

# Capital Budgeting for a New Dairy Facility <sup>1</sup>

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Dairy production throughout the United States has changed tremendously over the past twenty years. The trend in every major dairy region has been toward larger and more technologically sophisticated dairy farms. Florida has been a leader in this trend with average herd size increasing from 300 cows/herd to over 500 cows/herd in the past twenty years. In fact, most growth in the Florida dairy industry during the past five years has occurred due to the establishment of new herds in excess of 1,000 cows. The trend of increased herd size is expected to continue in the future.

The Florida dairy industry has also been a leader in technological change. Major improvements and innovations have taken place in dairy cattle housing; environmental modification to reduce heat stress; milking parlors; feeding systems; and waste management systems. Many of these technological advances have also encouraged the trend of larger herd sizes since they are often most profitable when applied on a large scale.

Both factors, increased herd size and increased technological sophistication, have resulted in dairy production becoming an even more capital-intensive agribusiness. The capital-intensive nature of dairy production, coupled with its often low operating margins, makes it essential to formulate a realistic capital budget. Such a budget is a systematic evaluation of the dairy investment's capital expenditures and operating cash flows.

The difficulty of the capital budgeting task can be managed by following three basic steps. Step one: determine the

capital expenditures of the investment (e.g., cost of land, cattle, buildings, etc.). Step two: estimate the cash flows (i.e., revenues and expenses) the investment will generate over its expected life. Step three: combine the information gained in the first two steps and analyze the feasibility of the investment. This publication will present an example capital budget built on a computer spreadsheet program, with a subsequent analysis of its feasibility for a new 1,200 cow dairy operation in north Florida. The hypothetical dairy in this publication purchases all replacements. Its crop land and farming operation are designed to meet current waste disposal regulations.

Before starting the capital budgeting process, it is important for the potential dairy investor to consider long range goals. A realistic evaluation of the project will be determined not only by the data generated from the budgeting process, but also by the attitude of the potential investor. The potential dairy investor should answer these questions: Am I entering the dairy business to purely maximize the return from my investment? Or, is my search for profits tempered by a desire for a lower, more stable level of "satisfactory profits" that will, hopefully, result in a better prospect of long term survival for the business? Honest answers to such questions will affect decisions throughout the entire capital budgeting process.

## Preparing the Capital Budget

The first step in the capital budgeting process involves defining, categorizing, and estimating the cost of capital

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expenditures. In our example capital budget we consider four main categories of capital expenditures: 1) real estate; 2) cattle; 3) construction; and, 4) miscellaneous equipment. A complete breakdown of these categories and an estimation of their costs for a 1,200 cow free-stall dairy with a double-20 herringbone milking parlor are given in Exhibit 1.

## Estimating capital expenditures

Capital expenditures, or investment costs, include all costs to bring the project into operation. They include the four main expense categories plus consulting fees, legal fees, permit fees, etc. In order to formulate an accurate estimate of capital expenditures, the potential dairy producer must work together with other industry professionals to form a design team. These professionals may include university Extension personnel, construction contractors, milking equipment dealers, soil/water district personnel, financing/banking officers, consulting engineers, attorneys, etc.

The dairy producer and the design team must view the capital budget as an evolutionary process that passes through several stages before it is finalized. Four distinct phases may be identified for most cost category estimates:

- Per animal unit cost estimate. This estimate usually is the first part of the budget process. It is used to establish a preliminary design budget and usually has a relatively low accuracy of +/- 20%. In some cases, the accuracy of this estimate can be improved if it is based on actual cost data of an actual recent project. For example, in Exhibit 1, section III.G, the cost estimate for the free-stall housing is stated on a per animal unit basis; however, this data is accurate since it is based on actual barns recently built in Florida and the Southeast.
- Preliminary design cost estimate. This estimate applies to the construction portion of capital expenditures and is based on such things as number of square feet (SF), cubic yards (CY), linear feet (LF) of materials. This phase of the budget forces the design team to consider production strategy (e.g., milking frequency, replacement rate, feeding regime, level of mechanization, waste handling method, etc.) and to calculate approximate sizes of buildings, manure storage area, etc. Typically such estimates are +/- 15% of actual costs. Working with construction contractors who have previous dairy construction experience may improve the accuracy of these estimates.
- Complete systems cost estimate. In dairy construction, these estimates are usually provided by specialized equipment dealers which supply and install many of the

sub-systems outside the realm of expertise provided by the general contractor. Items included would be milking equipment, milk refrigeration systems, manure pumps, irrigation equipment, etc. In most locations, dairy producers seek competitive bids from several dealers. In this case the information should be accurate within +/- 2 to 10%.

