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Physics for Sustainable Personal Transportation

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Often portrayed as the major villain in discussion of global climate change, the modern automobile is a surprisingly efficient transportation appliance. Measured by CO₂ emissions per passenger mile, a compact hybrid electric vehicle (HEV) with two occupants compares well with mass transportation. However, so long as automobile ownership remains an aspiration in the developing world and a necessity in many parts of the developed world, continuous reductions in in-use and life-cycle environmental impact will be necessary if this form of highly-capable personal transportation is to remain a viable option in a sustainable future. The automobile is an unusual consumer product in that over its lifetime, the energy that 'moves through' it is many times that required to create and dismantle it. In this presentation, the life-cycle of an automobile is considered as a series of transformations of material and energy. This construct illustrates the many places where research in various areas of physics will play a role in reducing that environmental impact. Several important Ford research projects will be highlighted. While many of those efficiency opportunities may seem merely incremental, the sheer number of conversions associated with each vehicle, the energy that moves through each vehicle and the global vehicle population hugely magnifies even the smallest improvement. The development and deployment of the requisite technologies in products that are efficient, appealing and affordable is the key to sustainable personal transportation.