

## Case study: Dairies



 **UTAH POWER**

Making it happen.

**“ I think it’s important to be as efficient as you can in these times and Energy FinAnswer® can help. ”**

**Dan DeRuyter**

Manager, George DeRuyter & Sons Dairy



*With VFD control, Brent Christiansen of Sunny Dene Ranch can maintain a stable vacuum.*

## Milk extraction vacuum pump with variable frequency drive (VFD)

At a typical dairy, groups of cows cycle in and out of the milking stations. An operator connects the cows to the milking equipment where the cows will finish one by one. The operator then connects the next group of cows as they arrive. The milking operation continues for many hours – typically an eight-hour milking cycle – and ends with a 30-minute flush of the system (flushing cycle durations vary). Once flushed and clean, the next milking operation begins.

The milking process uses vacuum to extract milk from the cows. A typical vacuum pump is sized to the largest possible airflow into the system and operates at a constant speed. Excess vacuum is bled off through a vacuum control valve.

With the installation of a variable frequency drive (VFD) and controls, the power delivered to the vacuum pump is automatically adjusted to maintain a specific vacuum level – eliminating the need to bleed off excess vacuum.

The control system typically consists of the VFD controller and the sensor/monitoring unit. In some applications they are two separate components and sometimes they are an integrated single unit. A sensor line monitors the level of vacuum through the lines and is normally located next to the receiver jar or the sentinel. The pressure controller and tap are located as close to the milking station as practical.

## Helping dairies control costs

**Utah Power offers energy-saving expertise through its Energy FinAnswer® incentive program. For nearly two dozen dairy operations in Washington and Oregon,\* it has been a profitable partnership.**

By participating in Energy FinAnswer, 23 dairies reduced energy costs associated with vacuum pumps used for milk extraction by an average of 71 percent – from an average of 22 cents, to an average of 6 cents per thousand pounds of milk produced. These savings were achieved with the installation of variable frequency drive (VFD) controls on milk extraction vacuum pumps.

The Energy FinAnswer program paid for a vendor neutral, investment grade analysis in addition to providing attractive cash incentives:

- The energy analysis identified and quantified energy-efficiency opportunities.
- FinAnswer's cash incentives paid for an average of 48 percent of the project costs, accelerating the average payback time from 4.5 to 2.3 years.

Plus, the equipment refinements were completed without interrupting production.

In addition to energy cost savings, Energy FinAnswer brought dairy operations more vacuum stability, significantly reduced noise levels, reduced equipment maintenance and extended equipment life.

## How it works

Start with a phone call to Utah Power's Energy Services Hotline at **1-800-222-4335**. Utah Power works with each individual dairy owner to determine the goals and economic criteria for a successful project. If it appears a project can be successful, Utah Power contracts with a consulting engineering firm to complete an energy analysis. The engineering firm makes a site visit and collects the

\* These projects were completed through Utah Power's sister company, Pacific Power.



## at a glance

Variable frequency drive for dairy milk extraction vacuum pumps

### Overview of vacuum pump VFD projects

Number of dairy participants	23
Average # of stations per dairy	27
Average # of cows per dairy	743
Average vacuum pump motor hp	16

### Average vacuum pump VFD project summary

	Prior to VFD retrofit	After VFD retrofit	Savings	Percent savings
Annual energy consumption (kwh/yr)	117,993	32,372	85,621	73%
Annual electricity costs (\$/year)	\$3,540	\$971	\$2,569	73%
Annual electricity costs per k pounds of milk	\$0.22	\$0.06	\$0.16	71%

Implementation costs	\$11,568
Annual electricity cost savings	\$2,569
Utah Power Energy FinAnswer incentives paid	\$5,580
Incentive as % of implementation cost	48%
Simple payback before incentives (Yrs.)	4.5
Simple payback after incentives (Yrs.)	2.3
(based on \$0.03/kwh)	

### Additional benefits:

- Stable vacuum
- Reduced noise level
- Extended equipment life

### Consulting Engineer:

EMP2, Inc.