- Detailed per unit cost estimate. This phase consists of a competitive bid from the general contractor and produces a complete, line-by-line, listing of all material quantities, labor costs, and equipment costs. This method requires complete plans and specifications for the project and is accurate to within +/- 5%.

Due to the limited information available on dairy construction projects, many of the categories of cost estimates will not be highly detailed. Thus, most dairy project planners will have to rely, at least in part, on per animal unit cost estimates or preliminary design cost estimates for some portions of the proposed project. Exhibit 1 is a listing of the items that should be considered as a minimum. The costs given for each item are the best available at the time of publication for north Florida. The cost figures also reflect the current requirements for waste disposal (e.g., manure storage and handling, crop land for waste disposal). Readers of this publication are warned, however, that these figures may, or may not, apply to dairy projects they may be planning. Costs of capital items can change rapidly, waste management regulations are subject to change, and different management strategies (e.g., raised replacements) alter items included in the budget. However, follow the basic method of constructing and analyzing a capital budget outlined in this publication if you are considering an actual project. Furthermore, you should consider the cost categories given and seek up-to-date information that is relevant to your management strategy, geographical area, etc. before making a final decision.

Two final topics related to capital expenditures also deserve mentioning: capital replacement costs and salvage value of replaced capital. These two areas are important since many portions of the dairy investment have differing lengths of useful life. For example, in considering the 20-year life of the entire project, some items (e.g., milking equipment) will have to be replaced once, or even several times, during the project's life. Therefore, it is critical to accurately predict useful life of system components and accurately project replacement costs. Furthermore, since replacement of some capital items is anticipated, it is important to establish accurate salvage values for those items. It is critical to realistically determine if a market exists for replaced capital

items or if past history shows that these items end up rusting behind the farm shop.

## Estimating cash flows

The next step in the capital budgeting process is estimating the expected cash flows (i.e., cash revenues and cash expenses) that the project will generate throughout its expected life. This can be more difficult than estimating capital expenditures. Estimating cash flows requires a detailed analysis of the day-to-day operation of the business and proficiency in the technical aspects of dairy production. Even with the best of planning, the timing and magnitude of future cash flows will remain uncertain over the entire life of the project. Therefore, methods of dealing with these uncertainties, like “what-if” analyses using spreadsheets or simulation modeling, should be employed.

The first step in estimating cash flows involves the identification and quantification of all revenue and expense categories. Within each revenue and expense category it is necessary to identify the revenue/expense driver. A revenue or expense driver is any factor whose change causes a change in total revenues/expenses. For example, important revenue drivers are number of cows and milk sold per cow. Common expense drivers include number of cows, culling rate, number of employees, etc. Table 1 shows the revenue and expense categories chosen for this example spreadsheet analysis and gives a brief explanation of each revenue/expense category and its associated revenue/expense drivers.

## Analyzing the Capital Budget

A sound analysis of the capital budget should consider both its cash flow and profitability. Analysis of the project’s cash flow seeks to answer the question: “Can I pay for this project?” Thus, the cash flow analysis determines whether the dairy investment can generate adequate cash to meet periodic obligations to claimholders who have contributed capital to the investment (e.g., owner equity, bank or other financial institution). Profitability seeks to answer a broader question: “Is this project a wise investment?” Therefore, analysis of the project’s profitability determines how favorably the dairy investment compares to other investment opportunities available for the same capital. A sound analysis of any investment must consider both of these aspects because an investment may be profitable but not feasible from a cash flow standpoint and vice versa.

When considering the profitability of an investment, two important and related concepts must be understood: 1) time value of money; and, 2) timing of cash flows. The capital invested in the dairy facility is tied up by the project

for a particular period of time and unavailable for investing in some alternative investment. Therefore, the time value of money accounts for income that must be sacrificed from an alternative investment over this period. The income sacrificed is often referred to as an opportunity cost. In other words, by tying up capital in the dairy the investor must forego the opportunity of income from other investments.

Timing of cash flows is related to the time value of money since the further into the future a cash flow is realized the less value it has today. Thus, the absolute value of revenues (positive cash flow) or expenses (negative cash flow), in terms of present worth, decreases the further into the future they are expected to be realized. Furthermore, the impact of cash flows on today’s decisions should decrease as those cash flows extend further into the future.

