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"Gheorghe Asachi" Technical University of Iasi, Romania

OBTAINING THE RESIDENTIAL MANAGEABLE CARBON DIOXIDE EMISSION CAPACITY BY ACTIVITY-BASED POWER MODELS

Mehmet Ali Sonmez*, Mustafa Bagriyanik

Department of Electrical Engineering, Istanbul Technical University, Ayazaga, 34469, Turkey

Abstract

Participants in Residential Demand Response are motivated via incentives offered by aggregators to reduce CO_2 emissions. Aggregators aim to succeed the day-ahead emission of CO_2 in the allowed range thanks to the loads that make up the manageable electricity demand. The reduction in the peak value of CO_2 emissions can be done by postponing the running time of the manageable loads. In this study, a novel method that aimed to obtain manageable residential CO_2 emission capacity by activity-based power models was introduced. Studies were conducted with sixteen residential appliances involved in twelve activities in three cases. Power models were created by adding realistic electricity energy data, consumer behaviors, behavioral adaptations, habits, and physical determinants. Simulations were done over a week for twelve months to obtain direct CO_2 emissions due to electricity and natural gas demand of 100 houses. Day-ahead electricity related CO_2 emissions were calculated via the share of resources involved in electricity generation to meet consumers' demand. The manageable capacity of the emitted CO_2 was at least 56.7% of the total electricity-based emission. The share of the manageable capacity in emitted CO_2 was at least 28.8%, 14.8%, 13.1% for interruptible, automatic deferrable and manually deferrable loads respectively. The mean value of the gas-induced CO_2 emission in a house for hot water need and space heating with combi boilers was 4.1 kg.

Key words: carbon dioxide emission, consumer behavior, demand response, manageable demand

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* Author to whom all correspondence should be addressed: email: masonmez@itu.edu.tr; Phone: +90 2122856710; Fax: +90 2122856700