Green Gusher!

Bernie Karl hits pay dirt

Geothermal In Our Future?
When a trucker with a name like Kimosabe Bublitz can cash in on the Green Economy by hauling oversize windmill parts to Texas, you know the world is changing. Learn how you can change with it at the:

**GREEN Industrial Business & Career EXPO**

*Making It Real*

Friday, October 10, 2008
South Seattle Community College - Georgetown Campus
and the Westin Hotel

www.nwgreenexpo.org

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Meet Bernie Karl
Geothermal Pioneer
Post-Expo Reception
October 10, 2008
Westin Hotel, 5:00 p.m.

Keynote Speaker: Tom Plimpton
PACCAR Vice Chairman
CAS Gala Banquet
October 10, 2008
Westin Hotel Grand Ballroom, 6:00 - 10:00 p.m.
Heat of the Earth
Learn about our regional prospects for cleaner electricity from geothermal power – literally, the heat of the earth. Featuring: Bernie Karl, Chena Hot Springs Resort; David Paul, UTC Power – United Technologies Corp. and Susan Petty, AltaRock Energy Inc.

Styrofoam Killer
Sick of Styrofoam and other petroleum-based packaging material? Is your company searching for a greener alternative? The PAKIT Company from Vancouver, B.C. can help you make biodegradable products to replace petroleum-based plates, trays, and clamshells. Featuring PAKIT president Brian Birmingham.

Green Careers
The Green Economy already offers a wide ranging of great technical career opportunities. How will we get students interested? Learn how they do it at The North Alberta Institute of Technology in Edmonton, a vocational college with a lights-out recruiting program. Workshop features Leanne McCarthy, NAIT director for recruitment and student life.

Ultimate Recyclers
Pound for pound, the Nucor Steel Plant in West Seattle is among the top recyclers in the state. See one of the least likely green spots in the Greater Pacific Northwest during the Nucor Steel plant tour. Must be 18 and wear long pants and closed-toed shoes.

Greener Products
Northwest companies are making greener airplanes, tugboats, trucks, and greener ways of doing things. Featuring products from The Boeing Company, Kenworth Truck, Foss Maritime, GreenIT, and WindBalance.

Green Up
Learn how your company can increase energy efficiency and reduce carbon emissions. Featuring help from Puget Sound Energy, Washington Manufacturing Services, the Environmental Coalition of South Seattle, Seattle City Light, Seattle Public Utilities, and the Climate Partnership.

Full Expo Guide Available On-Line at www.nwgreenexpo.org
Register Now!
Admission: $75.00, Non-profits: $45.00, Educators and Career Counselors: FREE
A4–B4 We All Go Green

In support of the October 10, 2008, Green Industrial Business and Career Expo, we take an extended look at emerging power resources, greener technologies, and the shifting politics of the A4 era – as in, After 4-dollar-a-gallon gasoline.

Green Gusher

Bernie Karl hit pay dirt early, but we all may be enriched by geothermal power.

Hybrids from Foss Maritime and Kenworth Truck

Two of the region’s oldest companies turn to new technologies to create tugboats and trucks that save on fuel costs while dramatically lowering diesel emissions.

Ahead of the Curve

The Port of Seattle moves to stay ahead in reducing seaport greenhouse gases.

In the Air and On Land

Boeing greens up as the aerospace industry takes a deep, hungry look at the jet fuel potential of algae.

Styrofoam Category Killer

Another Vancouver, B.C. company helps us go green: PAKIT creates biodegradable alternatives to Styrofoam and other petroleum-based products.
Seattle Industry Online!
The Voice for Industry
Get more news @ www.SeattleIndustry.Org
And with Seattle Industry eBulletin you can get on-the-spot updates emailed directly to you.

Seattle Industry eBulletin

Turning 10
The Manufacturing Industrial Council of Seattle, publisher of Seattle Industry, this year celebrates its 10th Anniversary.

Join the party December 4, 2008
Rock Salt Steakhouse – Seattle
6:00 p.m. – 9:00 p.m.
Dinner, Drinks, Special Guests
Tickets $75 – Tables $750
RSVP to 206-762-2470
In 1970, the *New York Times*’ best seller list was topped by a book titled *The Greening of America*.

Written by a sociologist, the book argued that the young Americans who were then smoking pot, wearing bell bottoms and listening to psychedelic rock music were transporting the nation to a cozier corner of the cosmos – one that would be largely devoid of jealousy, greed, violence and non-cosmic people of the type who might snatch your hash pipe.

Thirty-eight years later, the greening finally occurred, but not in the way the sociologist imagined. Forget the Summer of Love. In 2008, our consciousness was raised by the Summer of A4 – as in, After 4 dollar-a-gallon gasoline, many things are different than they were B4.

B4, we were energy hogs. A4, we are slimmer hogs. Americans are driving less and oil consumption is down for the first time in three decades. Hummers are left unsold. Priuses can’t be kept in stock. TV sets are turned off when not in use. Light bulbs are even turned off more often when people leave the room.

B4, our national energy debate was Either-Or. You were either for more renewable energy or more oil, and the conflict was often not just about energy – the disagreement was part of a cultural dispute older than the Tet Offensive.

A4, opinion surveys show public opinion has left Either-Or for the more expansive land of All-of-the-Above. Americans are in favor of more renewables AND more drilling.

B4, the debate was inherently negative. There isn’t enough power capacity in renewable resources, oil is running out, people who disagree are either inanely naive or stupendously immoral – evil even.

A4, our new energy possibilities suddenly seem abundant. U.S. natural gas production is up dramatically thanks to new drilling technologies that may also fuel dramatic growth in the production of clean geothermal power – literally, the heat of the earth.

A4, we even seem to find occasional patches of common ground emerging from the smoke that shrouds old battlegrounds. When T. Boone Pickens, Al Gore and Paris Hilton can agree on some of the planks that need to be in our national energy strategy, you know the Times Have Already A-Changed – maybe, by a lot.

A billionaire former oil wildcatter, Pickens put $58 million of his own money into an effort to force energy to the front of the presidential campaign. Pickens argues we should invest more of our own money into
developing domestic renewable energy resources so we will spend less of our money buying oil from foreign suppliers who wish to do us harm. Pickens also called for more domestic drilling.

Environmentalists would not go that far, but many, including Al Gore, said Pickens was putting forward ideas that deserved further review.

Hilton was drawn to the fray by a John McCain TV ad that compared Obama’s celebrity to that of Hilton and her sometime running mate, Britney Spears. For once, Hilton didn’t take it lying down.

She responded with a wildly successful Internet video in which she lounged by a swimming pool in a remarkable leopard skin-print bikini while announcing her own candidacy for President of the United States.

She also unveiled her own energy plan, calling for more renewables and environmentally sensitive drilling to create an integrated approach to a brighter energy future when we might all start driving electric Lamborghini.

The video was astonishing, and not just because of the bikini. The more remarkable thing was that Hilton sounded so much smarter about energy than most of our elected leaders. Does this mean she is smarter? Not in most cases. It’s just that while she counts on her inheritance, our elected leaders count on true-believer, deep-pocketed campaign contributors and when it comes to energy and the environment, these folks may never be able to leave the world of Either-Or behind.

B4, the Green Economy seemed like a campaign gimmick tie-died to the Sixties.