The process of accounting for opportunity costs due to the time value of money is accomplished by discounting future cash flows. Cash flows are discounted, or reduced, by using a discount factor whose effect becomes greater the further into the future the cash flow is realized. An interest rate (i.e., discount rate) is used to calculate the discount factor and should represent the expected rate of return from an alternative investment of relatively the same size and level of risk. Generally, the investor desires the largest positive cash flows early in the investment’s life so capital from the investment can be recaptured and reinvested. Reinvestment puts the money back to work earning even more returns, thus reducing opportunity costs.

The cash flow aspect of capital budget analysis does not consider the time value of money. However, the timing of cash flows is still very critical. The magnitude of undiscounted positive cash flows must be high enough each period to meet periodic obligations to claimholders who have supplied capital for the investment. If these obligations cannot be met, foreclosure may result, even though in the long term the investment might be profitable. Cash flow problems of this nature are typical in the first stages of a project when production is lowest and expenses are usually at their highest.

## Investment analysis tools

There are several tools useful in analyzing the profitability of any investment. First, payback period (PP) calculates the number of years to recapture the initial investment in a project. Equation 1 shows how PP is calculated if the net annual cash receipts are equal.

$$PP = \frac{\text{Initial investment outlay}}{\text{Annual net cash receipt}}$$

Figure 1. How the payback period (PP) is calculated if the net annual cash receipts are equal.

If the net annual cash receipts are expected to fluctuate year-by-year, PP is calculated by summing the net annual cash receipts until the initial investment outlay is covered. Payback period is an important consideration with many investors, and widely used in agriculture; however, it has serious limitations. First, it does not consider the time value of money or the timing of cash flows. Therefore, PP provides no information on long term investment value between the proposed investment and other investment alternatives. Furthermore, looking at PP alone can often result in incorrect decisions because PP does not consider the profit beyond the PP. For example, one investment alternative may have a longer PP than a competing alternative, yet in the years exceeding its PP it may have several years of positive net cash receipts greatly in excess of alternative investments with shorter PPs. If the investment decision is made solely on PP, alternatives with shorter PPs would be chosen and long-run profit would be sacrificed.

A second method of analyzing the profitability of capital investments is simple rate of return (ROR). Equation 2 shows the general calculation for ROR.

$$ROR = \frac{\text{Estimated average annual return}}{\text{Initial investment outlay}}$$

Figure 3. The general calculation for rate of return (ROR).

Again, many investors are concerned with the ROR of a proposed investment. However, as with PP, ROR does not consider the time value of money or the timing of cash flows. It also does not consider the size of competing investments or their length. For example, would you rather have a return of 25% on \$1 for one year, or 15% return on \$1 million for ten years? The answer is obvious, and shows the limitation of relying only on ROR as a decision criteria for competing investments. A final consideration for ROR is exactly what number to use in the numerator. Firms commonly use estimated average annual net profit (after deducting depreciation). However, modified versions of ROR use a variety of measures of return in the numerator, depending on the purposes of the analysis. For example, we have chosen to use after-tax, net cash flow (estimated cash

income) as the numerator in analyzing the dairy investment. This method of calculating ROR indicates to the potential dairy investor the actual “in-pocket” ROR from the investment.

A third method of analyzing the profitability of capital investments is called the net present value (NPV) of the investment. This method has the advantage of considering the time value of money, differences in the timing of cash flows for competing investments, and differences in competing projects’ size and length of useful life. Equation 3 shows the general calculation for NPV.

$$\begin{aligned} NPV \text{ equals sum of } & \left[ \frac{\text{Each year's tax adjusted revenue}}{\text{Each year's discount factor}} \right] \\ \text{minus sum of } & \left[ \frac{\text{Each year's tax adjusted expenses}}{\text{Each year's discount factor}} \right] \\ \text{plus sum of } & \left[ \frac{\text{Each year's depreciation tax shield}}{\text{Each year's discount factor}} \right] \\ \text{minus dollar amount of} & \text{ initial investment} \end{aligned}$$

Figure 4. The general calculation for net present value (NPV).

As indicated in the NPV equation, this method considers revenues, expenses, tax savings gained through depreciation (depreciation tax shield), and cost of the initial investment. This net present value calculation reduces each competing investment to its value in terms of after-tax, present dollars. The values for NPV may be positive, negative, or equal zero. A negative NPV is telling you that the next best investment alternative, which earns returns at the selected discount rate, is a better investment, therefore, any investment alternative with a negative NPV represents a loss and should not be considered. If competing investments must be reduced to only one choice, the alternative with the highest positive NPV will maximize profit.

