



ENERG CIVILIZATION

By Doug Reynolds, illustrations by Harrison Carpenter

THE FOLLOWING ARTICLE IS ADAPTED FROM THE PROLOGUE TO *ENERGY CIVILIZATION*, PUBLISHED IN 2011 BY DOUG REYNOLDS, PROFESSOR OF ECONOMICS WITH THE SCHOOL OF MANAGEMENT. THE BOOK EXPLORES HISTORICAL ECONOMIES RELATIVE TO ENERGY SUPPLIES.

In January 1991, Saddam Hussein, the president of Iraq, proclaimed that the struggle to control Kuwait would be “the mother of all battles.” But Hussein’s words rang hollow, as it took a mere 100 hours for Iraq to lose Kuwait to the U.S.-led forces. However, Hussein’s words may have had more meaning than expected. During the famous Iraqi retreat some 700 oil wells were torched, and it took eight months to extinguish them. Nearly a billion barrels of crude oil were lost, the equivalent of \$100 billion, which does not include the cost of the effort to extinguish the fires or of the war in the first place. Given the expense of the Gulf War and the subsequent invasion of the coalition into Iraq — actions that involved the security of oil supplies — you might say that oil is the mother of all resources, and may indeed be worth more than one war.

In the 1970s, I knew energy was the key to the world’s future, and I assumed, like most economists, that new technology would come to the rescue. After all, we know that necessity is the mother of invention. I have now come to a very different conclusion: rather than invention, necessity is the mother of adaptation. Counting on technology to solve a crisis is at best a 50-50 proposition.

But counting on adaptation to respond to a crisis is 100 percent reliable. Adapt and thrive. So, I decided to adapt ahead of time and find the most successful strategy to use less oil, partly as a research experiment, partly to make a significant lifestyle change at my own pace, and partly to explore a new future.

Fairbanks is a perfect place to carry out such an experiment because the Fairbanks economy is intensely dependent on oil. There is a major oil pipeline and a refinery near town, and the majority of residents use fuel oil to heat their homes and gasoline to drive their cars. However, contrary to what you might expect in an oil-producing state, Fairbanksans pay more for gasoline than most Americans, even with a refinery nearby. Additionally, the town is heavily dependent on tourism and mining for employment, industries that rely on oil to transport tourists, employees and machinery. Finally, according to the weather service, we have 100 percent probability of snow on Christmas. So, how to adapt?

On a cold day in Fairbanks, it can reach 40 below zero and be pitch dark. The sun doesn’t rise until midmorning. In spite of this, I have managed to bicycle to work nearly every day to save fuel and money. I wish I could tell





WHAT IF ALMOST EVERY FAMILY IN FAIRBANKS WERE FORCED BY THE HIGH COST OF ENERGY TO RELY ON WOOD OR COAL HEAT?

you of the beautiful scenery I pass on the bike path and along the river, of the way a simple black spruce looks covered in snow, of how the snow makes even a dark morning seem brighter, but really it's a tough ride. I wear heavy snow pants, a parka, gloves, boot gloves, a face mask and a helmet fitted for ear warmers. I also have studded bike tires, which cost more than studded automobile tires. I have two front headlights, one on my helmet and one on my bike handlebars, front and back blinkers, and reflective tape all around. Yet still drivers do not always see me.

The cold is often so bitter, my tires begin to flatten as the cold reduces tire pressure, so I have to make sure they're fully inflated. My breath freezes on my face until ice builds up around my eyes, but I can't wear goggles or glasses because they fog up instantly and I can't see. (One of my graduate students found a solution, though — snorkeling gear.) It's fair to say I look strange as I come in from the cold with ice all over my face.

I don't ride my bike to the store or take my kids in my bike trailer in the winter. Beside the potential of being hit by a car or getting frostbite, my kids would complain the whole way. I do know a mom who manages to bike

her kids to preschool in winter here, but for most people bicycling just isn't a viable alternative to a car.

