

## **Estimation of Life Cycle Energy Use Implications of Wired and Wireless Communications Networks Using Hybrid LCA Models**

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There has been rapid growth in the popularity of mobile phone use in the US. According to the Cellular Telecommunications and Internet Association (CTIA) semi-annual Wireless Industry Survey, the US has seen a steady increase in the number of subscribers, wireless minutes of use, cumulative capital investments, total number of cell sites and total service revenue. Further, a 2002 report from the Yankee Group stated that 3% of US households have completely replaced landlines with wireless phones. As the size of the cellular network grows, it is important to analyze the energy impacts and implications of its growth, compared with the 'traditional' Public Switching Telephone Network.

This paper investigates the energy consumption of the telecommunications network in the United States. The scope of the study covers the 'voice' network, including both the Public Switching Telephone Network (PSTN) and the Mobile cellular network. Using results from a previous study, the estimated total electricity consumption of the telecommunications network in the US was found to be about 25 TWh/year, about 0.6% of the US total electricity consumption. This paper also analyzes the breakdown of the energy consumption between the PSTN and the Mobile network, and found the Mobile network to be more energy efficient in terms of energy used per subscriber connection.

One important consideration when making such comparisons is the allocation of core communications network services to wired and wireless networks. This is because wireless networks are only wireless at the endpoints. They still depend heavily on a wired core network to provide service. These results on the energy consumption of voice communications networks are compared to previous work done by the authors on energy implications of data networks.

An additional component to this analysis is an estimate of the energy required to manufacture the wired and wireless telecommunications equipment (e.g. network cards, etc.). This estimation is done using EIO-LCA, an economic input-output based LCA model available freely on the Internet. Economic input output models have been used as an alternative approach to process based life cycle assessment models. A United States input-output model for this purpose is maintained by Carnegie Mellon's Green Design Institute and is available at the website <http://www.eiolca.net>. The model traces the supply chain requirements, energy use, and environmental impacts of purchases from any of up to 480 economic sectors. The current model uses the 1997 benchmark of the US economy, as released by the US Department of Commerce Bureau of Economic Analysis.

Overall, this paper will show the relative energy use of wired versus wireless networks considering manufacturing and use-phase energy effects.