Although NPV is the most sound investment decision criterion, it also has its problems. The two primary problems are the selection of the length of planning horizon and of a legitimate interest rate (discount rate) to be used. The length of planning horizon for a dairy facility is typically 20 years. However, it may be considerably reduced if the entrepreneur considers external forces (e.g., technological change, government policy, market conditions) that increase the risk of the investment. A good rule of thumb for selecting the discount rate would be to use the expected rate of return of an investment alternative of relatively equal size and level of risk. Another problem with NPV, which it shares with all other investment analysis methods, is providing realistic estimates of revenues and expenses.



The value of any investment analysis is only as good as the estimates from which it is calculated.

A fourth method of analyzing the profitability of capital investments is called the internal rate of return (IRR) of the investment. This method has many of the same advantages as NPV; it considers the time value of money and differences in the timing of cash flows for competing investments. The IRR is defined as the discount rate the dairy investment would have to earn in order for its NPV to equal zero. Thus, if the IRR is greater than the discount rate used in the NPV calculation, the dairy investment is superior to the next best alternative investment. If the IRR is less than the discount rate used in the NPV calculation, the dairy investment is inferior to the next best alternative investment.

Finally, to determine the cash flow feasibility of the project we need to look at the magnitude of the periodic cash flows. The magnitude of these cash flows indicate the ability to meet periodic debt service and other cash operating expense obligations. Additionally, a breakeven analysis gives an indication of how large the primary revenue drivers (herd size, milk sold per cow, and milk price) must be in order to have a breakeven (i.e., zero) net cash flow. For example, a breakeven herd size of 1,350 cows indicates the required number of cows that must be milked at the selected milk sold per cow and milk price to produce a zero net cash flow for the year.

The magnitude of these breakeven points is particularly useful to the potential investor when a yearly net cash flow is negative. In this situation, the magnitude of the breakeven points gives the investor an indication if there is a chance to break even if production or market conditions were to change. For example, if the projected milk price was \$15.50/cwt and the breakeven milk price was \$15.75/cwt, there might be some justification for optimism on the investor's part that a breakeven cash flow for the year could be generated. A positive fluctuation of \$0.25 in the milk price is within the realm of possibility. However, if the breakeven milk price was \$19.50/cwt, the investor would have no optimism that an adjustment in milk price would produce a breakeven cash flow for that year.

As previously indicated, the accuracy of any capital budgeting process is highly dependent on the accuracy of the data used to formulate the budget. Therefore, the importance of sound, realistic estimates for capital expenditures, forecasted revenues and expenses, discount rate, length of planning horizon, and other input data cannot be overemphasized. All data used in this example analysis represent the best estimates of the authors at the time of publication.

However, these data should not be relied upon in an actual budgeting situation. Each budgeting situation demands collection of new data that best represents the time, place, and circumstances involved.

## Using spreadsheets as an analysis aid

Once you have collected all of the capital expenditure and estimated cash flow information, it is necessary to put it into a form so the capital budget analysis can be completed. Excellent tools for organizing and managing this information are microcomputer spreadsheet programs. For our example analysis of a 1,200 cow dairy, we have set up a spreadsheet. (The spreadsheet template is available in Microsoft Excel for Apple Macintosh computers and for IBM compatible computers (requires Microsoft Windows). This spreadsheet has four main areas that drive the calculations necessary to analyze the project:

1. Capital expenditures (Exhibit 1): This information is used directly in the analysis. When coupled with additional input data, it provides information necessary to calculate principal payments, interest payments, and depreciation. These are necessary to calculate estimated cash flows.
2. Input data (Exhibit 2): This area of the spreadsheet provides the information on revenue/expense drivers and financing necessary to calculate estimated cash flows. Information is also entered here that determines how the investment will be retired and how the retirement value will be determined.
3. Cash income statement (Exhibit 3): This area produces an estimated cash income statement for each year of the 20-year dairy investment. It is set up in a contribution margin format (i.e., variable and fixed cash expenses separated) so that a breakeven analysis can be performed for each year. In addition, each year can be expanded (see year 20) to show cash revenues and expenses per cow, per cwt, and a percentage analysis of cash revenues and expenses.
4. Investment analysis summary (Exhibit 4): This area gives a brief summary of the investment analysis. It provides measures of profitability, NPV, average ROR, and PP for the investment, and a summary of estimated net cash income (total and yearly). In addition, it shows the total equity and debt capital required for the investment and a breakeven analysis for herd size, milk sold per cow, and milk price. Actual milk sold per cow is also shown.

