Courting Maine's ENERGY FAVOR

Nature has supplied us with many tools to keep our modern world turning, but selecting the best combo is complex. **Robert Moore, Richard Silkman, Les Otten, Todd Presson,** and **Chris Sauer** pitch the woo for oil, solar, wood, wind, and tidal power.

BY TORI BRITTON • ILLUSTRATIONS BY M. SCOTT RICKETTS

Anybody under any illusions that the U.S. still functions as a free market economy need only look at the energy industry. Presidents, Congress, state legislatures, governors, and regulatory bodies of all shapes and sizes have been trying to strong-arm the energy industry into controlled prosperity since the Federal Power Act of 1920.

The bad part—or the good part, depending on your point of view—is that maneuvers which prop up one industry and put the kibosh on another may not always make economic sense, but they sure do change outcomes. Some people get rich, some get robbed; new industries and technologies emerge that would never had made it in the marketplace without Big Brother's help, and a few fail no matter how much money is funnelled their way. Laissez-faire lovers hate it, but *c'est la guerre.*

The five businesspeople in this month's panel are all operating inside that mucked-up matrix of government and market demands. Each one would testify that the right laws or regs could make his job a whole lot easier, and the wrong ones could put him out of business.

These five—Robert Moore of Dead River Company (speaking on behalf of oil energy); Todd Presson of Patriot Renewables (wind); Les Otten of Maine Energy Systems (wood-derived fuels); Richard Silkman of Competitive Energy Services (solar); and Chris Sauer of Ocean Renewable Power Company (tidal)—all make a great case for their respective sectors. But it doesn't take a lawyer, an MBA, an *Inc.* magazine Entrepreneur of the Year, a PhD economist, or a professional engineer (their respective credentials) to figure out that we don't need *some* of these energy sources. We need them all. Big Brother, are you listening?

ENERGY PANELISTS

Robert Moore
Dead River
CEO & Chairman
Moore has been with Dead River since 1995. He is a former law partner at Pierce Atwood and was a U.S. Navy officer and pilot.

Richard Silkman
Managing Partner
Competitive Energy Svcs.
Silkman, a PhD economist, is a founding partner of GridSolar LLC and a former director of the Maine State Planning Office.

Les Otten
Cofounder
Maine Energy Systems
Otten chaired former Governor Baldacci's Wood to Energy Task Force. He is the former CEO of American Ski Company.

Todd Presson
Chief Operating Officer
Patriot Renewables
Presson is a licensed professional engineer and also holds an MBA from Rensselaer Polytechnic Institute.

Chris Sauer
President & CEO
Ocean Renewable Power Company
Sauer is a professional engineer who specializes in developing emerging green technologies.

What percentage of Maine's electricity and/or heat comes from the energy sector you represent?

Robert Moore: According to the 2010 census, 70% of the homes in Maine are heated primarily by heating oil and kerosene. Approximately 220 million gallons are consumed for residential use, 86 million gallons for commercial use, and 17 million gallons are consumed in the industrial sector.

Oil plays a very small role in the production of electricity; oil-fired generators produce approximately 2% of Maine's electricity. Natural gas, on the other hand, appears to be playing a growing role in electricity production.

Richard Silkman: The relative percentages for solar are too small to measure. Neither PV (photovoltaic) solar to generate electricity nor solar thermal to generate heat has achieved measurable market penetration levels.

One area that may be significant, though very difficult to quantify, is the use of passive solar for residential and commercial space heating—for example, the orientation of buildings to capture solar gain.

Chris Sauer: None, yet.

Les Otten: Maine makes the highest percentage of electricity from wood of any state, over 25%. [Next is Vermont, at 7.8%.] Maine also uses a lot of wood for heat, but most is currently in woodstoves or outdoor wood boilers.

Todd Presson: Wind energy that is generated in Maine primarily feeds into the ISO New England grid. It is difficult to say exactly what percent of electricity in Maine is generated by wind power; however, in New England, it is currently about around 1%. Currently there are 265.5 megawatts of wind power installed in Maine and 130.6 megawatts in construction. These projects will produce approximately 1,180 gigawatt hours each year —roughly 10% of the electricity used in Maine.

