Fuel options for the transport sector in the Kathmandu Valley, Nepal
Dilip Khatiwada

Summary
Given the present adverse situation of energy security, flow of hard cash in importing scarce fossil fuels and deteriorating air quality of congested urban cities of developing countries, it is important to evaluate worthiness of available renewable energy options in transport sector. This thesis examines and reviews appropriateness of available fuel options—ethanol blended gasoline and electricity—in the transport sector of the capital city of Nepal, Kathmandu Valley. First, the study estimates the net energy value (NEV) and energy yield ratio of molasses-based ethanol from cradle to grave approach. Second, performance of ethanol blended gasoline vehicle is reviewed. Potential of ethanol production and subsequent gasoline savings are scrutinized. Third, energy efficiency of battery operated three-wheeler electric vehicle (EV) is examined and compared with conventional fossil fuel powered three-wheelers.

Preliminary finding shows that fossil fuel consumption to produce one litre of anhydrous ethanol (EtOH) is 2.799 MJ, which gives energy yield ratio of 7.573 at the present condition. This ratio becomes lower when the use of fertilizers/chemicals and rate of irrigation are increased. Price of molasses contributes a big role since economic allocation is used to partition the energy values associated with sugar and molasses. The study also depicts that total energy inputs (fossil plus renewable) are higher than the net energy content of EtOH. At present, E10 (blend of 10% EtOH and 90% gasoline in volume by volume) can substitute 5,485 m³ of the imported gasoline annually. Besides, local air pollutants like CO, HC are greatly reduced. Three-wheeler battery operated electric vehicle (EV) has lower well to wheel (WtW) and tank to wheel (TtW) efficiency than their LPG, gasoline and diesel operated counterparts in terms of fuel consumption per kilometre. WtW efficiency of the EV is 1.789 MJ/km while diesel and gasoline three wheelers have 3.587 MJ/km and 3.712 MJ/km respectively, considering 99% of electricity in the grid is supplied by hydropower and the rest 1% by diesel power plants.