A4, the Green Economy seems to be bursting out all over, and if you don’t believe it, consider the case of Kemosabe Bublitz.

B4, Bublitz cut his teeth in the trucking industry hauling logs with his dad in and around Shelton, Washington.

A4, Bublitz is based in Abilene, Texas, epicenter for the multibillion dollar windmill construction boom that is blowing up and down the American Midwest.

Bublitz was sucked into the field two years ago after he helped a friend drive a truckload of windmill equipment on a 1,000 mile run from a metal fabricating shop in Fontana, California to a windmill farm outside Abilene.

The load consisted of four steel cylinders for use in erecting a windmill tower.

Each tower section was 16 feet in diameter. The sections varied in length between 30 and 60 feet and they weighed 120,000 to 130,000 pounds. Bublitz used vacation time to make the trip with his buddy, and he came home fascinated by the amazing logistics and business challenges of transporting some of the biggest, most sensitive equipment that’s ever been hauled across the open road.

In November 2007, Bublitz opened Blitz Transportation Services, equipped with a single 1992 Freightliner tractor and a special Trail King trailer that can extend like a trombone to haul windmill blades that are 200 feet long.

Less than a year later, in addition to the original rig, Blitz operates two brand-new Kenworth-Trail King rigs and the company has two more on order. Blitz drivers now haul windmill parts from the West Coast, East Coast and the Gulf of Mexico to wind farms all across the Midwest.

B4, wind accounted for less than one percent of all U.S. electrical production.

A4, it accounts for about two percent and the doubling was due largely to the boom in Texas. The U.S. now produces more wind-generated electricity than any other country. The government predicts wind may account for 20 percent of U.S. electricity by 2030 and the rapid expansion rate is rattling a growing supply chain that extends from turbine makers to metal fabricators to truck drivers.

Why Texas? The commitment came from elected officials, utility managers and industry leaders who, instead of battling environmentalists, opted to pursue wind power as a clean alternative to building new coal plants to meet growing electricity demands. The wind industry also helps boost the economies of rural communities.

B4, energy development was almost always about resources that were in the ground or in the sky.

A4, it turns out the most important energy resource is that lump of gray matter between our ears.

It’s difficult to talk with Kemosabe without asking about his name. “My dad suggested naming me Doug,” he said. “My mom was the one that did it.” Friends call him Kim or Kimo.

The name was spelled Kemosabe in the scripts for the old Lone Ranger radio and television shows, which claimed the term came from a Native American dialect and meant “faithful friend.” The producer of the radio show later said he took it from a summer camp for kids in Michigan called Camp Kem-Oh-Sabe.

Therefore, it sounds like we are free to decide whatever it is that we want Kemosabe to mean. In Kim’s case, we pick “Smart Trucker.”

But, is Kemosabe Bublitz green? Or is he – you know – Green?

A4, even asking the question seems so … B4.

“I see it both ways,” he said. “It’s thrilling to see the capabilities and the cleanliness of these machines creating so much energy without any wastes, but the business side is terrific, too. They say they are going to put up 2,000 more windmills in Sweetwater before the end of the year. The opportunities just keep knocking.”

Forget the Summer of Love. In 2008, our consciousness was raised by the Summer of A4 – as in, After 4 dollar-a-gallon gasoline, many things are different than they were B4.
The laptop computer that processed these words was powered by electricity from a power plant fueled by water that is just 165 degrees Fahrenheit. Coffee that temperature is hot, but cool enough to sip and it is widely believed that it is impossible to generate electricity with water that cool. Yet, at a rustic resort located off the electrical grid outside Fairbanks, emission-free electricity is being created with 165 degree water 24 hours per day, and it powers far more than words.

The generating system meets all the electrical needs of the 88-room Chena Hot Springs Resort. It also provides the power to heat the resort’s industrial-sized greenhouse, which grows fresh produce for the resort restaurant, even during the darkest, coldest days of the long interior Alaskan winter. It also supplies the electricity that keeps the resort’s 154,000 cubic foot Aurora Ice Museum frozen during the brief summer, which brings surprising heat.

At today’s fuel prices, it generates another thing – big savings. The geothermal power system will save the resort owners about $625,000 this year because they don’t have to fire up the resort’s old diesel-powered electrical generators.
The story of how this all came to be is an amazing, only-in-Alaska tale that combines the intellectual prowess of a brilliant young scientist and/or sled dog musher with some of the best engineering and manufacturing talent in the United States. And, the whole adventure was driven by the inspired entrepreneurship of a former oil field mechanic, gold prospector, and North Slope wheeler-dealer named Bernie Karl.

In Alaska, just about everyone calls him “Bernie” and, in Alaska, it seems like just about everyone knows him. Bernie and his wife Connie are the ones saving $625,000 on diesel fuel. They own the resort and Bernie is a hard-crusted, soft-hearted, high-volume, renewable energy pioneer who takes Lower 48 concepts about who and what is “green” and spins them into a whirling kaleidoscope.

The Chena plant attracts a growing volume of publicity that tends to portray Bernie as some kind of Green Guru of the bush. To which he responds, “People say I’m a greenie? Well, I’m a greenie all right. Here’s my green!” To underscore that last point, Bernie holds up a wad of green dollar bills. But, this is mostly Bernie bluster. Because he is also a frontier-style showman who gives tours of the resort for his guests while dropping one-liners the way Foreman dropped Frazier – namely, often, and with much authority. Like, “My mom raised ugly kids, not dumb ones.” And, “You know how I spell luck? W-O-R-K.” And, “I’ve never had a bad day.”

But, we will set aside the Bernie Karl story for a moment to explain why his Chena power system and other new developments may soon make geothermal power the Next Big Thing in the drive for cleaner energy resources.

**Next Big Thing**

It is not a new idea to generate electricity from the heat that emanates from the center of the earth. It was first accomplished in Italy more than a century ago and, today, geothermal power fuels electricity in a couple dozen countries. Iceland may be the best-known geothermal user, but the United States is the world’s biggest producer, with much of the activity concentrated in California where The Geysers power plant north of San Francisco turns out enough electricity for more than 900,000 homes.

But while geothermal power grinds away in relative obscurity, it is drawing growing attention because it possesses major strategic advantages in the bid to find reliable, clean alternatives to fossil fuels.

Like wind, solar, and nuclear power, geothermal can generate electricity while emitting few if any greenhouse gases. Emission levels depend on the nature of the generating plant. While the Chena system creates none, most plants create some, but at levels far below those of fossil fuels.

But unlike wind or solar, geothermal provides baseline power 24 hours per day. In this way, geothermal is like nuclear power, with one huge difference – maybe two. It creates no dangerous wastes – in fact, it creates few wastes of any kind. And, so far at least, it doesn’t scare the bejesus out of anybody – more about that later.

Like nuclear power, geothermal could also create power at a mind-boggling scale. Scientists estimate the earth’s heat could generate 130,000 times more electricity than humanity consumes today.

So why aren’t the presidential candidates falling all over each other to be the first to promise that geothermal power will be one of the foundation stones of our cleaner, more abundant energy future? There are probably many reasons for this – so many promises, so little time – but we’ll focus on the two that seem most relevant.

