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Research Article

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Efficiency Gains, Alternative Sources and Environmental Tracking Systems for Telecommunications Networks

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Abstract

The article aims to investigate the power consumption of radio-telecommunication devices beginning with the on-site evaluation carried out by mobile communications providers in Italy, which takes into consideration of differing types of devices, various sites, and varied workloads of technologies. There are many more than 60000 radio stations in France, according to the APAT data. They demonstrate that they will have a significant energy usage: 0,7% of Italy's electricity consumption is much more than 1.5 TWh annually. Researchers have indeed proven that the energy demand of one associated air - conditioning system service linked to the transmitting activities is 2/3, respectively, 1/3 of the power consumption. Furthermore, we present on-site renewable energy sources for producing a portion of the energy required by communication equipment, produced with vodafone supplier: a photovoltaic system has been planned and built for the first time the term at two different Italian locations. All processes have indeed been finished is for the German government to acquire financial incentives at each location.

Keywords: Radio-telecommunication; Transmitting activities; Vodafone supplier

Introduction

Recent days, renewable energy sources like solar, wind, geo thermal etc. are adopted to reduce the environmental pollution in different industries like Manufacturing [1-2], Automotive, Aerospace and Telecommunications. For enhancing the power efficiency, the expansion of communications in the latest days has led to a marked increase in Base Transceiver Station (BTS) numbers in France: as per a data (2007 update) of the National Environment Agency's Non-Ionizing Radiation Observatory BTS, there are around 60.000 in Italy. But on the other side, the increasing interest in innovative and dependable mobility services requires a rise in operating times and the traffic management of BTS so that the quality of services can be guaranteed wherever and at all times and the energy usage of BTS is considerably increased.

The decrease in energy usage of BTS consequently constitutes one of the essential aspects of telecommunication technology to create the administration of wireless communications systems to achieve a moral value of financial resources and to implement 'environmental' development actions. We aim to examine various options for the performance and improvement of telecommunications power systems' electricity consumption.

Active accounting for BTS in multiple technical settings are major research topic [3]

- Verification of energy sources of communications systems, including by special measurement data
- Analysis of energy-saving and performance measures
- Evaluation and creation of treatments and technological solutions based on the generation, by using solar cells on infrastructures itself, of a part of the electricity required by radio telecommunication equipment
- Analysis of prospective applications of renewable energy sources of off-grid telecommunications energy systems
- Environmental and social benefits analysis for the application of alternative source technology that meets requirements of the relevant of powerful broadcasting plants

Observations

Results collected from a representative study of about 100 cognitive radio networks across the national area, which correlates with even more than 1000 tracking dates, were obtained through the participation of Italian mobile telecom operators. Utilizing commercialized surveillance equipment, all field measures are done. Data has already been developed including the following data: power consumption (kWh), immediate energy (W), the location type, fitting technique, position, indoor sheltering temp (°C), exterior temp (°C), and mobile phone traffic.

Energetic utilization on radio station

Assessed daily energy use average data of 98 kWh/day, i.e. 35321 kWh/year, Average data. The whole nationwide energy usage, which is combining with the mobile telephone service, is around 3 TWh/year, which represents 0.7% of Italy's electrical power use, and 56% of telecommunications use [4]. The emissions of carbon monoxide linked with a BTS have been assessed based on such energetic consumptions. These were equivalent to 1.18 tonnes of CO, eq a year, which must be contrasted with both the entire national power emissions [5].

As something of an additional stage, it is worth studying the energy usage of the equipment and its structures, both in terms of their transmission function and electricity generation. To accomplish these objectives, by utilizing the program R of an "R-foundation for stochastic computing" [6], we calculated the statistics connections between both the energy usage and the operational parameters of BTS. In Figure 1, 4 study days demonstrate the electrical power:

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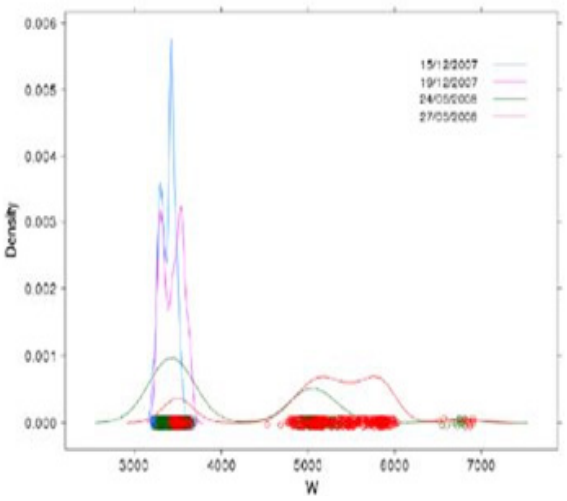

Figure 1: Condition density vs. energy distribution.

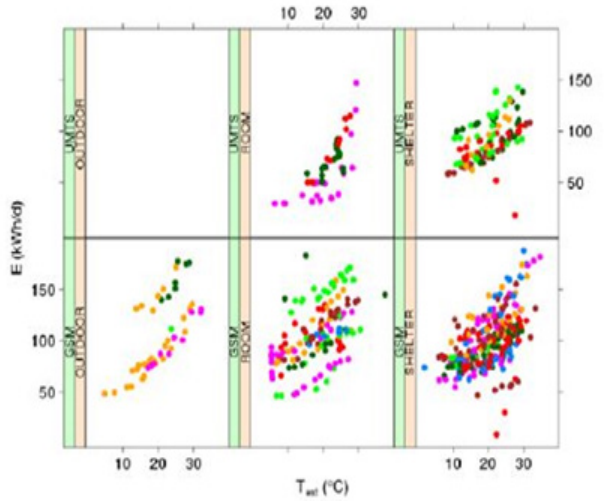

Figure 2: Exterior temperatures vs. electricity generation.