One winter, I did some consulting in downtown Fairbanks. I had to be in several places around town during the week, which meant I couldn't ride my bike as easily. I ended up taking the bus to the university, one downtown and sometimes yet another one back to the university before going home on a fourth bus.

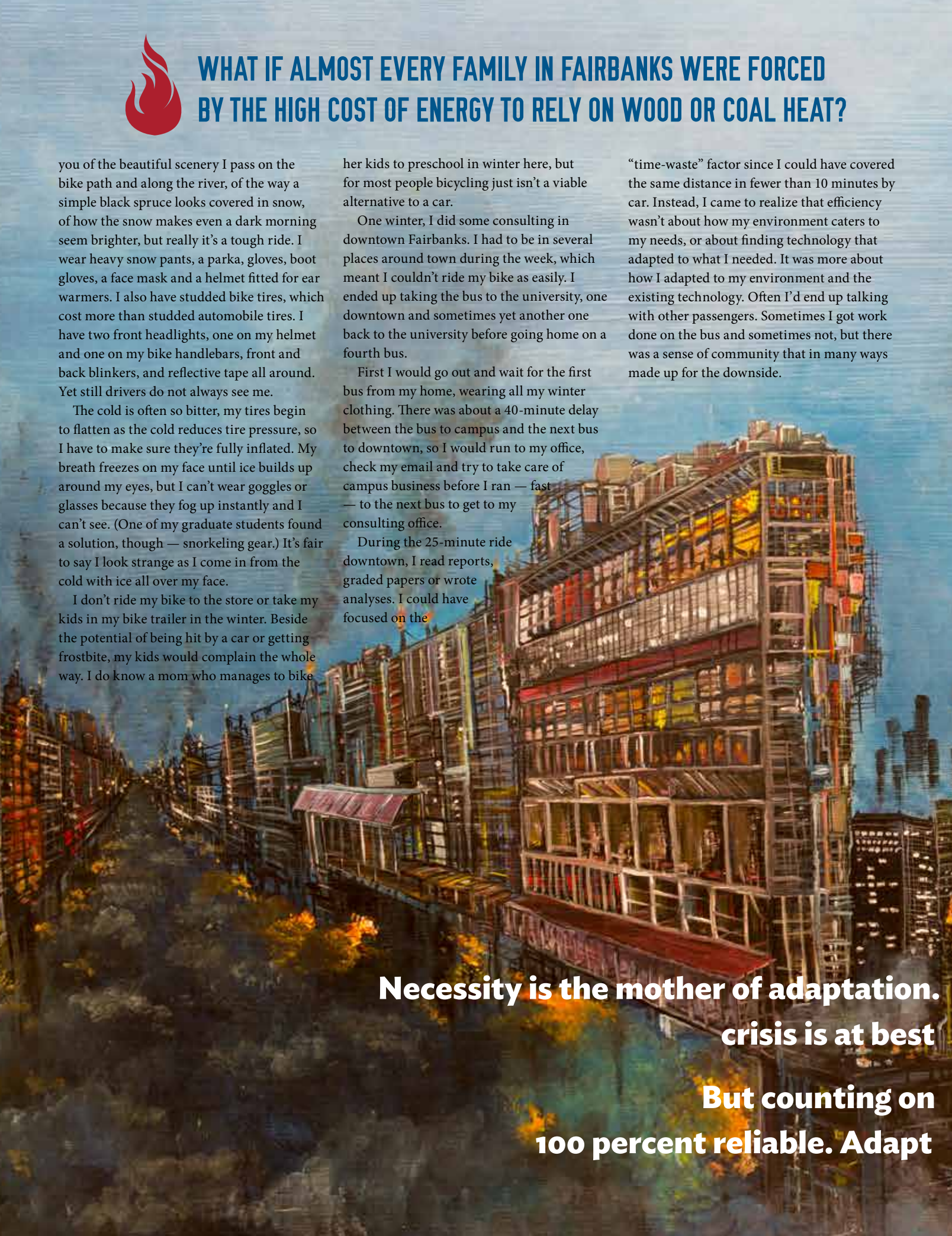
First I would go out and wait for the first bus from my home, wearing all my winter clothing. There was about a 40-minute delay between the bus to campus and the next bus to downtown, so I would run to my office, check my email and try to take care of campus business before I ran — fast — to the next bus to get to my consulting office.