If renewable resources were cars, geothermal would be an Oldsmobile – your dad’s alternative to fossil fuels, maybe even granddad’s. The resource is literally as old as dirt and although geothermal power was up and running in the 1960s, it never acquired the Maui Wowie buzz that attached itself to wind and solar.

But, speaking more practically, until now it was also believed geothermal was only feasible in exotic, remote areas of high volcanic activity – and the operative phrase is “until now.”

At 165 degrees Fahrenheit, a cup of coffee is just cool enough to sip. But, at 165 degrees, water is hot enough to generate electricity. Most experts believe this is not possible, but it’s happening 24 hours per day, seven days a week at the Chena Hot Springs Resort outside Fairbanks, AK.
In 2007, the Massachusetts Institute of Technology – MIT – released an eye-opening report regarding geothermal’s future in the United States. The MIT report documented that with new technologies already in use by the oil and gas industries, it would be possible to artificially create the kind of conditions that naturally fuel geothermal power in places like Iceland. This approach is called an Enhanced (or Engineered) Geothermal System – EGS.

With EGS, an initial well is drilled deep enough to reach rock formations that are 300 to 400 degrees F. This initial well is used to inject cold water. When the cold water enters the fissures within the hot rock, the reaction is explosive, blowing open fractures in the rock formations. Additional wells are then drilled to pump water through the fractures and this water is...
then pumped back to the surface as steam or water hot enough to turn a generating turbine.

The water is then cooled and recycled back into the well. Such a closed system not only saves water – a valuable resource itself – it creates very few greenhouse emissions.

The explosive mix underground between cold water and hot rocks will no doubt create a fear factor for some, but the scale of the process can be controlled along with the locations of the target rocks.

The engineers and scientists who worked on the MIT report found “no technological showstopper” that would stymie EGS development and, as if to underscore that point, the world’s first EGS plant recently came on line in Germany.

The MIT report is highly provocative. Because, while you may or may not find oil, gas, or gold if you drill into the earth, it is a lead-pipe cinch that you will find heat, and the MIT report concludes that if we just drill deep enough, most of the U.S. can be transformed into a huge geothermal power zone while drastically reducing the nation’s carbon footprint.

For instance, the geothermal prospects for the U.S. eastern seaboard were previously considered to be nil. But, the German EGS plant sits above geological and geothermal conditions very similar to those that exist beneath Washington, D.C.

That’s worth noting because the MIT team projected that if the federal government were to invest just $1 billion to demonstrate the large-scale viability of EGS, they believe it could spur private development that would ramp up geothermal electrical generation to 10 percent of all U.S. electric production by 2050, up from 2 percent today.

One billion dollars. Isn’t that about the size of the U.S. Air Force budget for wrenches and toilet seats? Sheesh. What if we put up $1.5 billion? What if we could tap just one or two percent of the potential resource? We might be rolling in more low-emission electricity than we know what to do with.

Much of this might sound like science fiction, but it isn’t.
**Closer to Home**

Susan Petty, a Seattle-based geothermal power developer, served on the MIT team. She also founded a company, AltaRock Energy Inc., which in August received $26 million to pursue EGS development in Oregon, Washington, California and Nevada. The investors included Google.org and Paul Allen’s Vulcan Capital.

Petty believes geothermal is about to receive a “perfect storm” boost from the combination of rising concerns about global warming, rising energy costs, and the fact utilities in many states, including Washington, are now under legal mandates to increase renewable energy production.

Petty recently told *US News & World Report* that EGC “brings an absolutely gigantic amount of power into the realm of economic feasibility.”

The Snohomish PUD is now assessing the feasibility of tapping into the geothermal resources that exist along the western slope of the Cascade Mountains in that exotic area to the Far East of the Everett Convention Center.

The PUD hopes to find 300 degree water at a depth of 5,000 feet, but the PUD’s resource manager, Craig Collar, says the utility is still assessing the situation because the estimated drill costs range from $1 to $6 million per well. And nobody knows if it will take two, three, four, or a hundred such wells to make geothermal work on the western slope of the Cascades.

Then again, this scenario is based on the MIT, Big Science, EGS approach that requires very hot water – and that is not the only option. At the opposite end of the spectrum there is now the Little Guy, low-temperature, low-cost Chena approach.

If Chena produces electricity with 165 degree water from a well that is just 700 feet deep, why assume you have to drill down a mile to find 300 degree water?

After a century in which geothermal power never really took off, it is now creeping up on us from two very different directions. The PUD is mulling all of the possibilities. As Collar says, “the Chena system opens a window that was not there before.”

Which brings us back to window-opener-in-chief, Bernie Karl.

**Bernie’s Window**

People who leave the Lower 48 to seek their fortunes in Alaska are different than you and me. For one thing, they are often way more interesting, and the most interesting thing about Bernie is the fact he is so positively imbued with an extraordinary sense of his own good fortune.

Now, you might expect that someone who once prospected for gold might feel they are “lucky,” but when he says “good fortune” Bernie does not mean L-U-C-K. He means it in the literal sense that he feels divinely blessed with the enormous good fortune

![The UTC power plant at Chena functions like air conditioning in reverse. Instead of using electricity to create a heat/cold differential, it uses a heat/cold differential to create electricity.](image)

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of being able to get up every morning, ready and able to put in a good day’s work, doing things he loves doing. That’s the real power behind Bernie’s journey to the Chena Hot Springs, and it comes from Peoria, Illinois, where Bernie grew up on a farm on the edge of town, one of 16 children.

Just as it is now, Peoria was then famous for being home base to Caterpillar, the company that makes some of the world’s best, and biggest, heavy construction and mining equipment. Bernie loves machines, and the Caterpillar impact sunk in early and deep. “In Peoria, people said we grew up with blood in our veins that was yellow instead of red, and I suppose we did,” Bernie recalls.

Bernie’s dad worked at Caterpillar, and — after graduating from high school — Bernie got a job at Caterpillar too. But then he heard about the plan to build the trans-Alaska oil pipeline and he was soon bit by the bug to pursue his fortune up north.

He wanted his father’s blessing, and when Bernie went to ask for it, he found his dad in a field at the family farm, lying on the ground, peering into a fancy camera and snapping pictures of an ant crawling up a stalk of wheat.

And this brings us to just one of the many unexpected turns in the story of Bernie Karl.

Bernie’s dad was not a mechanic, production worker, or an engineer at Caterpillar. He was a world-class photographer for Caterpillar who made good money traveling the globe to take action photos of Caterpillar rigs for promotional purposes. That’s how he could afford to support his wife and 16 kids. When he was young, Bernie tried developing an interest in photography, but it just didn’t click. Cameras were neat but they simply did not compare with big equipment.

Bernie told his dad about his Alaska dream and he remembers that his dad “stood up, dusted himself off, looked me in the eye, and said, basically, ‘Go West, young man.’ He said he’d probably do the same thing if he was my age. He gave me his blessing and that was important to me.”

North to Seattle

Bernie then proceeded with a career plan that was surprisingly wise for a 20-year-old mechanic. Instead of heading for Alaska with no contacts or job prospects, he traveled first to Seattle, figuring he would get a job with a Seattle company that did business in Alaska, then transfer north to look for a good pipeline job while he remained gainfully employed.

