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# Preface

The preface is an opportunity for the author to have a conversation with the reader concerning various aspects of the book. Many readers skip the preface. One author was so determined that his preface be read, that he inserted it between the first and second chapters.

The intended audience includes the buyers or would-be buyers of hybrid vehicles. This book provides reasons why or why not to buy hybrids, as well as the facts necessary to guide the buyer's choice of a hybrid. The reader who is interested in the impact of hybrids on the environment will find useful concepts herein. The future of personal transportation vis-à-vis global warming and the finite limit of petroleum is addressed in great detail and questions such as "What's new on the horizon?" and "When will these advances appear in the showroom?" are answered.

More specifically, the intended readers are potential hybrid customers; automobile enthusiasts who subscribe to *AutoWeek*, *Motor Trend*, *Car and Driver*, *Automobile*, etc.; automobile dealership sales and repair personnel; clients of both educational and public libraries; government workers from the Environmental Protection Agency, Department of Energy, California Air Resources Board, state departments of transportation, etc.; rescue personnel from fire departments, ambulances, and highway patrols; and members and staff of Congress. Some business executives need a reliable source of information about hybrids to make intelligent business decisions.

One goal of the book is to provide information for the educated citizen. Important decisions are to be made in the coming years. Driving a car is fun, but the cumulative consequences of 1,000,000,000 cars on the road are serious. (That is right, in the near future, 1 billion cars will be on the roads of the world.) The potential for wars being fought over oil and the subsequent economic disaster is great. Intelligent decisions may avoid the rocks and shoals of the future.

The book is itself a hybrid of material primarily for the intelligent general reader with added insight for the equation-confident reader. The level of writing is similar to that of *Scientific American*. The book combines descriptions in nontechnical English with the accuracy and insight of equations. With regard to equations, approach them with an open mind. If you balance your own check book, you are qualified for this book. If you prepare your own income taxes (using TurboTax or TaxCut, even), then you are overqualified for the contents of this book. Equations provide transparency; all the assumptions are clearly presented. The technology discussed is neither shallow nor overwhelming.

For the engineer, the book provides a starting point for additional research. Many engineers in the scope of their technical knowledge do not cover all the different topics presented in this book. An engineer specializing in structures and the finite element method for computation is unlikely to be familiar with electrochemistry. An expert in control theory will likely not be conversant with advances in internal combustion engines. For the various engineering disciplines, the book provides a nontrivial introduction to each of the technologies essential for hybrids.

To really understand this subject, one must have some feeling for the magnitude of numbers and what a certain magnitude means. Most of the car-buying and car-driving public recognizes that 50 hp is really small for a car while 300 hp is quite powerful. For hybrids, electrical units, such as those for power (kW) and energy (kWh), are being force-fed to the public. The hybrid enthusiast develops an understanding of the implications of a 2 kWh battery. This book nurtures and expands your understanding of numbers related to hybrids.

This book is written by a retired engineer and college professor. Engineers love to learn how gadgets work. Around two years ago, the author read an article that listed the components in a hybrid. From the list, the functioning of hybrids was apparent. This stimulated two years of research on hybrids followed by 18 months, more or less, writing the book.

Besides a career teaching at the college level and a background in engineering, the author was exposed to automobiles while still a teenager. During World War II, he managed a Shell service station on old Highway 66 in Gallup, New Mexico. Later in college, he worked for \$1/h in a service station to help pay college expenses. He has owned cars (from the United States, Germany, Italy, Japan), pickups (from the United States), sports cars (from Italy, Britain), and minivans (from Japan, the United States). He has overhauled Ford Model A four-cylinder engines, Ford V-8s, and Rio pickups; and also differentials and cooling systems. He later became a fellow of the Society of Automotive Engineers (SAE). Four wheels and an open road still remain a strong attraction.

This may be the tenth and final book the author has written or edited over a span of 40 years. Approximately three months were devoted to Chapter 12. Considerable material was assembled, and numerous equations were derived. Enough information was gathered to write another book!

Parts of the contents have formed the basis for several luncheon and dinner lectures. At the end of the talks, the author came to know the interests of the audiences. Also, he was made aware of the weak spots in the presentations.

One feature of the book is the information placed at your fingertips on the inside front and back covers. This includes data on the energy density of gasoline, conversion factors from horsepower to kilowatt, etc.

The data for this book have been gathered from the Internet, SAE technical publications, auto enthusiast magazines, and government reports. With regard to the Internet, two types of postings are available. One type of Internet listing is called “buoyant nonsense,” buoyant because of an optimistic (unrealistic) view and nonsense because of the huge disconnect from the realities of the technical world. Another type is called “accurate” and “informative.” This book uses the latter type to its advantage and discards all that is unnecessary. The SAE reports are written by and written for automotive engineers working on hybrids and other vehicles. These reports have been dissected and presented herein.

Julie Fleer and Donna Aikins, who are professional graphics artists, translated most of my hand drawn sketches into exceptionally fine figures. Figures in Chapter 14 were drawn by Larry Omoto of the Hana Group, Monterey, California. A few of the figures in Chapter 17 were drawn by Thomas Blackwell while he was completing his degree in graphic arts.