What could or should that percentage be?

Todd Presson: According to GE Energy Applications and Systems Engineering, which conducted a study for ISO New England last year, wind has the potential to supply up to 24% of the region's electricity by 2020.

Chris Sauer: I would say in the midterm, say in five years, the percentage of the tidal-generated power in Maine will probably be 3% to 5%. I think on the

10- to 15-year horizon, we'll be up to 10% to, at the most, 15% of the total electricity needs of the state of Maine.

Les Otten: Maine could heat all the homes in Maine with about 8.6 million tons per year of wood. The current sustainable annual harvest is about 16.5 million tons per year. But about 12 million tons of that goes to pulp and sawlogs. About 3.2 million tons goes to biomass power plants. The rest goes to pellet making or firewood. However, with better forest management, more than half of Maine's homes could eventually be using pellet fuel for heat. If the pulp and paper industry declines significantly, then all of Maine's homes that use heating oil or propane could be heated by pellets.

Robert Moore: Market decisions about energy uses are based on the consumers' opinions of value. In Maine, consumers have decided to heat their homes and run their businesses primarily with oil. The value consumers find in heating oil is that it's a transportable, storable liquid product, which makes it an excellent fuel for meeting seasonal or peak demand needs.

Richard Silkman: In 10 years, for the average Maine home or business, there would be relatively little change in how solar is used, given current technologies and energy market prices.

We see two uncertainties that could have a major impact on solar development in Maine and across the world. One is improved technologies and lower costs for solar PV systems. The efficiency with which the solar PV cell can convert light into electricity ranges from about 7% (thin film) to 15% (crystalline) in today's technologies, with lab technologies now reaching as high as 40%, and a theoretical maximum of about 90%—so lots of upside potential.

Another factor would be increased market penetration of electric or plug-in hybrid vehicles. The ability to use solar generation to charge car batteries, and to do this at the home or business level through the use of solar PV systems, will revolutionize both the transportation and the electric industries.

Where does it make sense for Maine's public sector and private sector to invest more in improving our use of this energy source?

Richard Silkman: The distinguishing features of solar PV systems are very important to consider as a future energy source for Maine. First, solar is renewable. However, it is not tied to any specific geographic feature of Maine, e.g., proximity to the ocean for tides or current, adjacent to rivers for hydro, or on ridgetops for wind. This means that it can be located anywhere on the electric grid—the only renewable energy resource that offers this feature.

Second, solar is scalable. The per unit cost of a small system is approximately the same as the per unit cost of a larger system. This is not the case with wind, tidal, biomass, or any other form of electric generation. As a result, solar PV systems can be developed by every electric consumer.

Third, solar is easily permitted; it has no noise, no emissions, no visibility problems.

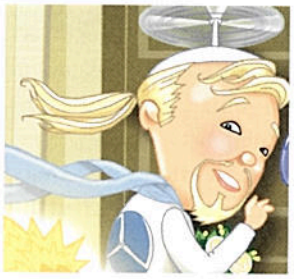
In addition, solar PV output is highest during the hours when the load on the grid is highest, which makes it a good resource for offsetting increased infrastructure requirements driven by increases in peak loads. This provides a very powerful economic rationale for investing in new solar PV generation, but is one that the current regulatory process does not factor in.

Robert Moore: Technological advances in heating equipment efficiency have dramatically impacted fuel consumption. Residential and commercial consumers can save money over time and decrease their carbon footprints by investing in heating system equipment upgrades. In many circumstances, weatherization reduces fuel consumption as well.

Two of our northern markets—Brewer and Presque Isle—are offering Building Performance Index (BPI)-certified home energy audits and weatherization services. In some instances, combining equipment upgrades and weatherization can reduce overall energy costs by up to 50%. The commercial and industrial sectors see similar reductions through equipment and process upgrades.

