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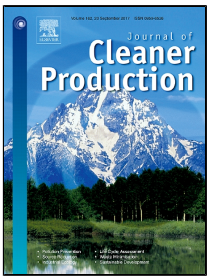

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PII:	S0959-6526(17)31909-1
DOI:	10.1016/j.jclepro.2017.08.176
Reference:	JCLP 10435
To appear in:	*Journal of Cleaner Production*
Received Date:	15 May 2017
Revised Date:	11 August 2017
Accepted Date:	20 August 2017

Please cite this article as: Branislav Milanovic, Boris Agarski, Djordje Vukelic, Igor Budak, Ferenc Kiss, Comparative exergy-based life cycle assessment of conventional and hybrid base transmitter stations, *Journal of Cleaner Production* (2017), doi: 10.1016/j.jclepro.2017.08.176

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Comparative exergy-based life cycle assessment of conventional and hybrid base transmitter stations

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Abstract
Within a mobile communication network one can discern between base and hybrid base transmitter stations (BTS). The hybrid base transmitter stations differ from the conventional ones in that they use some alternative energy sources for power. This work presents a comparative assessment of life cycles of solar-powered hybrid BTS, and conventional BTS, using CML-IA method and CExD-based exergy analysis. Complete analysis was conducted, presenting the results of life cycle analysis for both systems. The results of assessment are presented using CML-IA and CExD categories at the mid-point level. The results also reveal a detailed insight into the mechanism of evolvement and sources of negative impact during life cycles of the analyzed systems. This establishes the basis for the development and manufacture of sustainable products and processes. Considering majority of factors, the use of hybrid BTS is justified. The exceptions are the categories of abiotic depletion, ozone layer depletion, and acidification according to CML-IA method, as well as the categories of non-renewable, primary and non-renewable minerals according to CExD method, which indicates greater negative impact in comparison with the conventional BTS.

Key words: life cycle assessment, comparative analysis, exergy, hybrid base transmitter station

1. Introduction

Base transmitter station (BTS) represents a part of communication network which provides communication between end-user's equipment (e.g., mobile phone) and the network. The ever growing number of BTS worldwide, currently estimated to around 5 million, has motivated increased interest in providing more efficient power sources, especially having in mind the climate changes. Although the optional solutions mostly include photovoltaic panels and wind power generators, there are also solutions based on small hydro generators, biofuel generators, as well as hydrogen fuel and fuel cells. BTS locations which utilize these alternative options, are called hybrid base transmitter stations (HBTS). The combination of these alternative options with the batteries and diesel generator as backup, constitutes a standalone hybrid system. However, such hybrid systems are mostly connected to local power grids, wherever possible. The introduction of alternative options for power supply in locations which lack access to power grid, or which abound with alternative energy resources, is economically and technically justified since it reduces energy consumption. It should be noted that local conditions predominantly dictate the selection of alternative power source options. Since BTS is part of communication equipment which accounts for approximately 60% of the total energy consumption in the mobile communications sector (Han et al., 2011), there is an interest in reducing energy consumption and CO_2 emission through: reduced BTS energy consumption, reduction of BTS installations, use of renewable energy resources. BTS locations can produce green energy, storing the potential energy surplus and, eventually, redirecting it into the power grid.

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