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Is Green Networks Tangible for Next Mobile Generations?

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Abstract

Green technology's ability to supply clean, low-cost energy has been taken for granted, but its associated costs have rarely been factored in. As a matter of fact, there are a plethora of costs and benefits associated with making such technology a reality. This research therefore assesses and contrasts conventional mobile networks with their green energy-oriented alternatives. We analyze the factors to be considered when favoring one green/renewable approach over another. This study demonstrates that green networks can have a cost efficiency (CE) that is roughly double that of typical networks, such the cloud radio access network. Hence, we can estimate the future total green network's trade-offs with varying site, city, country, regional, and equipment manufacturing features. Having this information will help service providers, investors, and network manufacturers strike a good balance between the two types of networks.

Introduction

More and more people are signing up for mobile networks, which means that more and more base stations are needed to handle the increased data traffic. This is causing a surge in energy use and worsening the energy crisis, both of which are contributing to the acceleration of global warming [1]. Heterogeneous networks, cognitive radio, energy harvesting [2], optimized resource allocations [3], cloudification [4], discontinuous transmission [5], and network function virtualization [6] are just some of the methods proposed in the literature to increase network capacity while also reducing spectral and energy waste.

Although these advances have the potential to cut power usage, they continue to rely on conventional electricity sources, which increases the proportion of harmful pollutants produced. Therefore, the 5G enabling technologies must not only provide these bandwidth and energy savings, but also facilitate a transition from diesel to green energy-based networks across the whole ICT industry, including cellular communications. It is hoped that by 2020, renewable energy would supply 20% of the world's energy demands and by 2035, that number will rise to 30% [7]. This environmentally conscious transition is necessary to replace traditional energy consumption patterns and to protect the planet from the worst effects of climate change and weather pollution [8]. Green refers to the fact that the network is fueled by renewable energy sources like solar and wind farms rather than the conventional electrical grid. Green technology, often known as renewable energy, refers to any system that is designed with negligible impact on the natural world as its primary goal.

The emerging communication networks will need energy, and green sources are expected to provide that energy without diminishing the earth's resources [9]. These objectives, however, cannot be met at the expense of fundamentally altering the way energy is produced and consumed.

The literature has emphasized the use of renewable energy sources in place of traditional grid supplies to power communications networks, without assessing the cost or tradeoffs behind the use of green technique.

Operational Challenges

1. The initial cost of deployment is quite substantial. Nevertheless, recovering this cost will happen after period in terms of the significant revenue and power gain that would result. When compared to using the standard grid, employing green energy over time results in a reduction in the amount of money spent on monthly electricity bills. When exactly does this benefit become available then? This problem demands a comprehensive modeling approach to determine the trade-offs at the level of the network system.
2. To get green networks up and running, you will need to spend a lot of money on things like purchasing equipment, having it installed, and performing routine maintenance. Launching a green network can be a daunting task as a result, particularly in the absence of backing from governments and other high-level institutions.
3. The process of generating green power is complicated, and the resulting power production rates are low when compared to the conventional method of generating energy, which involves the use of straightforward fossil fuel generators.
4. Because the geographical area needed to perform a green project is typically larger than the geographical area required for standard forms, the rent for the former might be significantly more expensive than the latter.
5. Green networks offer a potential answer to the problem of how to cut back on the increased harmful emissions that are the direct result of the burning of fossil fuels.
6. Because of this, it is imperative that the scientific research that is being done on 5G networks be focused on green electricity.