During the 25-minute ride downtown, I read reports, graded papers or wrote analyses. I could have focused on the

“time-waste” factor since I could have covered the same distance in fewer than 10 minutes by car. Instead, I came to realize that efficiency wasn't about how my environment caters to my needs, or about finding technology that adapted to what I needed. It was more about how I adapted to my environment and the existing technology. Often I'd end up talking with other passengers. Sometimes I got work done on the bus and sometimes not, but there was a sense of community that in many ways made up for the downside.

**Necessity is the mother of adaptation.
crisis is at best**

**But counting on
100 percent reliable. Adapt**



Conserve before consume

I've spent several years living in Europe, so I know Europeans are greatly concerned over energy conservation.

A lot of buildings now have very good insulation and tight doors and windows. But when you have a lot of insulation and little ventilation, you get humidity and mold, causing as many health problems as bad air.

So one of the habits I noticed all across Europe was to open windows for at least 15 minutes a day, even in the dead of winter.

Back in Alaska, I added insulation and sealing to my home. Sure enough, my humidity level indoors skyrocketed, and I got iced windows and the beginnings of mold problems. So I intentionally reinstalled air leaks, with a heat recovery ventilator. HRVs are used in Fairbanks and elsewhere, but they cost thousands of dollars to install and use energy themselves.

Although I added insulation and participated in weatherproofing programs offered by the state, quite frankly, in Fairbanks that just isn't enough. Most people in Fairbanks use oil, a very expensive fuel, to heat their homes. The bills are dragging many folks under. I wanted something cheaper.

Luckily, there is a world-class coal mine 100 miles southwest of town. While fuel oil is delivered at around \$4 per gallon

of gasoline equivalent, coal is about \$1.50 per GGE. Even though the coal does not burn as efficiently as fuel oil, it still saves half the energy cost of fuel oil. So I bought a coal-fired hydronic boiler for my backyard.

This coal system automatically feeds coal to a burning chamber every time the house calls for extra heat. It was expensive, well over \$15,000 dollars after all the installation, but the reduction in fuel costs has made up for that. I eventually added an insulating shell around the boiler to reduce the need to fill the coal bin and haul away the ash as often, and I heightened the chimney to make it more efficient and even cleaner burning. Those changes made the boiler about twice as efficient and half as smelly.

I sat on a committee for energy options in Fairbanks in 2008 to discuss these looming concerns of expensive heating fuel oil coupled with extremely cold temperature inversions in the winter. The inversions cause coal and wood burning particulates, as well as pollutants from vehicle exhaust, to remain close to the ground, where we breathe them in. (The downtown coal power plant has a scrubber to remove the particulates.) The

particulates can be as small as 2.5 microns, which has been shown to be unhealthy. But with fuel oil so expensive and natural gas unavailable in Fairbanks, the only cheap heating

options available are those that pollute — wood or coal.

The question for the committee was, what if almost every family in Fairbanks were forced by the high cost of energy to rely on wood or coal heat? Clearly, the particulate matter would be horrendous. The entire town sits on the front lines of the world's energy and environmental crises. The committee for energy options advocated bringing natural gas to town. Three options were vetted. One was the construction of a small-diameter natural gas bullet pipeline from Prudhoe Bay to Anchorage, which would go past Fairbanks and provide relatively cheap natural gas for both major metropolitan areas. That could take six years from start of construction to finish. Another option was to put super-cooling liquefied natural gas modules on the North Slope, turn the North Slope's natural gas into LNG and then truck the LNG to Fairbanks, which would take two years to develop. A third option was to drill for natural gas and build a small, eight-inch pipeline from the drill site to Fairbanks. That would take three years, if they found natural gas, which they haven't.