### Equipment suppliers and installing contractors:

BBS, Inc.  
 Dairy Fabrication  
 Excel Dairy Service  
 Freeburg Supply  
 Mulders Dairy Supply  
 Orange Dairy  
 Udder Guys

operation's essential operating characteristics including measuring the vacuum pump motor power.

Next, the consulting engineer prepares an energy analysis report, which includes energy efficiency recommendations; estimates of savings, costs, and incentives; and commissioning guidelines. Commissioning the project helps the dairy be sure the system is working as designed and achieving maximum energy savings. Utah Power reviews the report with the dairy owner, and if the owner is ready to implement the project, Utah Power provides an incentive agreement. The dairy owner signs Utah Power's incentive agreement and chooses equipment suppliers/contractors.

Once the new equipment is installed and commissioned according to Utah Power's guidelines, Utah Power reviews project costs and completes an inspection to review the installation. After the inspection report is finalized, Utah Power issues an incentive check based on the final energy savings and the project costs.

“Site visits are scheduled at the dairy's convenience, the time investment needed is only about 2 hours. For most dairy projects, it takes less than 30 days from the initial call to presenting an incentive offer.”

**Chris Helmers**  
 Project manager, Utah Power

## Benefits

In addition to improving energy efficiency and long-term energy cost savings, VFDs provide additional benefits: they ensure a stable vacuum level and result in a considerable reduction in noise level. VFDs also reduce maintenance and extend equipment life.

## Savings

Even though vacuum pumps in the dairies ranged from 10-40 hp, the savings and paybacks are very attractive. On average, the dairies saved 71 percent of vacuum pump energy consumption and costs. See the table for details on each dairy.

“Often we find older oil-ring vacuum pumps – which create dirt and noise. After the installation of new lobe type pumps with VFDs, the operation runs quieter and cleaner without oil residue – extending equipment life.”

Steve Dunnivant  
CEM, EMP2, Inc. Energy and Resource Management Services



## Savings table

Participant	Facility information			Vacuum pump annual electricity costs and savings <sup>1</sup>				Project costs		Paybacks	
	Number of Stations	Number of Cows	Vacuum Pump Motor Size <sup>2</sup> (hp)	Before retrofit (\$/thousand lbs. milk)	After retrofit (\$/thousand lbs. milk)	Annual electricity savings (kwh/yr)	Annual electricity cost savings (\$/yr)	Project Cost Prior to Incentives	Utah Power Incentive	Simple Payback Before Incentive (yr)	Simple Payback After Incentive (yr)
A	12	200	10	\$0.25	\$0.12	25,453	\$764	\$6,125	\$3,062	8.0	4.0
B	12	250	10	\$0.21	\$0.09	28,580	\$857	\$4,822	\$2,411	5.6	2.8
C	16	300	10	\$0.16	\$0.05	28,744	\$862	\$10,176	\$3,002	11.8	8.3
D	16	330	10	\$0.21	\$0.06	39,334	\$1,180	\$4,085	\$2,043	3.5	1.7
E	16	400	10	\$0.21	\$0.06	47,702	\$1,431	\$5,959	\$2,980	4.2	2.1
F	16	400	10	\$0.26	\$0.08	62,377	\$1,871	\$13,627	\$6,814	7.3	3.6
G	16	400	10	\$0.14	\$0.04	35,150	\$1,055	\$5,069	\$2,535	4.8	2.4
H	16	420	10	\$0.17	\$0.05	41,007	\$1,230	\$8,029	\$2,846	6.5	4.2
I	24	500	20	\$0.27	\$0.12	68,033	\$2,041	\$6,550	\$3,275	3.2	1.6
J	20	520	10	\$0.18	\$0.03	62,707	\$1,881	\$15,779	\$7,890	8.4	4.2
K	20	530	10	\$0.10	\$0.03	38,982	\$1,169	\$5,642	\$2,821	4.8	2.4
L	24	550	15	\$0.37	\$0.08	128,039	\$3,841	\$10,833	\$5,417	2.8	1.4
M	24	600	15	\$0.31	\$0.07	82,840	\$2,485	\$12,953	\$6,477	5.2	2.6
N	20	600	15	\$0.24	\$0.06	61,053	\$1,832	\$17,886	\$8,268	9.8	5.3
O	40	610	15	\$0.16	\$0.03	130,743	\$3,922	\$15,063	\$7,531	3.8	1.9
P	20	700	20	\$0.21	\$0.03	123,598	\$3,708	\$15,279	\$7,352	4.1	2.1
Q	24	800	15	\$0.15	\$0.05	74,277	\$2,228	\$6,956	\$3,478	3.1	1.6
R	19	850	15	\$0.16	\$0.06	61,719	\$1,852	\$7,681	\$3,841	4.1	2.1
S	28	880	20	\$0.19	\$0.03	136,875	\$4,106	\$18,575	\$9,288	4.5	2.3
T	52	1250	30	\$0.21	\$0.06	190,968	\$5,729	\$13,860	\$7,522	2.4	1.1
U	80	1590	25	\$0.12	\$0.04	175,458	\$5,264	\$12,132	\$6,066	2.3	1.2
V	64	2100	40	\$0.09	\$0.03	142,350	\$4,271	\$13,956	\$5,902	3.3	1.9
W	48	230	020	\$0.12	\$0.04	183,305	\$5,499	\$35,020	\$17,510	6.4	3.2
Total	17,080					1,969,294	\$59,079	\$266,057	\$128,331		
Average	27	743	16	\$0.20	\$0.06	85,621	\$2,569	\$11,568	\$5,580	4.5	2.3