Secondary areas of the spreadsheet, not shown in this publication, show the amortization schedule for the original

investment and capital replacement; equipment and building depreciation schedule; cow depreciation and gain/loss schedule; and a NPV calculation table showing each year's discounted, after-tax revenues, expenses, and depreciation tax shield.

Exhibits 1 through 4 represent the results of an example analysis. First, data on capital expenditures was collected and entered into the appropriate areas of Exhibit 1. Second, based on actual operating information from four large Florida dairy farms (July 1991–June 1992), information on revenue/expense drivers and prices was entered into Exhibit 2. Third, interest rate information for financing the investment was entered into Exhibit 2 based on current market conditions. Additionally, term lengths of financing and depreciation information and investment retirement information was entered into Exhibit 2. After all of this information was entered into these two areas of the spreadsheet, the program automatically generated the cash income statement shown in Exhibit 3 (only years 1 to 5 and year 20 are shown) and the investment analysis summary shown in Exhibit 4.

The results of this analysis (Exhibit 4) indicate, given the conditions and assumptions of the input data (Exhibits 1 and 2), the dairy would be a sound investment from a profitability standpoint with a positive NPV of \$1,996,159, an IRR above the discount rate at 13.45%, and an “in-pocket” ROR of 6.71%.

However, the analysis also indicates the possibility of cash flow problems during the first 2 or 3 years, making the project's feasibility less certain. The primary reasons for low initial cash flows are the high principal and interest payments due to 93% of the initial investment being debt financed. The 80% debt financing of livestock and miscellaneous equipment, and their five year amortization, is the primary contributor to the problem. The principal and interest payments due to 93% breakeven analysis indicates there should be no problem in achieving a breakeven cash flow if herd size, milk production, and milk price reach projected levels. To decrease the chance of cash flow problems, the potential investor should seek longer term lengths for these loans and/or decrease the amounts financed. If more favorable terms were available for this portion of the financing, another analysis could be run by simply plugging the new data into the input area (Exhibit 2) and recalculating the spreadsheet.

## Dealing with risk

Obviously any financial investment has risk associated with it. A primary component of risk is the uncertainty associated with the magnitude of potential net returns. Fortunately, there are some techniques available to deal with this aspect of risk associated with the potential returns from the dairy investment. First, the uncertainty primarily arises from uncertainty about the accuracy and stability of the data involved in producing the capital expenditure budget and estimated cash flows. Therefore, the first step in analyzing uncertainty is to run a variety of “what-if” scenarios of the proposed investment using the spreadsheet model. By plugging a variety of values into the capital expenditure budget (Exhibit 1) and/or changing various values (e.g., milk sold per cow, interest rates, discount rate, etc.) in the inputs affecting cash flows and financing (Exhibit 2), the potential investor can discern the impacts on investment value (Exhibit 4).

At a minimum, the potential dairy investor, working with the design team, should formulate three scenarios: 1) best case, 2) worst case, and, 3) most likely case. For example, milk sold per cow is one of the most critical determinants of profitable dairying. Figure 1 shows the changes in NPV and ROR as milk sold per cow changes. This graph makes it clear that, given the assumptions of Exhibits 1 and 2, the investment is not feasible unless milk sold per cow exceeds 17,000 lbs/cow. Similar graphs could be made for changes in milk price, interest rates, percent of investment financed with debt, etc. In this way the investor could determine if acceptable NPV, ROR, etc. are possible over feasible ranges of various input variables (e.g., milk sold per cow or milk price, etc.).

A second method of dealing with uncertain returns is called simulation modeling. Simulation modeling allows the analyst to specify the probability distribution for one or all of the inputs to the spreadsheet model. For example, probability distributions for various aspects of capital expenditures (e.g., land, construction, or equipment costs) or cash flow inputs (e.g., milk sold per cow or milk price) could be specified. A probability distribution for an input simply describes the possible values an input may take and the likelihood of each value. A common probability distribution used in business decision making is the triangular distribution. To describe a triangular distribution for an input variable, one simply must provide the lowest, highest, and most likely value a variable might possibly take. For example, the high, low, and most likely milk price might be specified as \$16.60, \$13.60, and \$15.60/cwt.