Good plan – and it worked. Bernie got a warehouse job in Seattle at a Caterpillar distributor, NC Machine, not that the job interview went that great. “The guy who hired me asked what my expectations were, how much money did I want to make? I
told him, Well, I want to make $100,000. He told me he didn’t think that was realistic. But, he’d asked me, and that was my goal. And, you know what? My first year on the pipeline, I earned about $100,000."

Not that it was easy. In fact, it was very, very hard, but Bernie worked through the cold months, the dark months, the weekends, and most of the days he could have taken off while pulling in as much overtime as he could get, using the good fortune of a pipeline job to make as much money as humanly possible. But, making good money was not the most fortunate thing that happened to him on the pipeline. Bernie says that stroke of true good luck was meeting his wife, Connie.

Like Bernie, Connie had traveled to Alaska to earn her fortune – she was from Connecticut. She started out working in resorts, but was able to get a better paying job driving a bus that transported pipeline workers. Bernie climbed on her bus one day and he did not make a good impression.

Recalls Connie, “The first time I met Bernie, I told him he was a loud-mouthed jerk.” But, as sometimes happens with rowdy kids on buses, there was more to Bernie than sheer volume. After 33 years, Connie says Bernie “makes life interesting.”

Bernie still can’t quite believe Connie married him. He thinks he sealed the deal at a camp dance on the North Slope. “It wasn’t much of a dance. There were like 1,200 men and four women. I picked her up, carried her to the dance floor, and we danced all night. We’ve been together 33 years and I hope we’re together for 50 more.”

The 800-mile-long pipeline was started in 1975 and completed in 1977. By the end of the job Bernie and Connie had saved a nice nest egg, and they decided to plow a good share of it into gold mining, pursuing an old-time technique popular in Alaska called “placer mining.” This is the approach that ordinary people in Alaska use when they want to try their hand at gold prospecting and it’s the process where you set up shop next to a promising spot along a river or stream and use the water to “wash” gold from the dirt, mud, and gravel that you dig up from nearby.

Placer mining is mostly a summer activity in Alaska because Alaska’s river and stream water temperatures usually range somewhere between 33 degrees and frozen.

Recalls Connie, “The first time I met Bernie, I told him he was a loud-mouthed jerk.” But, as sometimes happens with rowdy kids on buses, there was more to Bernie than sheer volume. After 33 years, Connie says Bernie “makes life interesting.”
Just like the summer growing season for Alaskan agriculture, the placer mining season is short, and Bernie used the prolonged downtime to return to the North Slope, where he made good money working in a variety of jobs, usually for oil service companies, and it was during a winter back on the North Slope that he came across yet another instance of his own good fortune.

**Horse Whisperer**

Bernie is a very good mechanic who pursues the craft through a “Horse Whisperer” approach. “I say being a good mechanic is harder than being a good doctor,” he explains. “A doctor has patients who can tell the doctor where it hurts, and the patient can do the things the doctor tells them to do to get better. A mechanic and a machine can’t do any of those things. You have to really listen to machines to understand what’s wrong with them and then it’s all up to you to fix them.”

Bernie’s mechanical skills and hometown pedigree turned out to be extremely valuable. Prudhoe Bay was the largest oil field ever discovered in the United States and the pipeline and oil development turned the North Slope into one of the world’s largest repositories of used heavy-duty construction equipment, nearly all of it made by Caterpillar.

The profusion of used, beat-up equipment was due to the extreme conditions under which the equipment ran and the haste with which the oil companies would abandon old equipment for new. The growing volume of used rigs was like a Caterpillar-yellow gold mine for Bernie because of his ability to tell which used equipment could be rehabilitated and which was shot.

He made his first used-equipment purchase in 1982 while working as the utility manager for an oil service company. The company put four Caterpillar 998 Loaders up for sale for $40,000 each. Bernie looked them over, gave a good listen, and determined they still had plenty of mechanical life within them. He went to the plant manager to buy them. “I’m the guy who is literally cleaning the toilets and keeping the sewer running, and he looks at me like I’m crazy. He said, ‘Bernie, that’s $160,000. Do you really have that kind of money?’ ”

As a matter of fact, Bernie was able to round up the money and he bought the loaders, shipped them south on the Dalton haul road, repaired them, and eventually sold two for a tidy profit. Bernie kept the other two – because in the Alaskan bush you never know when a Cat 998 Loader might come in handy.

With this experience, Bernie and Connie learned a fundamental lesson of the mining business, he says. “We realized there was a lot more money in selling equipment to the miners instead of mining the gold.”

Bernie and Connie expanded their business portfolio by adding a recycling business, at first specializing in heavy equipment sales to miners and mining companies, and then expanding their customer base. This venture eventually turned into K&K Recycling, now one of the largest recyclers of used industrial equipment on the North Slope. The company extends its reach for used equipment, scrap, and customers throughout the entire Pacific Northwest, from Seattle through British Columbia and all the way up to the Beaufort Sea, with the far-flung operations revolving around a 106-acre scrap yard in Fairbanks.

In the Lower 48, most of what we hear about Prudhoe Bay concerns the decline in oil production. But “decline” is a relative term. The remaining oil fields continue to operate on a vast scale, and the magnitude of the activity is reflected in the large...
By Barbara Clements

Even before the alarm bells rang about global warming, freight businesses and port authorities were concerned about the growing volumes of diesel emissions that were clouding the nation’s seaports due to the dramatic growth in global commerce.

Because of these developments, two of the Pacific Northwest’s oldest companies – Foss Maritime, and PACCAR, through its subsidiary, Kenworth Truck – began exploring how they might use some of the world’s newest technologies to “green up” their tugs and trucks to reduce emissions.

Now that their new products are about to hit the market, the two companies may reap a bonus they weren’t originally counting on. With diesel bumping up against the $5 a gallon mark, up 50 percent from two years ago, their new trucks and tug may be more appealing to customers because they not only reduce fuel emissions, they also reduce fuel consumption and expensive maintenance cycles.

Kenworth began production this fall of its new diesel-electric hybrids and will begin producing a Liquid Natural Gas (LNG) truck in 2009.

Founded in 1889, Seattle-based Foss Maritime is nearly finished building the first hybrid tugboat. When construction is complete the tug will be deployed at the Port of Long Beach in Southern California, where it will be the first tug to exceed the port’s new air quality standards.

Internal support for developing the new technologies came from company leadership and a commitment to “do the right thing.” Now, like the Quakers in early Pennsylvania who profited from many of their good works, it appears the companies will wind up doing well by doing good.

KENWORTH TRUCK COMPANY
Green for both the short and long haul

Just back from a U.S. tour, the two trucks gleamed – one blue, one neon yellow – in the Kenworth Truck Company parking lot outside its research and development facility in Renton.

One was a midsized delivery truck – the backbone of the distribution industry. The other was a utility truck equipped with a lift. Kenworth believes both medium-duty trucks represent a big part of the company’s future.

The trucks – officially named the Kenworth T270 and T370 models – are diesel-electric hybrids and, like the popular Toyota Prius, they are equipped with technology that reduces carbon emissions while getting good fuel mileage, making them ideal for stop-and-go urban driving.
Prius, they are equipped with technology that reduces carbon emissions while getting good fuel mileage, making them ideal for stop-and-go urban driving. Each hybrid truck has a monitor in the cab so the driver can determine which source of power the truck is using.