Chris Sauer: Successfully developing tidal power in Maine, besides having a lot of luck and incredible people working with us, takes money. Money is hard to come by; we are still considered way too risky

"With better forest management, more than half of Maine's homes could eventually be using pellet fuel for heat." —*Les Otten*



"There is a lot of misinformation online about wind projects—fear tactics put out by people who just don't want to see windmills." —*Todd Presson*

for typical venture capital people. So we rely on being able to qualify for some state funding, certainly federal funding, and we are constantly looking for private investment from visionary strategic partners who are committed to being a big part of this new industry and who have a horizon, in terms of return, that goes beyond a few years.

Todd Presson: Investments in wind power in Maine will pay off for industry, government, and residents, and will continue to benefit generations to come. Typically, commercial scale projects are more economic than small residential use systems; however, homes in windy locations without access to the grid may find that wind power is a clean, cost-effective choice for their power, too.

Government can help wind power by recognizing that long-term power contracts are needed to amortize the upfront cost of wind power over a long period of time. Since the cost of operating wind plants is very low and predictable, wind projects with long-term contracts and low-cost debt will yield competitive pricing for consumers. This is essentially the same effect that a long-term mortgage with a good interest rate has on your monthly home payment. The current market structure is biased against long-term contracts, since utilities have no incentive to enter into them. The unintended consequence of this market structure has been price volatility. Business needs predictable long-term pricing, not pricing that is low today and high next year.

Les Otten: The Northeastern states are uniquely and overwhelmingly dependent on No. 2 oil for heat. When heating oil prices rise, Maine families and businesses suffer, and jobs are lost as more and more money is drained from our state's economy and sent to other places. Maine has a unique supply of renewable energy in bioenergy feedstocks. Maine has a long history of using wood for heat; it's in our DNA. If Maine converted its existing oil systems to wood pellet systems, it would keep more than a billion dollars a year (at today's heating oil prices) in the state. It would also create or sustain, in the forest products and pellet industries, more than 110,000 jobs. The multiplier effects would create another 120,000 jobs.

Energy sources have several major factors to consider, including cost for setup and ongoing use, the ability to store the energy, and environmental considerations. Please address each of these.

Todd Presson: The cost for setup is the highest cost for wind power. Usually, the work done on wind farm permitting and construction is done with local businesses and local workers. For example, First Wind's Stetson Wind Farm had a $65 million construction budget. Of that, $50 million went to more than 100 Maine businesses doing work on the project.

The ongoing cost for wind power is one of the elements that makes wind power so appealing. Wind is the free fuel used to create the energy in a wind farm. Being able to bid into the ISO New England grid with a reduced ongoing cost displaces higher-cost generators, drives down the average wholesale electricity price in New England, and thus reduces the price of electricity for consumers.

At small percentages, wind power does not impact the grid stability. However, when wind power becomes more prevalent, we may need to explore new ways of storing energy to balance supply and demand. One of the products being tested right now is a battery that could store as much as 28 megawatt-hours of wind energy generated by windmills.

Wind farms significantly reduce the amount of greenhouse gases and harmful emissions that enter our air. There is a small amount of noise pollution that results from the spinning wind turbines. At our Beaver Ridge

Wind project in Freedom, which was the second commercial wind project in Maine, we have worked closely with the few neighbors who have had concerns regarding the noise coming from the project.

There is a lot of misinformation online about wind projects—fear tactics put out by people who just don't want to see windmills. If you have questions, the best way to find answers is to visit a wind farm. You will be amazed at how quiet the turbines are, and will see wildlife, vegetation, and clean energy being produced right in front of you.

Les Otten: Cost for setup [for wood pellet energy systems] is done on a case-by-case basis. It is consistently seen that over the life of the project, the combined cost of operation and investment is dramatically lower.

The ability to store the energy is pretty straightforward: It sits in storage tanks just like heating oil or propane.