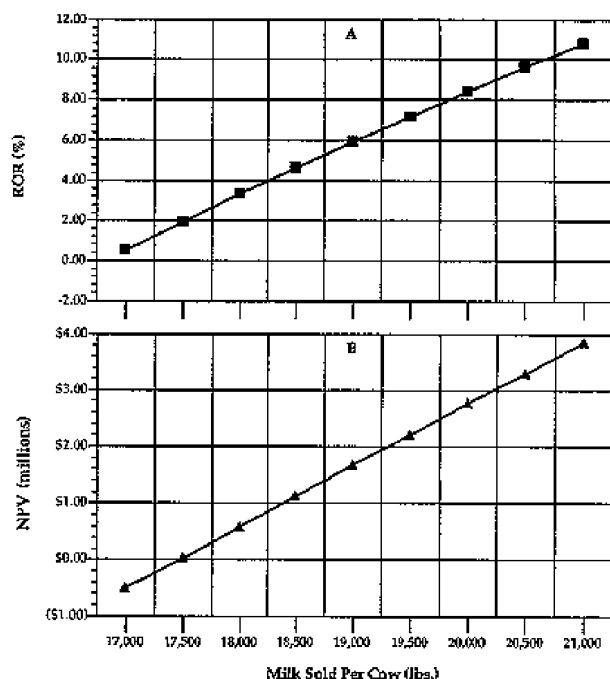


Figure 2. Changes in NPV and ROR as milk sold per cow changes. This graph makes it clear that, given the assumptions of Exhibits 1 and 2, the investment is not feasible unless milk sold per cow exceeds 17,000 lbs/cow.

Once the probability distributions of inputs are described, simulation modeling calculates the spreadsheet repeatedly. Each time the spreadsheet is calculated, a new value for each input, based on its specified probability distribution, is used. After numerous calculations, a range of output values can be generated for one or more selected measures of investment desirability (e.g., NPV, ROR, total net cash flow). This process allows the analyst to make probability statements about the output values (e.g., there is a 25% chance the NPV of the dairy investment will be below \$0).

Table 2, capital expenditures, shows the values (low, high, and most likely) for milk sold per cow, and milk price used in an example simulation of the spreadsheet model. All other input values were kept constant at those values shown in Exhibit 2. The computer simulation program used in this example is called @RISK™ (available from Palisade Corporation, 31 Decker Rd., Newfield, NY 14867). This program allows the user to specify the probability distribution for any input variable in the spreadsheet capital budget model and to forecast the value of any cell dependent upon the value of one or more input variables. The simulation was set to forecast total and yearly undiscounted after-tax, net cash flows, IRR, and NPV. Table 3 shows the results of the simulation analysis.

The minimum and maximum values in Table 3 indicate the range within which the analyst is 100% sure the actual value

will fall, given the assumptions of the particular simulation. For example, the actual NPV would never be expected to exceed \$3,338,858 or fall below (\$1,979,570). The mean value is simply the average value. The simulated average NPV was \$1,192,013, which is over \$800,000 lower than the NPV obtained from the non-simulated spreadsheet model of \$1,996,159. The far right column in Table 3 shows the percentage of simulated values for each measure that fell below zero. Thus, there is over a 13% chance that the NPV will be negative. The simulation also shows that, given the milk sold/cow and milk price assumptions, the cash flow situation may be much more serious than the non-simulated spreadsheet analysis indicated. The non-simulated spreadsheet indicated a cash flow in year 1 of \$15,715; however, the simulation analysis (Table 3) indicated that this cash flow could potentially go as low as (\$600,839) and that there is only about a 2.7% chance of it being positive. Furthermore, on average the cash flows for years 1 through 5 will all be negative.

The advantages of simulation modeling lie in its ability to handle a range of values for input data and the calculation of multiple values for the measures of investment value. For example, in the non-simulated spreadsheet analysis the results were predicated on the capital expenditures budget (\$4,905,910), milk sold per cow (19,300 lbs.), and milk price (\$15.60/cwt) being 100% accurate. Simulation allows more freedom in specifying these input values and provides additional information (e.g., range, percentiles, probabilities, etc.) on the measures of investment value (e.g., NPV, net cash flow, etc.). The addition of two uncertain inputs to this model indicates that the investment is much more risky than the original spreadsheet analysis would have suggested. In the end, this provides the decision maker with more information with which to make the difficult investment decision.

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Table 1. Revenue and expense categories and their associated drivers.