<sup>2</sup> Some facilities have more than one vacuum pump motor <sup>1</sup> Based on \$0.03./kwh



## Costs and payback

The costs associated with the implementation of a VFD system range from \$4,000 to \$35,000. The installation costs vary with each dairy depending on whether the vacuum pump and motor have to be replaced. Utah Power's incentives are based on energy savings and project costs. See the savings table inside for details on each dairy project.

The payback is short. Of the dairies that participated in Energy FinAnswer, every dairy with 24-hour operations, and most with two shift operations, chose to implement the recommendations in the energy analysis.\*\*

Utah Power is working with dairies and related industries on other energy efficiency opportunities. Examples include energy-efficient lighting, well water milk pre-chiller systems, and VFDs on milk transfer pumps and well pumps.

“ The Energy FinAnswer program really worked well. We had talked to several people about the variable speed.VFDs came highly recommended from the equipment dealer.The program helped us, and I'm really glad we did the project.”

**Dan DeRuyter**  
Manager, George DeRuyter & Sons Dairy

## About Energy FinAnswer

Utah Power's Energy FinAnswer program has helped commercial and industrial customers save money and improve energy efficiency for more than a decade. In Utah, Energy FinAnswer includes investment grade energy engineering assistance and attractive financial incentives. Incentives are for up to 50 percent of eligible costs for qualifying energy efficiency measures.

In addition to this program, Utah Power's FinAnswer Express program helps eligible businesses upgrade to energy-efficient lighting, heating and cooling, premium efficiency motors, and more.\*\*\* The FinAnswer Express program includes both technical expertise and financial incentives for up to 50 percent of the eligible costs of qualifying energy efficiency upgrades.

The Self-Direction Credit program is a third option for larger customers using at least 5,000,000 kwh/yr or 1,000 kw.

“ The estimations in the study turned out to be true. In the vacuum supply, we use about one-third of the power that we used to use.That obviously is a benefit, not only to the power supply, but pump life could be extended by a similar percentage. Also, the noise output, which was considerable, was reduced by two-thirds. ”

**Bill Wavren**  
Owner and operator, Sunny Dene Ranch

## Do the bright thing

For more information on how Utah Power can help you save energy and money, call our Energy Services Hotline at **1-800-222-4335**, e-mail [energy.expert@pacificorp.com](mailto:energy.expert@pacificorp.com), or visit our Web site at [www.utahpower.net](http://www.utahpower.net). Click on Business and Save Energy & Money. Because we have some requirements to qualify for an incentive, it is important to call us **before** you start your project.

*\*\*The economics are not as attractive for one shift operations or those with a smaller vacuum pump (< 7 1/2 hp).*

*\*\*\*Also included in the program are LED traffic signals and refrigerated beverage vending machine occupancy sensors.*

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