

Preface

The genius for the next generation

Richard H. Truly

Time and again during the past century, engineering genius turned imagination into reality. We created one marvel after another: from automobiles to powered flight, from the construction of cities on Earth to the exploration of our moon and planets, from the building of our interstate highways to the creation of the Internet. But somehow along the way we neglected and even jeopardized the prosperity that flows from natural ecosystems by creating a gargantuan demand for energy for our rapidly growing human population.

In April and May of 1961, Russian Yuri Gagarin and American Alan Shepard became the first humans to see the whole Earth and to feel the overwhelming realization of its fragility. The first astronauts saw the forces of nature and climate—smoke from volcanoes, spiraling hurricane clouds, and the blowing dust of the Sahara—and also saw human wonders—the Great Wall of China, the pyramids, and city lights.

Just 20 years later in November, 1981, on my first space mission aboard *Columbia*, I marveled at similar wonders—but I also saw the sobering evidence of thick pollution, from the Los Angeles basin to Mexico City to Tokyo. Twenty years after my first flight, US astronaut Frank Culbertson, Commander of Expedition Three aboard *Space Station Alpha*, reported that Earth was a planet clouded in smoke and dust and visibly scarred by mining and forest destruction. Culbertson believes the changes are a cause for great concern, and I couldn't agree more.

Our high level of energy consumption today reminds me of Edna St. Vincent Millay's famous stanza:

My candle burns at both ends
It will not last the night
But ah, my foes, and oh, my friends—
It gives a lovely light!

(A Few Figs From a Few Thistles, "First Fig")

It is, indeed, a lovely light. The result, however, is the continuing depletion of our storehouse of fossil fuels, our increasing reliance on vulnerable infrastructures, and our continuous addition of waste to our environment.

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I believe in a transition strategy called “investing for the future.” This strategy is the quick and substantial improvement of the efficiency of both energy production and end use, as well as mitigation of the environmental consequences of fossil fuel use and of nuclear waste. This strategy relies on the use and further development of renewable sources of energy. “Investing for the future” requires preparation and work on our part to move from incremental changes in the near term to full paradigm shifts in the long term. Paradigm shifts require unprecedented engineering, public involvement, and infrastructure.

Imagine a world described as YIMBY—“Yes In My Back Yard”—welcoming windmills, solar collectors, and complete product recycling centers. Imagine communities and businesses joining together to build the infrastructure necessary for the use of clean hydrogen power. Worldwide, the pay-off is that people will be able to prosper while putting minimal burdens on future generations, and that all countries will become more self-sufficient and less likely to wage war. No small feat!

This book is full of examples of how this imagined future is already becoming reality. It reminds us that human genius and corporate leadership can help citizens craft a future for their children and grandchildren. It reminds us that environmental progress also depends on research, government policy, and market demand. The genius in this book is a beacon for the next generation of engineers who will solve the daunting challenge of climate change with energy efficiency and renewable resources.

If we stay this course, then public policy, science, and engineering will transform markets into users of clean, secure, reliable energy. The candle will last the night!



Vice Admiral Richard Truly (Ret.) is Director of the Department of Energy’s National Renewable Energy Laboratory (NREL) and Executive Vice President of the Midwest Research Institute. NREL is a center of excellence for renewable energy and energy efficiency research to benefit both the environment and the economy. Prior to joining NREL, Truly was Vice President of the Georgia Institute of Technology, and he served as the National Aeronautics and Space Administration (NASA)’s eighth administrator under President George H.W. Bush from 1989 until 1992. In 1986 he led the investigation of the *Challenger* accident and spearheaded the painstaking rebuilding of the Space Shuttle program. Truly’s career as an astronaut included work in the Manned Orbiting Laboratory and NASA’s Apollo, Skylab, Apollo-Soyuz, and Space Shuttle programs. He lifted off in November 1981 as pilot aboard *Columbia*, and he commanded *Challenger* from August to September 1983. Richard Truly and his senior NREL engineers provided technical review to this book and are nominating additional technologies for subsequent editions.