Item	Category explanation	Revenue/expense driver
<b>REVENUES</b>		
Milk	Gross revenue from milk sales	Herd size, milk sold per cow, milk price
Cull cows	Gross revenue from cull cow sales	Culling rate, average weight of culled cows, cull cow price
Calves	Gross revenue from selling all bull and heifer calves at approximately one week of age	Average weight of calves, average annual death loss, calf price
Silage	Gross revenue from selling surplus corn silage	Acres grown, yield per acre, average consumption, storage and feeding losses, silage market price
<b>EXPENSES</b>		
<b>Variable cash expenses</b>		
Purchased commodities	Cost of all feeds not produced on the dairy	Herd size, ration composition, commodity prices
Silage	Cost of all purchased corn silage	Acres grown, yield per acre, average consumption, storage and feeding losses, silage market price
Labor	Cost of compensating all labor, including office and management staff	Number of employees, average hours worked per week, wage rate
Utilities	Electricity costs	Milk production, cost per cwt of milk produced
Vet and medicine	Cost of veterinary care, drugs, medicines, biologicals, etc.	Herd size, cost per cow
Breeding	Cost of semen	Herd size, services per conception, semen cost per unit
DHIA	DHIA production testing	Herd size, testing options, cost per cow
Hauling	Hauling costs	Milk production, cost per cwt
Coop dues	Membership dues for milk marketing coop	Milk production, cost per cwt
Advertising	Assessment for dairy product advertising programs	Milk production, cost per cwt
CCC	Government milk assessment	Milk production, cost per cwt
Repairs	Repair costs for all facilities and equipment	Herd size, cost per cow
Crops	All variable crop production and harvesting costs (e.g., seed, fertilizer, fuel, etc.)	Acres grown, per ton production and harvesting costs; harvesting, storage and feeding loss rate
Overhead	Supplies (e.g. soaps & cleaners, office supplies, etc.), fuel, oil, etc.	Herd size, per cow application rate
<b>Fixed cash expenses</b>		
Principal payments	Principal payments for capital expenditures and capital replacement	Capital expenditures, capital replacement, interest rates, and financing terms
Interest payments	Interest payments for capital expenditures and capital replacement	Capital expenditures, capital replacement, interest rates, and financing terms
Overhead	Accounting and other professional fees, travel, postage, other misc. fixed costs	Herd size, per cow application rate
Insurance	Insurance on real estate, facilities, equipment, and cattle	Herd size, per cow cost
Property tax	Property tax assessed by local government	Herd size, per cow cost
<b>Fixed non-cash expenses</b>		
Depreciation <sup>1</sup>	Amortization of initial and replacement capital assets	Capital expenditures, capital replacement, depreciation method, expected useful life (EUL)
Loss (gain) on culled and dead cows <sup>2</sup>	Losses or gains due to differences in cow salvage revenue and cow book value	Replacement price, cull price, depreciation method, culling rate, death loss rate

<sup>1</sup>Depreciation is a non-cash expense but potentially affects cash income by reducing taxable income

<sup>2</sup>Loss on culled and dead cows is a non-cash expense but potentially affects cash income by reducing (losses) or increasing (gains) taxable income.

Table 2. Variable inputs for example simulation of capital budget model.

Variable	Low	High	Most Likely
Milk sold/ cow (lbs) <sup>1</sup>	18,000	20,000	19,300
Milk Price (per cwt)	\$13.60	\$16.60	\$15.60
Capital expenditures <sup>2</sup>	- 5%	+ 10%	No change

<sup>1</sup>A milk yield trend of + 1.00%/year was included in the model. This means milk sold/cow increased 1.00% each year (e.g., if year 1 = 19,300, year 2 = 19,493, year 3 = 19,688, etc.)

<sup>2</sup>Applies to each capital expenditure category in Exhibit 1. The most likely value equals the value listed for the category in Exhibit 1, the low value equals the listed value less 5%, the high value equals the listed value plus 10%.

Table 3. Results of example simulation of capital budget model.

Measure	Range(min to max)	Mean	Percent below zero
Total, undiscounted after-tax net cash flow	(\$ 3,953,952) to \$ 10,412,350	\$ 5,101,959	3.16 %
Undiscounted, after-tax net cash flow			
1	(\$ 600, 839) to \$ 225, 859	(\$ 109, 412)	73.14 %
5	(\$ 514, 311) to \$ 239, 969	(\$ 20, 725)	52.82 %
10	(\$ 107, 434) to \$ 580, 506	\$ 338, 996	0.68 %
20	\$ 5,162 to \$ 660, 980	\$ 398, 974	0.00 %
Internal rate of return	4.24 % to 16.20 %	11.62 %	0.00 % <sup>1</sup>
Net present value	(\$ 1, 979, 570) to \$ 3,338,858	\$ 1,192,013	13.38%

<sup>1</sup>Probability of an IRR less than the discount rate (9.00 %).