Regarding the carbon story, the wood-to-energy pathways actually sequester carbon—with the necessary condition of sustainable forestry.

Damage to habitat is not an issue as long as, again, the wood supply comes from certified sustainable forests—certified through FSC, the Forest Stewardship Council, or SFI, Sustainable Forestry Initiative. To pass the carbon straight-face test, the wood supply must come from sustainable forests. Based on data from the Maine State Forest Service last year, a majority of Maine's forests are now certified sustainable.

Richard Silkman: Solar PV systems are currently more costly than land-based wind and biomass. Technological improvements and reductions in cost are projected to improve significantly the cost of solar generation over the next decade.

Solar PV systems are very low maintenance and have no fuel costs. The technology, though complex, is very simple once installed.

No renewable generation option, except hydro with a storage pond, offers the potential for storage. It must be coupled with batteries.

Environmental considerations are very favorable for solar: no emissions, no noise, no visibility problems, no harm to habitat.

Another key difference between solar and all other renewable energy generation technologies is the ability for this technology to be installed, owned, and operated by any person or business. This is not true for wind, tidal, hydro, geothermal, etc.

Robert Moore: The infrastructure for liquid fuels in Maine is already established and needs virtually no additional investment. An efficient delivery system—from transportation to Maine to delivery at homes—is in place and requires no government intervention.

A homeowner who installs a new oil-fired boiler should expect the installation (setup) costs to run between $5,000 and $8,000. There are many variations available, including hybrid systems that utilize solar and geothermal components. These additional inputs increase the setup cost, but reduce the usage of oil.

When assessing oil against other energy types, the costs aren't easily compared. Some analysts attempt a comparison by equalizing for BTU output; however, the BTUs associated with oil won't be what are necessarily needed for a boiler of another design or fuel type. For example, an oil-fired burner for a home that consumes 650 gallons of fuel per year produces the same BTU output as five tons of wood pellets. However, that same home with a pellet stove likely wouldn't require five tons of pellets annually.

Operating costs, service requirements, and maintenance are also factors that require careful consideration. Biomass requires more personnel to manage and operate than oil or gas, and the required maintenance is greater. The cost of petroleum-based fuel may currently be higher than biomass or natural gas, but it's still less than electricity.

Many people may consider the environmental impact of the energy they choose. As the densest energy form, oil contains more energy per volume unit and naturally has a high CO_2 output. The introduction of modern equipment and control technology has reduced the CO_2 output, and the oil industry is progressing toward further reductions as biofuels become more prevalent in the blend of consumable oil products. A 10% biofuel blend with 90% petroleum heating oil produces the same greenhouse-gas emission as natural gas.

Chris Sauer: We're almost to the point now where we can connect to the grid and that's a triumph, but it's taken us seven years and $25 million to get here. So that's the setup cost.

On the operation-maintenance side, because we have to put these systems underwater and go out to inspect them and maintain them, the costs as a percentage of the total cost of power are higher than most other sources of energy. That's bad news and good news. It's a barrier we have to continue to reduce, but that also means that money to maintain our power systems will go into the local economy.

As far as predictability, that's one of the outstanding features of tidal energy. If you look at emission-free electricity generation, the only one that's totally predictable is tidal. Even though it's intermittent, it's highly predictable. I can tell you how much energy will be generated on May 3, 2018, at 4:18 p.m.

Now about the marine environment: When people first think about tidal energy, they typically ask, "What's going to happen to the fish?" Both science and our research tell us this is not an issue. The types of turbines that we use, called "foils,"

create a pressure barrier in front of them as they rotate. If you think about it, how many fish kill themselves running into a bridge pier? The fish apparently sense that this is a solid object and swim around it. There's a similar phenomenon here. You occasionally will get a small fish to meander through the turbines, but they aren't harmed, because the rotational speed of these turbines is very low. We have a four-year partnership with the University of Maine, and they have done a magnificent job of documenting this.

Maine has its own particular climate, political landscape, and geographic realities. Does anything make it more or less difficult to produce this type of energy in Maine than in other places?