The Kenworth hybrids use an integral transmission-mounted motor/generator, a frame-mounted 340-volt, lithium-ion battery pack, and a dedicated power-management system.

Advanced powertrain controls monitor driving conditions and automatically select the ideal power mode, smoothly switching among electric-only, combined diesel and electric, and diesel-only power modes. Electricity generated through regenerative braking is stored and used for acceleration, assisting the diesel engine. The hybrid system is monitored through a dash display. As the power requirements for different driving conditions change, the screen constantly updates the driver on system status.

The hybrids will cost about $40,000 more than comparable medium-duty trucks. But buyers should be able to recoup the higher purchase price in four or five years through lower fuel bills.

The hybrids will get about 8 to 10 miles per gallon. A comparable diesel truck gets 6 to 8. That difference means a fuel savings for customers of up to $10,000 a year, according to Kenworth. Customers may also be eligible for a tax credit from the federal government of up to $12,000 per truck.

Atlanta-based Coca-Cola Enterprises bought 120 Kenworth hybrid trucks for its distribution fleet and rising fuel costs have spurred other orders.

“The environmental payback—the reduction of greenhouse gas and emissions—it’s important to us as a company, and for our customers,” said Preston Feight, Kenworth’s chief engineer. “All this is making them very interested in this type of technology.”

Another part of Kenworth’s future is riding on the success of the T800, a larger, heavy-duty truck powered by liquefied natural gas (LNG). Earlier this year, Kenworth announced it will expand its presence in the growing LNG market by producing the LNG trucks at its Renton plant in 2009.

Company officials expect to see significant market demand for the T800, especially from southern California ports. The move to produce the truck coincides with the ports of Los Angeles and Long Beach approving a new $1.6 billion Clean Trucks Program.
to help companies retrofit or buy replacements for the 168,000 big Class Eight diesel rigs that work at the ports.

Kenworth will use the Vancouver, B.C.–based Westport Innovations Inc. LNG fuel system technology, which was adapted for a Cummins 15-liter engine. Westport’s fuel technology is currently the only alternative fuel system that meets the qualifications set by the California Clean Truck Fund.

About 200 T800s have already been delivered or are on the way to customers serving the Ports of Los Angeles and Long Beach. Eight of the trucks are currently in operation with Total Transportation Services, Inc., in Rancho Dominguez, California. These eight are the first alternative fuel vehicles to operate in full-time drayage service at the Ports of Los Angeles and Long Beach under the Clean Trucks initiative.

Innovation is nothing new at Kenworth, PACCAR, or the company’s other subsidiary, Peterbilt Motors Company. PACCAR trucks typically cost more but their customers pay because of the company’s longstanding reputation for high quality, dependable products, and high resale values.

Originally founded in 1905 to build railroad cars at what is now the site of the Nucor Steel plant in West Seattle, PACCAR is the second largest truck manufacturer in the United States and ranks third globally for “big rig” truck production.

PACCAR earned the National Medal of Technology in 2006 for its leadership in developing aerodynamic, lightweight commercial vehicles that have dramatically reduced fuel consumption and increased the productivity of freight transportation. The medal was accepted on behalf of PACCAR and its employees by Chairman and CEO Mark C. Pigott during a ceremony with President Bush at the White House.

Truck sales have slowed in the past year or so due to the cyclical nature of the industry, but in 2007 PACCAR still turned a net profit. It was the 69th year in a row that PACCAR did so. Which just goes to show “green” isn’t exactly a new concept at the PACCAR family of companies.
Foss Hybrid Tug

Foss Maritime was founded in Tacoma by a Norwegian immigrant named Thea Foss, who later became the model for the female hero of the *Tugboat Annie* movies. The company thrived in the last chapter of the sailing age because the sheltered waters of Puget Sound often lacked reliable wind, creating a thriving market for tow and tugboat services.

More than a century later, Foss continues to make waves as a national leader in the tow industry, and later this year it will produce the world’s first hybrid tug at its shipyard in Oregon.

The concept for the hybrid emerged about two years ago when Susan Hayman, vice president of environmental development at Foss, mulled over the idea of a hybrid tug with colleague John Barrett, Foss’s fleet engineering manager and champion of the idea for the hybrid tug at the company.

How could they make a hybrid boat? Would there be a market for it? Where would it be used? Should they try retrofitting an existing tug or build a new tug? Where would the batteries go? Would the batteries be too heavy?

In considering these questions, the pair used as their model another hybrid – a short-haul switch locomotive developed by RailPower Technologies.

After coming up with a working concept, the engineering team got the go-ahead from Foss president Gary Faber; the Foss team then developed the prototype in partnership with a Canadian firm, AKA Group, and Vancouver, B.C. designer Robert Allen.

The trick was to figure out how to engineer the hybrid tug so it was dependable and cost effective. The tug has two main engines, each 1,800 horsepower. The engines are smaller than the ones in a regular tug, but generate the same horsepower. The hybrid tug also has 600 hp in batteries. The energy management system was developed by the AKA Group, a Canadian systems integrator, and its affiliate, XeroPoint Energy.

The batteries will kick in when the engine is idling, which is 65 percent of the time. In all, the hybrid engine will cut PM and NOx emissions by 44 percent, and fuel costs by 30 percent. That adds up fast because tugs normally burn up to 5,000 gallons of fuel daily.

The $8 million hybrid cost about $2 million more to build than a regular tug, and Foss received about $1 million in assistance from the ports of Los Angeles and Long Beach. The tug will be operating in San Pedro Harbor sometime in December.

In the future Hayman will be looking into alternative forms of fuel, like LNG, because the Hybrid can operate using any fuel source. Hayman also said Foss is considering retrofitting some of its existing tugs to hybrid technology.

The company’s colors are dark green with white trim, but even so the hybrid wasn’t the company’s first green endeavor.

Foss provides a “shore power” system to power up its boats at the dock – literally plugging the tugs into the electrical grid while they’re parked there. Foss has also switched its entire fleet to burn ultra-low-sulfur diesel, the cleanest fuel available.

“It costs a little more,” Hayman said of the fuel switch. “But it results in a huge environmental benefit.”

She is grateful that Foss management gave the go-ahead for the hybrid in spite of high development costs. Innovation at Foss dates back to the company’s First Lady, Thea, who turned Foss into a powerhouse back in the days when tugs were powered by a precursor to gasoline, naphtha.

“It’s part of our core values,” Hayman said. “Maybe we can’t solve all of the world’s problems, but we do what we can. We want to be on the leading edge.”
Unlike its counterparts to the south, the Port of Seattle is not facing a regulatory hammer wielded by the EPA requiring reduction of emissions, and Wayne Grotheer, the port’s director of seaport professional and technical services, wants to keep it that way. The region recently exceeded federal standards for ozone, but that’s not expected to have much of an effect upon the Port because diesel trucks, ships and other equipment used to handle cargo don’t have much of an effect on ozone levels.

Just this year the ports of Seattle, Tacoma, and Vancouver, B.C. approved the Northwest Ports Clean Air Strategy, which sets goals to reduce emissions from ships while they are in port by 70 percent by 2010.

To meet those goals the plan will encourage the companies that work at the port to switch to cleaner fuels or to retrofit existing engines.

