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Session 17 | On Mon, Jul 24, 7:12 AM PDT, you asked about: "please tell me about energy saving methods for radio access networks specifically for **base stations**" / Earliest Paper Pub. date: 2018-01-01

paperGPT answered:

[Perspective 1](#)

- The paper published on IEEE Communications Magazine highlights the need for off-grid and green energy sources to power small cell networks due to the high cost and environmental impact of traditional electricity sources. Energy harvesting technology is proposed as a viable solution [Ref 6].
- The paper in Wireless Networks focuses on reducing power consumption by implementing sleep mode in **base stations** without traffic load in two-tier heterogeneous mobile networks consisting of femtocells overlaid by macrocells. This approach could lead to considerable energy savings [Ref 2].
- The paper on IEEE Transactions on Information Theory discusses the concept of cooperative decoding at the **base stations** for intercell interference mitigation, which can lead to high frequency reuse. This approach is dependent on the topology and quality of the backhaul links connecting the **base stations** [Ref 9].
- Both the paper on arXiv: Information Theory and IEEE Wireless Communications Letters study wireless powered communication networks that employ the slotted ALOHA protocol. During the energy harvesting phase, the base station broadcasts radio frequency energy to the Energy Harvesting Users (EHUs), who use this harvested energy to transmit information back to the base station, thus saving energy [Ref 12][Ref 11].
- The Procedia Computer Science paper proposes the efficient method of turning off a base station in low load periods without affecting user traffic demand. This approach targets the transmission power and constant power, which are primary sources of energy consumption in each base station [Ref 5].
- The paper on Lecture Notes in Computer Science suggests the dynamic operation of cellular **base stations**, where redundant **base stations** are switched off during low traffic periods. It also discusses the use of prediction mechanisms to make proper decisions on when to take this action [Ref 17].
- The paper published on Computer Networks investigates base station sleep modes that reduce power consumption during periods of low traffic. This approach assumes that service is provided by the active **base stations**, ensuring service availability over the whole area at all times [Ref 19].
- The paper on IEEE Access focuses on discontinuous reception (DRX) techniques for energy savings in 4G radio access systems, which are deployed on legacy 2GHz spectrum bands [Ref 10].

Overall, the research focuses on various energy-saving methods such as energy harvesting technology, sleep mode implementation, cooperative decoding, dynamic operation of **base stations**, and DRX techniques. The technical focus varies from hardware solutions like turning off **base stations** in low load periods to software solutions like cooperative decoding and DRX techniques. The semantic similarity between the question and answer relates to energy-saving methods specifically for radio access network **base stations**.

4 Published on arXiv: Networking and Internet Architecture: Volume: / Issue: / Page: -; Involved Companies or Institutions: **Boğaziçi University**; published on 2020-06-15

Title: Reducing the total cost of ownership in radio access networks by using renewable energy resources

Abstract: Increasing electricity prices motivates the mobile network operators to find new energy-efficient solutions for radio access networks (RANs). In this study, we focus on a specific type of RAN where the stand-alone solar panels are used as alternative energy sources to the electrical grid energy. First, we describe this hybrid energy based radio access network (HEBRAN) and formulate an optimization problem which aims to reduce the total cost of ownership of this network. Then, we propose a framework that provides a cost-efficient algorithm for choosing the proper size for the solar panels and batteries of a HEBRAN and two novel switch on/off algorithms which regulate the consumption of grid electricity during the operation of the network. In addition, we create a reduced model of the HEBRAN optimization problem to solve it in a mixed integer linear programming (MILP) solver. The results show that our algorithms outperform the MILP solution and classical switch on/off methods. Moreover, our findings show that migrating to a HEBRAN system is feasible and has cost-benefits for mobile network operators.

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Keywords: hybrid energy based radio access network

6 Published on IEEE Communications Magazine: Volume: 53 / Issue: 94 / Page: 94-101; Involved Companies or Institutions: **Hong Kong University of Science and Technology**; published on 2015-06-10

Title: Energy harvesting small cell networks: feasibility, deployment, and operation

Abstract: Small cell networks have attracted a great deal of attention in recent years due to their potential to meet the exponential growth of mobile data traffic, and the increasing demand for better quality of service and user experience in mobile applications. Nevertheless, wide deployment of small cell networks has not happened yet because of the complexity in the network planning and optimization, as well as the high expenditure involved in deployment and operation. In particular, it is difficult to provide grid power supply to all the small cell **base stations** in a cost-effective way. Moreover, a dense deployment of small cell **base stations**, which is needed to meet the capacity and coverage of next generation wireless networks, will increase operators' 2019 electricity bills and lead to significant carbon emission. Thus, it is crucial to exploit offgrid and green energy sources to power small cell networks, for which energy harvesting technology is a viable solution. In this article, we conduct a comprehensive study of energy harvesting small cell networks, and investigate important aspects, including a feasibility analysis, network deployment, and network operation issues. The advantages as well as unique challenges of energy harvesting small cell networks are highlighted, together with potential solutions and effective design methodologies.

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Keywords: energy harvesting technology is a viable solution.

Apex Standards paperGPT is a cutting-edge tool that facilitates knowledge discovery in academic and scientific papers. It plays a crucial role in the R&D pipeline, aiding in strategic publication, patent filing, out licensing, reinvestment, and sustainable research for driving innovation. In the context of the 3GPP discussion, our search highlights the latest hot topic of energy-saving for high-performance 5G base stations in scientific publications. Researchers can leverage this information to explore new research areas, file patents, and propose contributions to technology standardization.