- 15 December 2017: the coolest day of observation, the range of temperature from lowest 2.8°C to highest 9,SOC; 15 December 2017: (the blue line)
- on 19 December 2017, average temperatures are typically between

7.0°C to max 17.6°C during the worst time (the violet line)

24 May 2018, is the usual warmest day wherein the temperatures fluctuate from 15, SOC to 37, 3°C at a lowest (the green line)

- May 27, 2018, is the warmest day of the level issues where the temperature varies between at least 21.8°C and a high of 42SOC (the red line)

On colder days (blue and violet) there is a distinct difference between probability distributions. The immediate energy probably is only due to the apparent magnitude and the communications between defined power values is peak. On the hottest days (red and green) the distributions are the transfer and the distributions are very similar.

In this approach, the power consumption associated with the communication operations and the air-conditioning activities 2/3 and 1/3 of the overall energy consumption may be estimated accordingly.

In Figure 2, we draw a change from the outdoor temperature of energy consumptions, for different types of BTS (refuge, room, outside) and BTS technologies (UMTS and GSM). The change in energy consumption demonstrates that it relies on the same temperatures, either independent of the utilized method as well as the BTS typology.

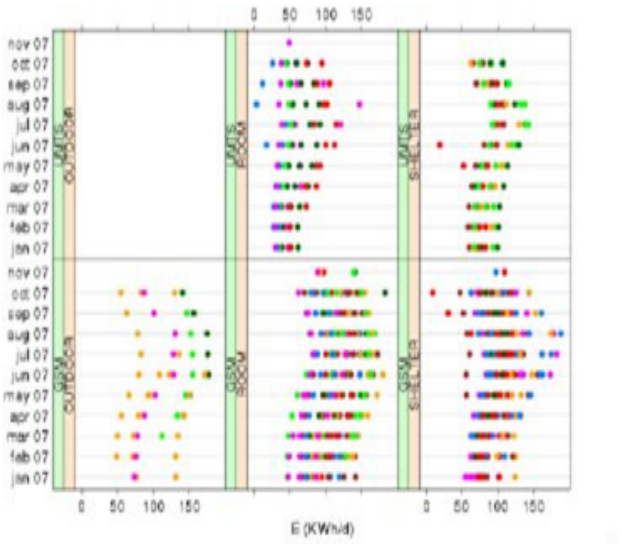

Figure 3: Utilization of energy vs. time duration.

The energy consumed in Figure 3 is discussed and recommendations BTS technologies (GSM and UMTS) and BTS site typologies depending on different times of the year (outdoor, room, shelter). Firstly, throughout the periods with more energy in the summertime winter season, we discover the same behavior as planned.

In addition, it is apparent from comparisons of the room typological charts to the shelter that, due to the differences in mobile communication standards, UMTS technology has and overall lower power consumption than GSM technology. In addition, for energy usage compared with year time, no variations have been identified for the three BTS types. Further analyses were performed to determine

the daily energy usage behavior based on the BTS telephone traffic (erlang). There are no correlations between the preliminary results. This has inspired new research to reduce the energy consumption of a BTS by utilizing specialized algorithms [7-8] and BTS activity and then on data [9-15].

Renewable energy and its applications

A few really pilot locations have already been recognized to evaluate energy efficiencies achieved via a full or partial inclusion of the solar cells fitting inside the broadcast ground station facilities; their energetically efficiency has also been shown to rely heavily just on space open to the photovoltaic's, the geography, and placement. Solar (PV) equipment was carried out at two of both the prototype plants on shelters and facilities; the size of solar panels varied from 17 m2 to 19 m2, with small radius availability, guaranteeing output of 2 kWp and 2.45 kWp. The construction on both locations is shown in Figures 4 and 5.

Figure 4: BTS structure design of Photovoltaic (PV) applications.

The two solar panels, correspondingly, were generated till 28/07/2018 and 1200 kWh and as per the VODAFONE Figures, which suggests an estimated annual estimate of 2350 kWh and 2790 kWh. This solar system thereby decreases CO, emissions by around two tones per annum. Semi-integrated equipment might potentially provide economic stimulus under Italian solar equipment regulations.

A monitoring station had been used to measure control conditions, such as consumption of electricity, domestic and foreign temperatures, and other environmental conditions for detailed reporting at some of these sites and to start comparing these same circumstances for power consumption before and after configuration of photovoltaic modules.

Conclusion

The assessment of the statistics and connection was performed to measure the average radio ground station power consumption, estimated in an order of 33,000 kWh annually, representing an estimated 30 percent share of the energy consumption for the air conditioner and 70 percent of the energy use for the transfer. In addition, the electricity consumption variance connected to the various locations, the various types, technology with varied workloads were verified.

Figure 5: Baseline structure design for Renewable Energy Sources (RES).

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