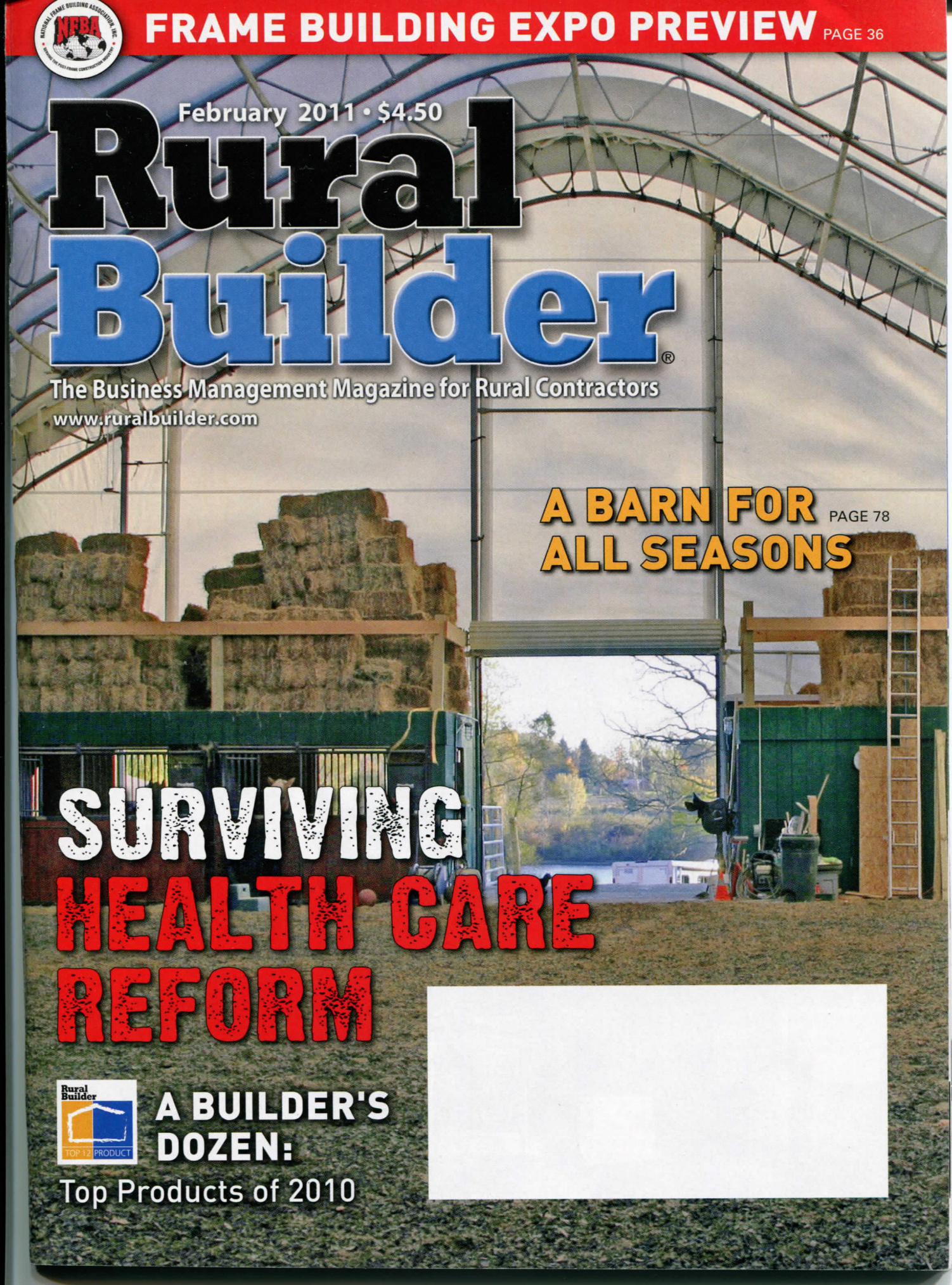
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BY OLIVER WITTE

An experiment in solar savings

Retired builder decides to do the math with home project

What does a rural builder do upon retirement? If the builder is as environmentally conscious as Allen Downs, maybe he experiments with some of the ideas he spent much of his life advocating. How would these ideas prove out if he had no one to please except himself (and maybe a dubious wife)?