“We’re working with the industries in a collaborative fashion, which sets us apart,” Grotheer said.

The Port is seeking out grants to help the industries with additional costs of these retrofits, he said.

All these small steps might add up – and they better.

The Port believes that the 1,800 trucks that use public roads near port facilities in Seattle and Tacoma emit 36 tons of diesel particulate (DPM) every year, or one percent of the region’s total DPM. Yet ships are far worse. It is estimated that ships at dock in Seattle and Tacoma now annually spew particulates totaling about 102 tons per year, or two percent of the region’s total DPM.

By focusing on the 400 some older semi-trucks – those with engines and emissions technology older than 1994 – port officials figure they can cut the emission rate by 60 percent in the next two years. The port, said Grotheer, is also currently supporting a grant proposal to help buy newer trucks, which will be retrofitted with pollution-control devices. In turn, these trucks will be leased back to the owner-operators at a reasonable price. By 2017, the port has set a goal that all Class 8 rigs in operation there will meet or beat the 2007 emissions standards.
The greenest port starts with the bluest skies.

Whether it’s at Seattle-Tacoma International Airport or Seattle’s seaport, Port of Seattle is setting new standards to help protect air quality in the Puget Sound region. With baseline inventories completed, we’re establishing partnerships with other ports, our tenants and customers to reduce diesel and greenhouse gas emissions.

By setting the highest-level benchmarks the industry has seen, we continue to strive toward our goal of becoming the cleanest, greenest, most energy-efficient port in the nation.

Learn more about Port environmental initiatives or watch a Commission meeting live at: www.portseattle.org

You can also watch Commission meetings Sundays at 1 p.m., on KCTV, channel 22.
By Barbara Clements

Most of us might consider the green scum that covers an inlet or lake a summertime headache. But for companies that comprise the Seattle-based Algal Biomass Organization, it's a viable replacement for petroleum-based products and to prove the point, they’ll almost gleefully trot out the oil-per-acre these tiny critters can produce compared to better known biofuel alternatives.

Soy can produce 60 gallons of oil per acre, noted John Williams, the organization’s spokesman. Canola? About 120 gallons. But, algae can produce 3,500 gallons per acre and some think it might go as high as 10,000 gallons.

To view algae’s production potential another way, you would need to plant 64 percent of the U.S. land mass in soy plants to produce the 70 billion gallons of diesel fuel that the nation presently consumes. But you could get the same amount from algae with a growing area one quarter the size of Arizona. Not that anyone is talking about filling up the Grand Canyon.

It’s just that algae advocates are highly enthused.
“It’s just full of oil, and it grows really fast,” Williams said of the tiny water-loving plant. “Because it’s a plant, it will digest carbon dioxide, so of course you’d want to build it next to a carbon emissions plant.”

The Boeing Company is one of the sponsors of the Algal Biomass Organization, and its commitment to algae research is just one way the homegrown giant is looking to reduce its carbon shadow. By air and by land, Boeing is committed to going green and company suggestion inboxes have been bulging with new ideas.

Over the next five years, the company wants to reduce its greenhouse gas emission intensity and hazardous waste by 25%, and boost recycling rates and energy efficiency by 25%.

These goals come on top of existing energy efficiency efforts that have saved an estimated $120 million since 1999. Along the way, ISO 14001 certification was achieved for production plants in Everett, Portland, Salt Lake City, San Antonio and Exmouth, Australia. The company goal is for all 15 of its major manufacturing sites to reach certification by the end of 2008.

While such mandates come from the top, support for them comes from the ground up, according to Mary Armstrong, vice president for Environment, Health and Safety, a new division formed in 2007. “I don’t care whether it’s an employee around Puget Sound or an Aussie, this all really resonates with them,” Armstrong said.

Boeing engineers Randy Jahren and Ronald Wu spent two years developing “Boegel,” a conversion coat that helps primer and paint stick better to aluminum body parts and rivets. Boegel is safer, more environmental and has now been applied to 150 Boeing airplanes.

The many local contributors to the effort include Randy Jahren and Ronald Wu, two engineers at Boeing’s material and process technology division located near Boeing Field. They spent two years testing a dozen mixtures to develop a better conversion coat for painting airplanes. Conversion coats are made from a layer of clear liquid that helps primer and paint stick better to aluminum body parts and rivets.
Conversion coating material used to include chromium and other heavy metals. It took two years to do it, but Jahren and Wu eliminated those to create a new greener substance called “Boegel.”

Boegel has now been applied to 150 airplanes. It requires less water to apply than the old conversion coat, it reduces worker exposure to heavy metals, it eliminates chromates from leaching into the environment and it saves the headache of purifying the water that’s used to rinse down airplanes.

On top of all that, it also reduces “rivet rash”: a patchy condition that develops when paint flakes off the rivets holding the aluminum skin to the frame.

Jahren and Wu are proud of what they accomplished.

Jahren looks to hike in the Olympic Mountains and enjoys viewpoints that make him feel like he’s contributing to a cleaner world. “One of the things I like to do is look up and see air that’s so clean and nice,” he said. “Then you look at a city and the uglier layer of air. You want to minimize that and it’s great to be able to help with that.”

Unlike oil found beneath the ground, algae exists everywhere around the globe, it can be grown in vast quantities in almost any water environment, and it produces oil in stupendous abundance.
Wu is a long distance runner who prizes clean air. “With the environment, you only get one shot at it, and you have to be careful about protecting it,” he said.

As the leader for the Boeing enterprise and energy management team, Jeff Nunn is responsible for finding new ways to heat or cool Boeing buildings, and making sure recycling efforts are maximized. He also makes sure fleets are updated to include hybrids and vehicles that use green fuels whenever possible.

A big part of his job is doing energy assessments and encouraging employees to survey their own working environments for savings. Are lights left on after hours? Does that computer really need to be turned on all night? Are the most energy efficient lights and appliances being used?

Blogs and wikis have been set up around the company so employees can share ideas.

“Employees are really passionate about being involved in all this,” he said.

But, these internal efforts may someday pale beside the environmental and efficiency wonders that will be scored across the skies by finding a good jet fuel alternative to kerosene.

Aircraft emissions account for about two percent of world carbon emissions and the environmental impacts were already placing major pressure on airlines and manufacturers before the run-up in fuel prices threatened to destabilize the whole aviation industry.

The backlog of orders for the 787 Dreamliner, an airplane that will use 20 percent less fuel for comparable missions than today’s similarly sized airplanes, demonstrates the need for more fuel efficient airplane technology, but the stakes have grown even higher for finding a more affordable, more reliable fuel source and that’s sharpened the focus on humble algae.

If burned as jet fuel, algae will still cause greenhouse emissions, but it could prove to be a game-changer if it proves to be a reliable, cost-effective, commercially cultivatable homegrown substitute for oil-based jet fuel and all the added environmental and financial complications of assuring continued oil supplies.

Unlike oil found beneath the ground, algae exists everywhere around the globe, it can be grown in vast quantities in almost any water environment, and it produces oil in stupendous abundance.

Major sticking points remain, but algae research is flying down a very fast track. Investors pumped almost $85 million into companies researching algae-based fuel this year, compared to just $29 million in all of 2007, according to Cleantech Group, an industry research firm.