Robert Moore: Maine's cold wintertime climate necessitates a lot of energy to keep warm, making the region well-suited for a dense and portable energy source such as oil. As a commodity, oil is common and accessible to Mainers. While Maine does not produce any oil of its own, most of the petroleum we use is refined in this country. We import from more than 100 other nations, and the United States' known oil reserves are still waiting to be tapped.

Biofuels made from Maine wood fiber represent a real possibility for supplementing oil usage in the near future. Biofuel will work seamlessly with the existing energy infrastructure while providing new life to the Maine paper mills, foresters, and others.

Today's political landscape is driving further development of technologies that can maximize oil's density and efficient infrastructure while reducing the environmental impact.

Les Otten: Recent history and our current dependence on installed oil make alternatives difficult. For 60 years we have been doing it with oil; it is the only thing that most people have ever seen. It is understandable that they will be skeptical. Changing habits of both energy providers and energy consumers is a tough challenge. But as the price of oil continues to increase, the obstacle of the new and efficient thermal biomass alternative seems less daunting.

On the easier side, Maine has a long history of a productive forest products industry. There has been a slow decline in pulp and paper, indicating significant supply opportunities. Forest management practices have dramatically increased the growing wood stock—and I mean dramatically. Wood prices are stable, and today's pellet boilers are as easy to own and maintain as their alternatives.

"We have the best tidal energy resource on the East Coast, and we sit at the edge of New England . . . a huge market for renewable energy." —*Chris Sauer*

Richard Silkman: Maine has average solar radiation, relative to the country as a whole. There is no particular advantage or disadvantage for the development of solar in Maine. Snow must be addressed for projects on greenfield sites or on rooftops; on the other hand, the frequency of rain keeps the solar panels free of the dust that reduces solar generation in desert regions.

Maine has considerable open space and woods (that were once farmlands) that can be used for ground-mounted solar systems at relatively low cost because land is inexpensive.

As we have noted many times in public remarks, solar PV systems are really not electric generating stations, as these have traditionally been defined. They are really much more like appliances that can be placed in any home or business. Once the costs of solar have fallen to the point where it is economic for a few homes to install solar PV systems, it will be economic for many, if not all, homes to do likewise.

Todd Presson: The winds along some of Maine's many ridgelines are conducive to wind power development. Construction in the mountains is something unique to wind power, but it does not present a significant challenge. Politically, Maine has welcomed wind power in its earliest stages. Former Governor Baldacci was supportive of the industry and the many jobs it has preserved and created over the past five years through wind farm development, construction, and operation. We did see a number of bills introduced in the legislature during this past session that would have slowed or stopped growth within the industry, but elected officials

rejected the bills. At a time where we are seeing fewer and fewer investments around the country, we continue to see investments in wind power construction and generation in Maine.

Chris Sauer: The argument in favor of tidal power in Maine is compelling. We have the best tidal energy resource on the East Coast, and we sit at the edge of New England, where there's a huge market for renewable energy. Beyond that, if you look at what it takes to be successful in tidal energy, it takes people who know something about composite material manufacturing, and who are skilled at working in a marine environment. Maine has a lot of history using composite materials in boat making. People on the coast of Maine know how to work on the water. We have been very, very pleased with that side of it.

From an economic standpoint and a capital-raising standpoint, Maine is at a huge disadvantage; Maine doesn't get a lot of federal money, for whatever reason. Maine isn't seen as the center of innovation in the United States, so it has inhibited our efforts to some extent to raise capital, but we've overcome that once people understand the compelling argument of why it makes sense to do it here.

Still, here we are, this little company in Maine, and we developed our power system and the skills and the know-how here, with the full cooperation of government and outstanding resources like the Maine Technology Institute. The tidal energy potential in Maine is only one-tenth of the potential of Nova Scotia. This is, for us, a stepping stone to be in one of the largest tidal energy resources in the world. So we are now a big player in the Nova Scotia market because of what we did here in Maine.