Moving to Las Cruces, N.M., made solar an obvious option for Downs. Las Cruces gets almost twice as much sunshine as, say, Seattle or Pittsburgh (about 84% sunshine vs. 43- and 45 percent), so if solar electrical power is going to work anywhere, it ought to work there.

In brief, the experiment was a technical success, and Downs is now happily selling electricity to his local utility, El Paso Electric Co. — but not without a string of surprises along the way. And the financial feasibility remains open to question.

Downs' first assumption — that a photovoltaic system would require batteries — almost stopped the project in its tracks. He and his wife travel during summers, and he didn't want to be tied down with battery maintenance. But as he researched the technology, he discovered that it might be possible to connect to the local power grid, eliminating the need for him to store energy.

The solution arrived as an insert in his electric bill. The insert announced that El Paso Electric supported net metering, which means that it can measure current in as well as current out.

The next hitch was the realization that building his own solar system was more complex than he was prepared for. A quick Internet search found a company called Positive Energy that sells and installs solar electric panels for homes and businesses in New Mexico. Downs responded and an on-site consultation followed. The proposed system would consist of nine 215-watt photovoltaic modules and would be rated at 1.935 kilowatts — enough to power the whole house for most of the year. Downs recalls being skeptical that the performance would match the promise, but he decided to proceed.

The system consists of nine 215-watt photovoltaic modules rated at 1.935 kilowatts.

More trouble: The siting of the house was less than ideal for solar collectors. For maximum efficiency, the solar collectors need to be aimed at 180 degrees, which is due south, but the roof of the house, where the collectors would be mounted, faced 250 degrees, or only slightly south of due west.

Would Downs permit the collectors to be mounted on a pole in the side yard? No, he said, and the project was off again. Although pole mounting would enable the nine panels to be adjusted with the seasons so their tilt would always be optimal, pole mounting would be more expensive. The structure would have to be strong enough to withstand high winds, and it would have to be fenced.

Then Downs realized he had another option: Installing the solar panels on the roof of his attached garage, which was turned 90 degrees to the house. On the garage, the panels would face 160 degrees, or 20 degrees off due south, which was judged to be acceptable. Locating the panels on the garage would reduce output by only 2 percent, compared to a loss of 18% on the house. The garage location took another 1 percent hit due to shading from the television antenna.

Because of Downs' experience with a 12-volt photovoltaic system on his recreational vehicle, he assumed that an inverter would need to be mounted as close to the panels as possible because the connecting wires would be carrying low voltage but high current.

"Wrong," Downs discovered. "With nine 40-volt panels in series, the voltage is around 360 volts and the current is low – around five amps – so the inverter could be located at the main power panel at the other end of the house from the solar panels."

Another surprise: Positive Energy predicted that the panels would produce the greatest amount of electricity in spring, whereas Downs had assumed that the maximum would be in June, when the days were longest and the sun was highest in the sky.

"It turns out," Downs said, "that I wasn't taking panel temperature into account.

The hotter the panels, the lower the output. In the heat of summer, the temperature factor overwhelms the additional sunshine, and output goes down."

With resolution of the technical issues in sight, Downs turned his attention to some rough payback calculations. How

long would it take for the anticipated savings to catch up with the anticipated costs? Assuming a 5% cost of capital, the payback looked like about 18 years, he said.

At this point, Downs' wife, Dinah, objected. It did not make sense to her to put money into a project that was unlikely to return their investment in the time they were likely to own the house and maybe not even in their lifetime. But Downs wanted to do it anyway.