Experts believe the first use will come in a mix of algae oil and jet or diesel fuel. Williams, of the Algal Biomass Organization, figures it will be about three to five years before companies produce algae oil on a commercial scale. But, it will happen, he said.

“Smart people are working very hard, tweaking the technology. We don’t have the luxury of time on this.”
GREEN BC CLUSTER

PAKIT Takes On Plastic Packaging

Some people grumbled when the Seattle Mayor and City Council decided to ban business use of expanded polystyrene (EPS) food containers - better known to you and me as “Styrofoam.” But, the news was like music to the ears of Brian Birmingham, CEO of PAKIT, Inc., just up the road in Vancouver, B.C.

PAKIT is selling a manufacturing unit that produces compostable plates, trays and clamshells that can take the place of expanded polystyrene and other petroleum-based materials. The company was already ramping up for a sales push into the United States when news of the plastics ban arrived from the south.

“I was thrilled to hear about Seattle’s action,” Birmingham said. “Lots of North American cities are taking some steps to address plastics but they haven’t taken complete steps to deal with it. Seattle has its eyes open and is aware there are viable replacement products available like ours.”

PAKIT is no shoestring business run by guys with pony tails. It has raised more than $45 million over the past five years to refine its equipment and mount a bid at becoming the world leader in the production of biodegradable alternatives to nondegradable petroleum-based packaging products.

Anyone surprised to encounter a Vancouver company with such lofty, world-saving aspirations shouldn’t be. The Canadian federal government estimates that more than half of all Canadian firms engaged in greener products or alternative energy resources...
are based in or around Vancouver, and a growing number of them are helping Seattle-based companies, like Foss Maritime and Kenworth Truck, “green up” their systems and product lines.

Among other greener things, Vancouver firms are engaged in designing and producing fuel cells, portable power and battery systems, hybrid power systems for commercial vehicles, cellulosic ethanol and biochemicals, as well as wind, solar, tidal and ocean wave energy technologies. The list stops here because we’re running out of breath, not because we have exhausted the actual list of green BC businesses.

The abundance of the BC cluster begs the question: Why?

First comes the climate change theory. Vancouver is by far the largest Canadian city where you are least likely to need a snow shovel. In a nation where about 100 people freeze to death each year, the relative warmth of the “Canadian San Diego” is often cited to explain Vancouver’s ability to attract bright Canadian companies and people.

But, there is also a historic root. Vancouver was a major counterculture hub in the 1960s for many reasons, including the balmy climate, the city’s European feel and the gorgeous scenery, to say nothing of the presence of a close-by international border that precluded any unexpected appearances by U.S. military police. It is the city where Greenpeace was born amid an environmental consciousness that extended from British Columbia to Seattle, Portland and San Francisco.

PAKIT CEO Birmingham grew up in Vancouver and believes we are all northwestern peas in the same green pod. “Vancouverites are like cousins to people in Seattle and Portland, Washington and Oregon. When it comes to the environmental movement, people from those areas have absolutely been at the forefront of it.”

PAKIT’s machines are environmentally simpatico too. They use one-third less the power of machines that make compostable paperboard products, Birmingham said. The goal is to expand the power savings to 50%. He says PAKIT’s machines also turn out a superior product. “You can hold one of our plates in your lap and cut a steak on it,” he said.

PAKIT's biodegradable alternatives also hold up well to microwaving and they can stand the heat of a 500 degree F oven. PAKIT owns the production equipment, but the technology was developed in Sweden with the first commercial machine made in Scandinavia. PAKIT plans to move production to North America to save on shipping costs and reduce the carbon content of its supply chain.

The company strategy is not to produce biodegradable packaging products, but to sell the production equipment to companies that will find a market edge in making their own sustainable packaging products. PAKIT is targeting food retailers, companies engaged in food processing and quick service restaurants, disposable medical products, and companies that make wood pulp, either on purpose or as a by product.

PAKIT made it first major U.S. sale to a company in Georgia, but Birmingham said the City of Seattle’s plastics ban inspired Pakit to start its southern push with a focus on the Pacific Northwest. “Many of your companies will like the product and their customers will like it too.”

The Canadian federal government estimates that more than half of all Canadian firms engaged in greener products or alternative energy resources are based in or around Vancouver, and a growing number of them are helping Seattle-based companies.
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It’s Our Nature.
volume of used equipment piled and stacked up inside the K&K yard. Graders, dozers, drill pipe, enormous valves and electrical control systems, trucks, buses, engines. Bernie cruises through the yard, picking which pieces to keep and which to turn into scrap.

The yard also contains one of the Cat loaders that he purchased back in 1982. The rig rolled off the Caterpillar production line back in 1974. It still runs almost like new and it can still lift just about anything that weighs up to 20 tons.

Road to Chena

Bernie eventually gave up gold mining to recycle full-time, but not before working a mining claim that put him on the road to Chena.

The claim was fed by warm water from the Circle Hot Springs, also located deep in the Alaskan interior. Bernie discovered it was great to wash gold near a hot springs because the warmer water made it so much easier to break up the mud, dirt, and gravel. It was also possible to work the claim for a longer period than you could with the cold water in other streams. Bernie never extracted much gold from the site, but he did take away a vision.

BEST SERVED COLD

Bernie Karl’s first brush with fame came in 2004, with the demise of his Ice Hotel at the Chena Hot Springs Resort.

The Ice Hotel was built from blocks of snow and ice and the hope was it would help to attract more guests.

The Ice Hotel looked great when it opened in January, but by the following June it was nothing but a damp spot. Due to a variety of malfunctions, the Ice Hotel melted in the summer heat.

Forbes magazine promptly proclaimed the Ice Hotel the “dumbest business idea of the year” and Jay Leno made jokes about it on the Tonight Show.

But, my, how the news cycle can turn.

Bernie rebuilt the structure as a new, improved Ice Museum. Among other changes, he removed snow from the construction mix, and the new museum was supported by a new power plant and ventilating system. The Ice Museum opened in 2005 and has remained rock solid ever since, hosting a collection of ice sculptures that include jousting knights and an oversized, Alaska-style chess set, along with a bar where guests are served martinis in special glasses cut from solid ice.

The story of the demise of the Ice Hotel and success of the Ice Museum is invariably retold in the many articles now appearing about Bernie’s revolutionary geothermal generating system. And, as often happens, Bernie’s revenge was best served cold.

He relishes retelling the story when he gives guests tours of the rest, telling one group last summer, “Dumbest business idea of the year? Forbes magazine can kiss my ass.”
It might be cool to own a resort in the Alaskan wilderness, but a major challenge is the cost of power. The resorts are far removed from electrical grids, so you have to provide your own electricity, a very expensive proposition, depending on fuel costs. But what if you could provide your own electricity cheap, through a geothermal-generated power system?

In 1998, Bernie came across an opportunity to put his theory into practice when the Chena Hot Springs Resort was put up for sale just 60 miles outside Fairbanks. Bernie and Connie bought it. Within days, Bernie hauled a drill-rig to the resort, drilled a well, and, inside a week, he was using the hot springs water to heat the resort’s swimming pool.

That was fast, but the first phase of geothermal development at Chena was the last one to move so quickly.

Bernie’s bigger dream turned into a long, hard slog that eventually brought him into partnership with an amazing young scientist, Gwen Holdmann. Gwen could not be interviewed for this article because she was occupied with pregnancy, but to make a long story short, Gwen is Wonder Woman, Alaska-style.

