

# **Integrated 5G base station sleep mode**





## Overview

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To reduce average power consumption and save power in 5G, we have modelled the 5G BSs sleeping mechanism as an M/G/1 queue with two types of vacations (two different sleep modes), idle period (close-d.

Can hysteretic base station sleeping control save energy in 5G cellular network?

Hysteretic base station sleeping control for energy saving in 5G cellular network. In Proceedings of IEEE 85th vehicular technology conference (VTC spring) (pp. 1-5). Zhang, H., Guo, H., & Xie, W. (2021). Research on performance of power saving technology for 5G base station.

How does sleep mode affect 5G BS?

As the maximum sleeps in sleep mode 1 increases average power consumption  $(P_{\text{cons}})$  and power saving factor (PS) of 5G BS initially decreases then it becomes increases.

Can base stations save energy in 5G cellular networks?

Base stations (BSs) sleeping strategy has been widely analyzed nowadays to save energy in 5G cellular networks. 5G cellular networks are meant to deliver a higher data speed rate, ultra-low latency, more reliability, massive network capacity, more availability, and a more uniform user experience.

Does sleep mode 1 duration increase power saving factor of 5G BS?

As the sleep mode 1 duration  $(\frac{1}{\nu_1})$  increases power saving factor (PS) of 5G BS initially decreases then slowly it becomes increases. This is happen due to the reason that shorter sleep mode 1 duration provides lower power saving factor (PS) and longer sleep mode 1 duration provides higher power saving factor (PS) of the 5G BS.

What is a minimal 5G BS energy consumption optimization model?

Therefore, the problem can be formulated as a minimal 5G BS energy consumption optimization model, i.e., the energy consumption reduced by



reasonably switching off the idle or lightly loaded BSs and reasonably associate UEs with BSs (i.e., the BS switching state and BS-UE association state scheme).

What is 5G base station?

1. Introduction 5G base station (BS), as an important electrical load, has been growing rapidly in the number and density to cope with the exponential growth of mobile data traffic . It is predicted that by 2025, there will be about 13.1 million BSs in the world, and the BS energy consumption will reach 200 billion kWh .



## Integrated 5G base station sleep mode

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### Optimizing energy efficiency in heterogeneous networks: An integrated

The Distance-Aware Sleep (DAS) algorithm operates by determining the operational mode (active or sleep) of small cell base stations (BSs) within a HetNet, primarily based on their proximity to ...

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### ZTE Hibernation in 5G Base Stations

Hibernation has been successfully implemented in over 350,000 5G AAUs in China, leading to an average annual energy saving of 75 million kWh compared to deep sleep mode. In August ...

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### [Advanced sleep modes in 5G multiple base stations using ...](#)

Abstract--We consider in this paper multiple 5G base stations (BSs) implementing Advanced Sleep Modes (ASM) wherein each base station is able to deactivate some of its components ...

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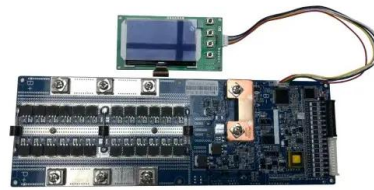


### Stochastic modelling of sleeping strategy in 5G base station for ...

To reduce average power consumption and save power in 5G, we have modelled the 5G BSs sleeping mechanism as an M/G/1 queue with two types of vacations (two different ...



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## **Energy-Efficient Base-Stations Sleep-Mode Techniques in Green ...**

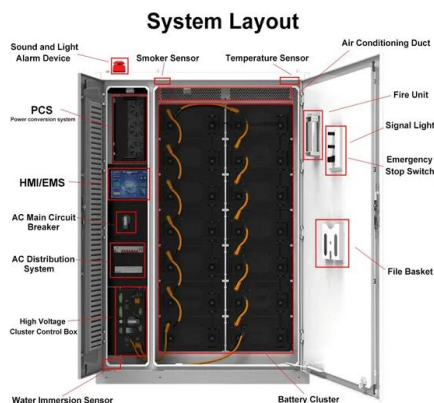
In this survey, we first present facts and figures that highlight the importance of green mobile networking and then review existing green cellular networking research with ...

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## **A User-Driven Sleep and Wake-Up Technology for Energy-Efficient 5G**

Abstract: As the primary source of energy consumption in communication networks, the power usage of 5G base station (BS) is a significant concern. The sleep mode (SM) of BS can be ...

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## [Adaptive Dynamic Programming for Energy-Efficient Base ...](#)

t the base stations to sleep mode when utilization is low over a time period. Salem et al. [16] performed base station switching between active and sleep modes periodically and maximized ...