Time to negotiate: "She had put money into landscaping our back yard with plants that needed watering, and I opposed the idea, but I didn't stop her," Downs said. "Now the tables were reversed: She opposed my plans, but she didn't stop me." The project was on again.

Downs signed the contract with Positive Energy on Dec. 9, 2009 – the last day that Positive Energy would be able to apply to El Paso Electric for a "Small System Renewable Energy Certificate" (REC) contract at a rate of 13 cents for every kilowatt hour (kWh) generated by Downs. This credit (shown in Column I in the adjoining table) is included in the amount El Paso Electric pays him (Column L) and is the key to making the photovoltaic system feasible.

The system was installed between March 12 and 16. The county electrical inspector approved the work the following day, and El Paso Electric replaced the existing revenue meter with a bi-directional meter a day later.

Direct current began passing immediately from the solar panels through the attic to the north side of the house, where the electric company's service entry is located. The direct current is changed to alternating current by a SunPower 4,000 watt inverter, and then passes through a meter which measures total generation to allow EPE to determine the renewable energy credit.

The final cost of the system came to $14,958, but various subsidies reduced Downs' cost to $8,974.80, he said.

"When I complete my 2010 tax returns in April 2011, I expect to get a 30 percent federal tax credit of $4,487.40 and a 10 percent New Mexico state tax credit of $1,495.80," Downs said. "In addition, the system is exempt from New Mexico's sales tax, saving another $1,118 which would have had to be added to the $14,958 price tag."

Downs said he did not expect any maintenance costs except for the inverter, which has a life expectancy of 10 years and costs about $1,500 to replace.

The expected saving breaks into two parts, Downs said:

-El Paso Electric, his power company, will pay him 13 cents for every kilowatt hour generated by his system under a 12-year contract – regardless of whether Downs delivers the power to El Paso Electric or uses it himself.

• For every kilowatt hour he generates and uses himself, he saves 11 cents, which is what El Paso Electric would have charged him. At the end of each

	GENERATED (kWh)	BOUGHT (kWh)	BUY RATE (Cents/kWh)	SOLD (kWh)	SELL RATE (Cents/kWh)	DOWNS USED (kWh)	EST. COST (w/o solar)	ENERGY CREDIT @13c/kWh	POWER (bought) or sold	FEES & Taxes	EPE PAID (with solar)	SAVINGS
APRIL	371			151	3.134	220	$32.09	$48.23	$4.73	($7.63)	$45.33	$77.42
MAY	387			130	4.960	257	36.20	50.31	6.45	(7.63)	49.13	$85.33
JUNE	357	45	11.118			402	52.78	46.41	(5.00)	(8.10)	33.31	$86.09
JULY	347			310	3.415	37	11.75	45.11	10.59	(7.64)	48.06	$59.81
AUG	358			316	3.296	42	12.31	46.54	10.42	(7.64)	49.32	$61.63
SEP	336	174	11.332			510	67.58	43.68	(19.72)	(9.78)	14.18	$81.76
OCT	308	26	10.849			334	44.27	40.04	(2.82)	(8.04)	29.18	$73.45
NOV	276			36	3.244	240	33.77	35.88	1.17	(7.73)	29.32	$63.09
DEC	261	68	9.240			329	38.79	33.93	(6.28)	(8.40)	19.25	$58.04
TOTAL	3,001	313		943		2,371	$329.54	$390.13	($0.46)	($72.59)	$317.08	$646.62
AVE	333					263	$36.62	$43.35	($0.05)	($8.07)	$35.23	$71.85