Originally from Wisconsin, Gwen moved to Alaska after graduating from college to pursue her dream of creating a molecular map of the Aurora Borealis. She hoped to do that as a graduate student at the University of Alaska in Fairbanks, which, like Chena, is located along an ideal latitude for observing the Northern Lights.

Graduate school didn’t work out, but she stayed in Alaska, homesteading a vacant cabin where she had to chop her own wood and fetch her own water. She became an avid “musher” or sled-dog racer, tough enough to finish the 1,161-mile Iditarod and good enough to win the 430-mile Wyoming Stage Stop, and eventually married another musher.

It might be pointed out that on top of all this, Gwen looks like a USC cheerleader, but that would probably offend some readers. In any case, forget her good looks and appreciate that her brains, her drive, her love of physics, and her expertise in mechanical engineering made her a perfect candidate for the job of spearheading the Chena geothermal generating system and the Karls hired her to do it.

After lots of starts and stops, Gwen and Bernie developed good contacts at the U.S. Department of Energy, which put them in touch with UTC Power, a subsidiary of United Technologies Corp., and UTC provided the last piece to complete the puzzle.

Heat Differential

At one time a subsidiary of The Boeing Company, UTC is now the seventeenth largest manufacturing company in the United States, with subsidiaries that include Otis Elevator, Pratt & Whitney, Sikorsky Helicopter, and Carrier Air Conditioning.

When they came into contact with the Chena project, UTC scientists and engineers were refining a small power plant that was first developed to generate electricity from waste heat at industrial facilities. The plant is based on a reverse-engineered version of air conditioning. Instead of using electricity to create a heat-cold differential that can be used to cool a room, the process uses a heat-cold differential to create electricity that can be used for just about anything. The science for this was not new, but the industrial application was, and UTC adapted it to the unique water conditions at Chena.

Because 165 degrees isn’t hot enough to turn a turbine, the power plant operates as a binary system that is powered by a liquid
refrigerant with a boiling point low enough so that it can create steam even at 165 degrees. The refrigerant is continuously sucked through the power plant by a heat-cold differential that vaporizes the liquid and then cools it back to liquid. The differential is provided by water from the hot springs and water from a nearby stream that is never warmer than 40 degrees.

Two of the UTC power plants went on line at Chena in 2006, and they’ve been humming ever since. The entire project cost about $2 million. Before the geothermal power came on line, it cost the resort about 30 cents per kilowatt hour to generate electricity. With the power on line, it costs about 6 cents per kilowatt hour – about the same as the citywide average in Seattle, which has some of the cheapest electrical rates in the country.

Bernie estimates that after he pays off his debt load for the power plant next year, he’ll be paying one cent per kilowatt hour, matching the super cheap rates that are paid for pure hydropower systems.

The success of the system has earned Bernie, Gwen, and Chena a steady stream of positive publicity and high praise in their adopted state, because the Chena system has so much promise to address two of the biggest, everyday, quality-of-life challenges of living in the Last Frontier.

Alaskan energy prices are extraordinarily high, especially in the remote locations where nearly half of all Alaskans live. But, as a hot spot on the Pacific Ring of Fire, Alaska is also full of promising geothermal resource areas. The reality of Bernie’s dream means it may be possible for many Alaskan settlements and small towns to tap into a relatively cheap resource. The present UTC power plants are small, but they are relatively cheap and ideal for serving communities the size of most Alaska villages.
But, as shown by the large greenhouse at the resort, Bernie’s vision includes food. The vast majority of Alaska’s food is imported because the climate limits the growing season, just as it limits the working season for placer mining. The Chena greenhouse demonstrates that Alaskans might someday be able to grow far more of their own food than hardly anyone can presently imagine.

And the Chena ramifications are not limited to Bernie’s adopted home. Like many other accounts, this article is guilty of making too much of the cool water that drives the Chena system. The cool temperature is unique, but it is not the key to the UTC technology that runs the power plants. The real key is the heat differential.

The UTC power plants can generate electricity wherever there are water resources with a 100-degree heat differential. In Chena, this was met by the difference between the 165 degree water from the hot springs and the 40-degree water available in the nearby stream.

In Florida, UTC, Bernie, and Southern Methodist University are setting up a power plant at an abandoned oil well where the low end of the differential will be met by seawater while the high end is met by hot water from the bottom of the oil well.

David Blackwell, a professor of geophysics for SMU, was part of the MIT team. He also helped with the Chena system and is one of the leading geothermal experts in the United States.

Hot water is found at the bottom of virtually every oil well and Blackwell believes the UTC plants can create emission-free electricity at thousands of abandoned oil wells around the Gulf Coast and throughout Texas. He predicts this application could create enough electricity to equal the output of five nuclear plants. “Chena could be the forerunner of great things,” he said.

Combine the Chena approach with the possibilities of EGS, and the benefits could prove to be greater than any of us know.

Pay Dirt

At Chena, after years of trial and error and disappointments, the rewards rolled in quickly.

Gwen was hired by the University of Alaska in Fairbanks to create the state’s new Alaska Center for Energy and Power, which will focus on meeting rural energy needs. Bernie is now one of Alaska’s leading citizens. He has explained his power system to academics at Stanford University and SMU. The Chena project is being written up in newspapers, magazines, and books, and featured on television shows, and the Chena team has won national awards.

But for Bernie, the most important recognition came 3,000 miles from home.

Bernie’s dad is now deceased, but before he died he sent Bern- nie a picture frame holding a laminated stalk of wheat. “I think it was his way of telling me he was proud of what I accomplished in Alaska.”

Then, there’s the shared sense of accomplishment that binds Bernie with his 15 siblings and the well head of his own good fortune.

Bernie was the sixth of the 16 children born to his parents, and five of his brothers were born with muscular dystrophy.

Some of the afflicted brothers are older than Bernie and some are younger, and Bernie emerged from his kinship with them profoundly inspired to do something constructive with his life.

The disease usually deprives its victims of the use of their limbs, but, Bernie says, his five brothers never let the disease turn them into victims.

Each one has to use a wheelchair, but all were gainfully employed throughout their adult lives, working as accountants and, for a time, teaming up to manage a construction company. All five now live at the family farm outside Peoria.

Bernie loves these brothers, he admires them and, the daily challenges and triumphs of their lives are constant reminders of his own good fortune.

“They are my role models. They could have lived off society. Instead, they contributed to society. They are the reasons I feel so blessed. I’ve got arms that work. I’ve got legs that work. They accomplished things even though their arms and legs didn’t work. They accomplished way more in their lives than I ever will. They are heroes to me.”

Bernie might be the one who finally struck pay dirt, but in the end, his story enriches us all.
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Class Begins September 23.

This seven-week class teaches everything needed to pass the Building Performance Institute (BPI) national certification exam for energy auditors. Every student in the last class passed the exam.

For information contact Molly Baxter at (206) 768-6627 or mbaxter@sccd.ctc.edu. Register at the Georgetown Campus, 6737 Corson Avenue South, (206) 764-5350.

South Seattle Community College and the Puget Sound Industrial Excellence Center are creating training for new jobs in the expanding green economy, including specialized contract training, in these and other areas:

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