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## Cooperative Sleep and Energy-Sharing Strategy for a Heterogeneous 5G

This paper proposes a cooperative sleep and energy-sharing strategy for heterogeneous 5G base station microgrid (BSMG) systems, utilizing deep learning and an ...

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## Comparison of Power Consumption Models for 5G Cellular Network Base

To the best knowledge of the author, there is no detailed information on the sleep mode specifics of actual base stations publicly available. As the relative disparity between the ...

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## Optimal Policies of Advanced Sleep Modes for Energy ...

SM4: it corresponds to the standby mode with a minimal duration of 1s. The base station is out of operation during this mode but the backhaul remains active so as to be able to re-activate it.

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### Lithium battery parameters

Product capacity: 100Ah

Product size: 135\*197\*35mm

Product weight: 1.82kg 197mm / 7.7in

Product voltage: 3.2V

internal resistance: within 0.5



## Energy Optimization of a Base Station using Q-learning ...

Abstract--A sleep strategy with several sleep mode (SM) levels for energy-efficient 5G base stations (BS) is proposed to reduce energy consumption. Energy consumption and Quality of ...

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## Energy consumption optimization of 5G base stations considering

An energy consumption optimization strategy of 5G base stations (BSs) considering variable threshold sleep mechanism (ECOS-BS) is proposed, which includes the initial ...

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## [Renewable energy powered sustainable 5G network...](#)

This survey specifically covers a variety of energy efficiency techniques, the utilization of renewable energy sources, interaction with the smart grid (SG), and the ...

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## [Base Station Microgrid Energy Management in 5G Networks](#)

The number of 5G base stations (BSs) has soared in recent years due to the exponential growth in demand for high data rate mobile communication traffic from various ...

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## [A User-Driven Sleep and Wake-Up Technology for Energy...](#)

Abstract: As the primary source of energy consumption in communication networks, the power usage of 5G base station (BS) is a significant concern. The sleep mode (SM) of BS can be ...

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## Energy efficiency of 5G mobile networks with base station sleep ...

The paper presents system level simulation results on future base station energy saving using a time-triggered sleep model. The energy efficiency of future base station is ...

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## Cooperative Sleep and Energy-Sharing Strategy for a Heterogeneous 5G

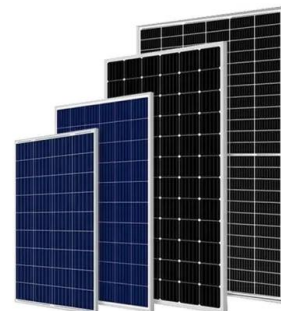
Moreover, traditional sleep-mode strategies for base stations (BSs) frequently compromise QoS during user handovers to active stations, while static optimization methods ...

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## A Holistic Study of Power Consumption and Energy Savings ...

The power consumption of a 5G base station using massive MIMO is dominated by the power consumption of the radio units whose power amplifier(s) consume most of the energy, thus ...

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## 5G Energy Modeling and Power Saving Schemes in ns-3

Our study evaluates 3GPP power-saving mechanisms, including connected-mode Discontinuous Reception (cDRX) and RRC INACTIVE state, to enhance UE energy efficiency in 5G ...

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## Maximizing energy efficiency in HetNets through centralized and

Lastly, sleep mode techniques, such as turning on or off underutilized base stations, offer simpler implementations and cost-effective solutions for improving energy efficiency.

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## Final draft of deliverable D.WG3-02-Smart Energy Saving of ...

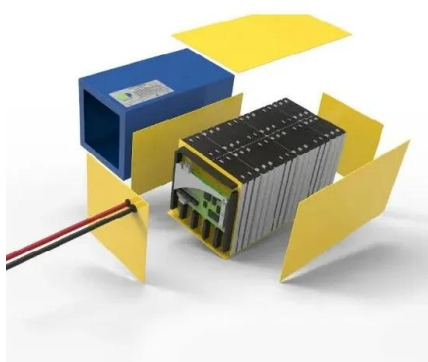
The 5G NR standard allows more components to switch off or go to sleep when the base station is in idle mode and requires far fewer transmissions of always-on signaling transmissions.

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## A Base Station Sleeping Strategy in Heterogeneous Cellular ...

Real-time traffic in a cellular network varies over time and often shows tidal patterns, such as the day/night traffic pattern. With this characteristic, we can reduce the energy consumption of a ...

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## Exploring power system flexibility regulation potential based on ...

A multi-BS cooperation self-optimising sleep strategy for 5G BSs that consists of an initial user association stage based on multi-BS cooperation (MBSC) and a self-optimising ...

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## Base station power control strategy in ultra-dense networks via ...

The DRL-based algorithm can dynamically optimize the base station sleep strategy and power allocation by taking into account the current system status, traffic load, and user ...

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