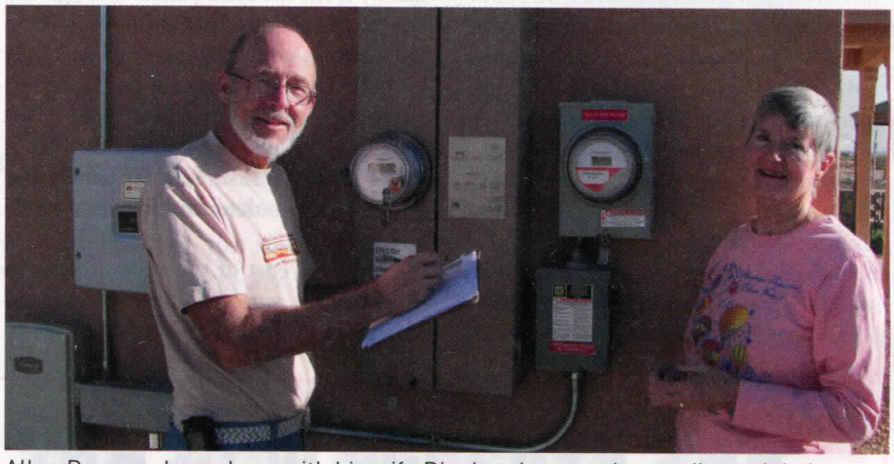
monthly billing period, if Downs has generated more power than he used, El Paso Electric pays him for the excess power at an "avoided cost" rate of about 3 cents to 5 cents per kilowatt hour.

Finally, Downs assumed that electric rates will increase about 4 percent per year and that the solar power output will decrease about one-half of 1 percent a year as the glass on the panels gets hazy and the system's efficiency diminishes.

Including all costs and with nine months of experience, the system now looks as if it will pay for itself in 14 to 15 years – somewhat sooner than originally estimated, Downs said, although without the 13-cent subsidy, payback calculations would have been meaningless. He provided the following history of his system for its first nine months of operation. Note that the billing cycle runs from the 18th of each month, so his first billing period (for April) is from March 18 to April 18. The column headed "Est. cost (w/o solar)" in the adjoining table is Downs' estimate of what his bill would have been without the photovoltaic panels.

Downs and his wife travel away from home from about June 1 to about September 1, skewing the summer statistics. The power used during the summer billing months would have been much higher if the house had been occupied during the peak cooling season, Downs said.

"If the costs appear low, keep in mind that there are only two of us, and I make an effort to reduce power consumption to the absolute minimum," he said. "Not being home during the hottest part of the year works against us as far as the system making financial sense. We would get the maximum cost saving if every month our usage equaled or exceeded our generation."



Allen Downs, shown here with his wife Dinah, takes regular readings of their power usage to measure the true costs of their solar system.

For every kilowatt hour he doesn't have to buy, Downs saves about 11 cents, but for every kilowatt hour he generates and doesn't use, he receives only about 4 cents.

Here are two examples of how to read the table above:

• In April, Downs generated 371 kilowatt hours and used 220 kilowatt hours, or 151 kilowatt hours less than he generated, so he sold 151 kilowatt hours to the electric company at a rate of 3.134 cents per kilowatt hour. Without his solar electric system, he would have paid EPE an estimated $32.09. But with solar, El Paso Electric sent him a payment of $45.33 – consisting of $48.23 renewable energy credit plus $4.73 for the 151 kilowatt hours delivered to them, minus "Customer Charge," fees and taxes amounting to $7.63. Thus the difference between paying an estimated $32.09 and receiving a $45.33 payment gives a total savings of $77.42.

• In December, on the other hand, Downs used more electricity than he generated (329 vs. 261 kilowatt hours), so he had to buy 68 kilowatt hours from the electric company at a rate of 9.24 cents per kilowatt hour. The $19.25 payment from El Paso Electric consists of $33.93 renewable energy credit minus $6.28 for the 68 kilowatt hours Downs purchased and minus the "Customer Charge," fees and taxes of $8.40. The $58.04 savings is the difference between paying an estimated $38.79 and receiving a $19.25 payment.

Note that electric rates vary between summer and winter and because of a "fuel and purchased power cost adjustment," according to El Paso Electric's bill. Note also that the rate for buying electricity from the electric company is significantly higher than the rate for selling it back.

The bottom line is that for his solar system's first nine months in operation, Downs is ahead $646.62, having generated about 25 percent more power than he used. **RB**