Preface: Running on Empty

Even as a child, I was interested in oil. When I was 10 years old, Dad drove us into the hot oven of Death Valley in a dark blue car with black seats and no air-conditioning. We were being cooked alive. The gas gauge crept toward empty for what seemed like hours. I thought, for sure, we were going to run out of gas. Cockroaches may be able to survive this heat, but I am not a bug! I will never forget finally pulling into the gas station, the drinking fountain getting ever closer until, at last, I felt the delicious chill of water in my throat. Dad gassed up the car, and all was well with the world.

A decade later, it looked like civilization itself was running on empty as the energy crisis of 1973 took over our lives. I was in college, and joined an alternate technology group. We watched engineers build electric cars, windmills, and convert a car to run on methanol. I got to help build a solar collector by drinking beer and painting the cans black. Saving the planet was not only going to be fun, it was going to be a party!

It wasn't long before non-OPEC oil was found and the Mideast turned their oil tap back on, and I stopped worrying about energy. Renewable power was on the way and the "evil" oil companies wouldn't be able to stop it. My grandfather, Professor Francis J. Pettijohn, was a seminal figure in sedimentary geology. Sedimentary basins—that is where you find oil! Grandfather would try to educate me about the energy density of oil and the high hurdles blocking the path of alternate energy, but it wasn't until I read his memoir that my world view of running the planet on beer-can solar power changed. That's when I discovered that Grandpa had been a friend and mentor of M. King Hubbert, who predicted world peak oil production around the year 2000.

Yikes! It *was* 2000. Had oil peaked yet? An Internet search led to a Pandora's box of Jay Hanson's die-off website, Yahoo group energy resources, and years later attending Association for the Study of Peak Oil conferences. I was a science writer and shifted my focus from natural history to energy-related topics, and have since then read hundreds of books and thousands of articles on energy from within the U.C. Berkeley library system.

Earlier in my life, to pay the mortgage I designed and architected software systems, which I learned how to do at Electronic Data Systems after rigorous training in analysis and assembler programming working on the Medicare system, followed by a stint at Bank of America in the check processing division, and finally 22 years at American President Lines (APL). As a systems engineer, you need to have both a "big picture" and detailed understanding of the business framework before designing a new system. Inevitably, everything is connected.

APL was a global shipping line that also routed cargo on trucks and trains as well as helped customers with logistics, especially just-in-time freight and the fastest, most reliable delivery times possible within a continuous intermodal flow of containers across ships, trains, and trucks. APL was a leader in transportation and had the most extensive container ship system in the U.S. by the late 1960s, and partnered with rail to start the StackTrain service, containers stacked double high on railcars, tremendously increasing the efficiency of trains and reducing fuel consumption.

All of the APL computer systems needed to be up 24 × 7, everywhere, or ships, trucks, and trains would stop as Bills of Lading, manifests, and dozens of other legal documents could not be produced. Around the clock, everything from military supplies for the 1991 Gulf War to running shoes was kept on the move with as little waiting time as possible between modes of transportation.

When a new project came along, I needed to understand how long it would take and how many staff were needed to make sure an "improvement" didn't cost more than the money saved. This is very much like the "energy returned on invested analysis" performed to make sure more fossil energy isn't invested than returned on a given technology or project.

In business, this kind of analysis is essential to prevent bankruptcy. Yet when scientists find oil, coal, and natural gas production likely to peak within decades, rather than centuries, or that ethanol, solar photovoltaic, tar sands, oil shale, and other alternative energy resources have a low or even negative energy return on the energy invested, they are ignored and called pessimists, no matter how solid their findings. For every one of their peer-reviewed papers, there are thousands of positive press releases with breakthroughs that never pan out, and economists promising perpetual growth and energy independence. Optimism is more important than facts. And, it's essential for attracting investors.

Civilization as we know it depends on our global transportation system of ships, trains, and trucks, all of which are fueled by oil. Since oil reserves are finite, one day supplies will be diminished to where the cost of moving freight and goods with our present oil-fueled fleet will not pencil out. We have an oil glut in 2015 and a corresponding lack of urgency. Yet, inevitably the day will come when oil supplies decline. What will we do? What are our options? That is the sobering reality this book will explore.

Using my transportation knowledge and the analytical skills I learned during my 27-year career as a systems engineer, my science background (B.S. in Biology with a Chemistry and Physics minor from the University of Illinois), and what I have

learned over what is now 15 years of energy research, I will look at the vulnerabilities of our current commercial transportation sector.

Everything in our homes, everything in our stores, got there on a truck at some point. Before that, many of those goods also were transported by ship and/or train.

Come the day that oil is no longer abundant and affordable, will the millions of trucks that make our way of life possible be able to keep on running? I'll look at the energy scenarios that could disrupt trucking, followed by overviews of the roles and respective energy efficiency of ships, railroads, and trucks—the three modes of heavy-duty transportation essential to keeping industrial civilization running. After that there are three chapters on oil: how invisible yet necessary it is, peak oil risks, and the distribution of liquid fuels. Then the viability of alternative fuels that are already commercially developed to replace oil is considered: biofuels, hydrogen, natural gas, and liquefied coal. Another way transportation might continue without a diesel fuel substitute is electrification with batteries or overhead wires, the subject of the next chapters. If electricity is to be used to power transportation, then it is important to understand the issues that need to be solved as we migrate towards a 100 % renewable electric grid as fossil fuels decline. Finally I look at other issues that will affect transportation such as climate change, at U.S. government energy policy since the first energy crisis in 1973, and then conclude with how I see the road ahead.

This book is very United States-centric, because the U.S. uses the most oil of any nation, is the most dependent on oil for transportation, and will be the most affected by oil decline. America is also the military superpower that keeps oil flowing from the Middle East (or at least thinks it does), where two-thirds of the remaining oil lies, to Europe and Asia. Finally, the U.S. is where I live.

We live in the Oil Age, and as oil declines, our lives will change. Eyes wide open, this book explores the way forward.

The book would need to be many hundreds of pages to cover commercial and noncommercial energy technology as much as I'd like, but more information can be found at my website, www.energyskeptic.com.

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