Green Network Limitations

1. Each month, fossil-fueled generators use approximately 1,500 liters of diesel fuel, which results in an annual expense of almost $25,000 for the network operators. In general, countries place a significant amount of their dependence on fossil fuels (such as coal, oil, and natural gas) as their primary source of energy. Unfortunately, fossil fuel is a non-renewable source of energy, which means that it will eventually run out because it is a resource that is in finite supply. Because of its restricted availability, its cost is expected to steadily increase over the course of time. If the cost of energy is high, then the cost efficiency (CE) (spectral efficiency (SE)/network cost) will also be high, which will result in a decline in the performance of the network [10]. Therefore, the answer to the problem of how to power the networks of the future lies in the use of alternative energy sources. Having said that, there needs to be an adequate supply of green electricity delivered to the location where the network is hosted.
2. The cost is a significant factor that must be considered when making the transition from conventional to renewable sources of power. The upfront, ongoing, and initial costs of purchasing, installing, and maintaining environmentally friendly equipment are higher than those associated with conventional equipment. However, this cost will decrease over time as the prices of environmentally friendly gadgets continue to decline, which bodes well for the long-term viability of environmentally friendly technology.
3. It is currently a priority on a global scale to cut emissions of carbon dioxide (CO2) in order to make the environment cleaner and to fight climate change. Clean energy is commonly referred to as renewable energy because it does not pollute the surrounding environment. About two to three percent of the world's total greenhouse gas emissions were attributed to the information and communications technology industry in 2010 [11], and projections indicate that number will rise to four percent by the year 2020.
4. The mobile industry alone was responsible for 0.2% of all emissions in 2010, with an expected increase to 0.4% by 2020. This increase in the quantity of harmful emissions is the result of an increase in the quantity of power that has been utilized. However, the use of green energy sources can have a negative impact on the surrounding ecosystem. For instance, disposing of large quantities of acid-based batteries can cause harmful radiation, and wind turbines may kill birds and impede the movement of ships if they are not carefully designed and constructed. In addition, solar cells require a huge quantity of space and a substantial quantity of electrical components, but they only create a negligible amount of power.
5. Since environmentally friendly technology has only been around for a short while, it does not yet have a proven track record of effectiveness. Because of this, potential investors in green energy projects may be dissuaded from doing so because they cannot be guaranteed of making a profit in a short amount of time.
6. As a result of the fact that a significant number of green energy projects are placed outside of the urban cores of cities, this may bring about economic benefits to some areas for workers and residents who live nearby and have a tough time finding jobs. In addition, the presence of renewable energy sources in these regions makes the process

of transporting energy to network sites much easier. This, in turn, shortens the lengths that transmission lines must travel and saves the amount of money needed to maintain them. The movement of traditional energy from the urban core to the rural areas, on the other hand, necessitates increased transmission losses and complex management.

7. For a mobile base station to function properly, it is necessary to use a certain quantity of electricity. If the station is entirely reliant on or fed by environmentally friendly power, then this source must be able to always produce the necessary amount of electricity. This is a definitive matter in terms of the dependability and scalability of green energy because green energy is completely dynamic and is depending on the weather and nature [12]. Rainfall is necessary for hydroelectric generators, whereas steady wind is necessary for wind turbines, and a certain amount of sun and a cloudless sky are necessities for solar panels. When these parameters are reduced to their barest minimum, the capacity of the system to generate energy becomes unstable and unpredictably variable. In addition, what is the likelihood that the environmentally friendly supply would be unsuccessful? What is the contingency plan, exactly? The issue of breakdown can be a significant problem for rural and suburban locations, particularly those in which there is complete reliance on environmentally friendly sources, but no hybrid (traditional-environmentally friendly) style of operation is utilized. In the same vein, focusing on renewable sources of energy in these kinds of locations can provide a solution, which is important given the difficulty of installing transmission lines.

Conclusion

If one were to take all of the above information into consideration, it would seem that the adoption of hybrid systems would be the more trustworthy option. This would mean that the network would be able to function using both traditional energy and green energy when the latter was available. If the service providers or network operators have a tool for calculating the power cost for traditional and green energy in a given area, a decision can be made quickly as to whether it is worthwhile to go green, hybrid, or completely traditional in terms of energy provision. This decision can be made by comparing the power cost for traditional and green energy in the area.

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