Another idea was to use heat from the downtown coal-fired power plant to warm homes and businesses — district heating. Already, hot steam and hot water from the power plant is piped around the Fairbanks downtown area to heat houses and buildings, a system often called cogeneration. More houses could use that heat source if more



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pipes were laid, but the commission determined this alternative to be too expensive. Another alternative, which I saw used in the former Soviet Union, was to put pipes above ground rather than underground, all over the city. It's ugly but cheap. The Soviets did it often.

[The committee also explored alternative-energy options, and Reynolds offers an analysis of some alternative energies in the book.]

A recommendation for the two-year LNG option was pushed, but because the commercial interests needed time and incentive to try their options, nothing was done with the recommendation, and Fairbanks continues to head into greater environmental and economic decline. But that is typical. Energy transitions by their nature are divisive, expensive and economically devastating. There are no easy technologies, no cheap solutions, no clear path — only extremely difficult and painful adaptations.

There are no easy answers to high energy costs. People will simply have to pay more for energy, including electricity, and will have less money for vacations, consumer goods, even necessities. Rather than waiting for that man-on-the-moon

technological breakthrough or the perfect hydrogen fuel cell car, it is better to start right now to change your lifestyle. Prepare to change your job, or accept lower wages, or live with other families, or use alternative transportation, or use coal to heat your home. Just don't prepare for the easy life that technologists have promised.

Ultimately, people will make do. We were made to adapt. Now people will have to manage again, and with environmental problems to boot. When I taught in Kazakhstan, a student told me, "It could be fun for everyone to live in a yurt." And so it could be. Just remember to wear your reflective gear and snorkel. 

Doug Reynolds, professor of oil and energy economics, has been at UAF since 1997. He has done research in oil and natural gas supply, natural gas pipeline projects and nonrenewable resource scarcity. He has studied energy issues in Kazakhstan, Mexico, Norway, Russia and Poland, and has done energy consulting for the State of Alaska.

Artist Harrison Carpenter was born in Fairbanks and raised in Delta Junction, Alaska. He will graduate from UAF this spring with a BFA in art. He is particularly interested in the urbanization of landscapes.



HIVE OF INDUSTRY

Sometimes they come before you've even built it. In the last 10 years, enrollment in the College of Engineering and Mines has doubled, to 749 students in fall 2012, but the space for them to learn has stayed the same.

"Right now we are breaking classes up into three or four sessions," says Billy Connor, director of CEM's Institute of Northern Engineering. "[The introductory class] is a good example. We have no classroom for 80 students."

Lab and research space are other commodities in short supply. But a proposed engineering building between Duckering and Bunnell will give more room for everyone, from classrooms to research facilities. Placing the structure between the traditional homes of CEM and the School of Management holds potential for collaboration between engineering and business majors. (The School of Management's enrollment has increased 88 percent this past decade, to 635 students).

"Engineering now is much more interdisciplinary than it's ever been," says Connor. "We need to understand what people want, communicate with them and provide what they are looking for."

Alaska could theoretically import its engineers and businesspeople, but as Doug Reynolds points out in *Energy Civilization*, the 49th state has specific physical constraints and requirements that require specific structural and business expertise.

That's prompted companies like BP, ConocoPhillips Alaska, Kinross Fort Knox, Shannon & Wilson Inc., Shell Exploration and Production, Sumitomo Metal Mining Pogo, Teck Alaska Inc., and Usibelli Coal Mine to donate to UAF more than \$3 million over the last two years alone.

Dan Snodgrass, who manages operations at Kinross' Fort Knox Mine, outside Fairbanks, likes hiring UAF graduates. "They're used to an arctic environment. It is much different working in an arctic environment versus other areas or other countries around the world."

UAF's practical approach is also a big plus. "I believe that makes a good engineer: somebody who's got a little mud on their boots now and then," he says. "So when they get back in the office making their plans, they've got a little empathy for the individuals carrying out those plans."