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GHG EMISSION SCENARIOS RELATED TO PASSENGER ROAD TRANSPORT ENERGY USE IN THE MAIN MEXICAN METROPOLITAN AREAS

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OVERVIEW

Transport energy use amounted to 26% of total world energy use and the transport sector was responsible for about 23% of world energy-related Greenhouse Gas (GHG) emissions in 2004 (IEA, 2006).In the case of Mexico, transport represented 34.5% of primary energy use and 39.3% of GHG emissions related to energy use in 2007 (Sener, 2008; Sheinbaum et al, 2009). Urbanization is one of the main factors influencing the growth of fuel consumption for transportation. About 75% of people in the industrialized world and 40% in the developing world live in urban areas (Kahn et al., 2007). According to the last Mexican population account, in 2005 76.5% of the 103.3 million inhabitants of Mexico lived in cities, and of those, 34% lived in the three main urban regions: Mexico City Metropolitan Area (MCMA), Guadalajara Metropolitan Area (GMA), and Monterrey Metropolitan Area (MMA). MCMA is located in the south center of the country, it accounted for 19.2 million of inhabitants distributed in 59 municipalities of the State of Mexico, and 16 delegations of the capital city (Distrito Federal), and it represents around 35% of the national GDP. GMA is located in the West of the country; it is the second largest metropolitan area with 4.1 million of inhabitants distributed in 8 municipalities of the state of Jalisco. MMA is located in the North of the country, had 3.7 million of inhabitants in 2005, distributed in 12 municipalities of the state of Nuevo Leon.

The present study estimates energy use in road passenger transport and related GHG emissions for the three main Mexican metropolitan areas, for year 2020. It presents a baseline scenario supported on historical trends, and estimates energy use and GHG emissions for four mitigation scenarios: a) better fuel economy in new vehicles; b) introduction of hybrid vehicles; c) changes in the rate of growth of minivans and subcompact vehicles; and d) increase use of public transportation by Bus Rapid Transportation Systems (BRT).

METHODS

A simple end-use model has been developed to estimate energy demand and GHG emissions of passenger road transport sector in the Mexican metropolitan areas, stand on the *Mexican Energy-Emission Scenario Model (MEESM;* Sheinbaum and Masera, 2000), and other end-use models, and similar to the one used by Yan and Crookes (2009). It is based in the following expressions:

$$E_t = \sum_{j\,i\,t} V_{ijt} * d_{ijt} * fe_{ijt} \tag{1}$$

$$CO2_t = \sum_{j\,i\,t} V_{ijt} * d_{ijt} * fe_{ijt} * EF_{ji} \tag{2}$$

$$G_{ty} = \sum_{j\,i\,t} V_{ijt} * d_{ijt} * F_{jiyt} \tag{3}$$

Where, E (J) is the energy demand for passenger road transport, *t* is the calendar year; *i* is the vehicle type, *j* is the fuel type, V_{ijt} is the vehicle population of the fuel type *j* for vehicle type *i* in the year *t*; d_{ijt} (km) is the fleet average annual vehicle distance travelled of the fuel type *j* for vehicle type *i* in the year *t*; fe_{ijt} (J/km) is the fleet average on-road fuel economy of the fuel type *j* for vehicle type *i* in the year *t*. CO2t is the CO_2 emissions in year t, EF_j is the emission factor (g/J) of fuel type j obtained from IPCC (1996). G_{ty} is emission of gas *y*, where *y* could be N_2O (nitride oxide) or CH_4 (methane); and F_{jiyt} is the emission factor of gas *y* (g/km) of the fuel *j* for vehicle type *i* in year t.

RESULTS

According to the business as usual (BAU) scenario, the vehicle fleet in year 2020, will almost doubled respect to 2006, with a share of private car of 88% of total. The number of private cars of the three metropolitan areas will account for 10.4 million in 2020. Energy demand of passenger road transport of the three metropolitan areas will increase 80%, from 407 PJ to 736 PJ and GHG emissions will rise 87%, reaching the value of 57.6 Tg of CO_2 equivalent. Accounting for all mitigation measures, the GHG emissions can be reduced in 2020 by 20% respect to the BAU scenario.

CONCLUSIONS

The growing use of the private car, together with inadequate public transport services has promote energy consumption and GHG emissions increase, but also has placed the mobility of persons under pressure in many cities of the world. Mexican cities are not the exception. This study shows that car efficiency measures and structural changes from private to public transportation have to be taken in order to reduce fossil fuel consumption and GHG emissions in the three main metropolitan areas of Mexico.

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