Table 4. Capital expenditure.

Quantity	Description	Units	Unit Cost	Total Estimated Cost
<b>I. REAL ESTATE COSTS</b>				
595	Land (crops)	per acre	\$ 1,400	\$ 833,00
85	Land (dry cows)	per acre	\$ 1,400	\$ 119,000
40	Land (dairy)	per acre	\$ 1,400	\$ 56,000
			<b>Sub-total</b>	<b>\$ 1,008,000</b>
<b>II. LIVESTOCK COSTS</b>				
1,200	Cows	per head	\$ 1,140	\$1,368,000
			<b>Sub-total</b>	<b>\$ 1,368,000</b>
<b>III. CONSTRUCTION COSTS</b>				
<b>A. Milking Barn (includes office)</b>				
10,240	Steel frame building (40' X 256') complete with parlor, pit, holding and wash pens	per sq ft	\$ 20.00	\$ 204,800
2,250	Pump & equipment room (45' X 50')	per sq ft	\$ 24.00	\$ 54,000
1,200	Office/employee and supply storage areas	per sq ft	\$ 19.00	\$ 22,800
			<b>Sub-total</b>	<b>\$ 281,600</b>
<b>B. Parlor Equipment</b>				
40	Stalls (Dbl. 20 Herringbone)	per stall	\$ 1,200	\$ 48,000
165	Cow wash system	per sprklr	\$ 70	\$ 11,550
1	Crowd gate	each	\$ 15,000	\$ 15,000
2	Flush valves	each	\$ 2,500	\$ 5,000
			<b>Sub-total</b>	<b>\$ 79,550</b>
<b>C. Milking Equipment</b>				
40	Claws, shells, pulsators, wash system	per stall	\$ 550	\$ 22,000
40	Automatic detachers	per stall	\$ 1,200	\$ 48,000
1	Balance tank, vacuum & pulsator lines	each	\$ 8,500	\$ 8,500
1	SS 3" milk line w/ fittings, 2 receivers, etc.	each	\$ 19,000	\$ 19,000
			<b>Sub-total</b>	<b>\$ 97,500</b>
<b>D. Milk Storage &amp; Equipment Rooms</b>				
2	6,000 gal milk tank	each	\$ 35,000	\$ 70,000
1	Two stage plate cooler w/chiller	each	\$ 20,000	\$ 20,000
6	Refrigeration compressors for milk tanks	each	\$ 3,250	\$ 19,500
1	CIP system and milkhous equipment	each	\$ 12,000	\$ 12,000
2	Vacuum system (25 hp pumps w/all equipment)	each	\$ 15,000	\$ 30,000
2	Heat recovery hot water heaters	each	\$ 2,100	\$ 4,200
2	100 gal. Hot water heaters	each	\$ 1,250	\$ 2,500
1	Compressed air systems	each	\$ 14,500	\$ 14,500
			<b>Sub-total</b>	<b>\$ 172,700</b>
<b>E. Water System</b>				
2	Wells w/pumps, pressure tanks	each	\$ 18,000	\$ 36,000
30,000	Water tanks (3) (parlor flush, wash floor)	gal.	0.50	\$ 15,000
1	20 hp jet wash pump (wash floor)	each	\$ 5,000	\$ 5,000
5,000	Water distribution system	per linear ft.	\$ 5.00	\$ 25,000
			<b>Sub-total</b>	<b>\$ 81,000</b>
<b>F. Electrical System</b>				
1	Main & parlor service entrance	each	\$ 20,000	\$ 20,000

Quantity	Description	Units	Unit Cost	Total Estimated Cost
1	150 kw standby generator	each	\$ 25,000	\$ 25,000
1	Waste lagoon, manure separator service	each	\$ 3,800	\$ 3,800
			<b>Sub-total</b>	<b>\$ 48,800</b>
<b>G. Housing System</b>				
1,200	Complete freestall system (includes building, stalls, electrical, flush system, water, concrete & grooving, gates, fans, sprinklers, cable fencing, lock-up stanchions, etc.)	per cow	\$ 625	\$ 750,000
			<b>Sub-total</b>	<b>\$ 750,000</b>
<b>H. Feeding System</b>				
2	Bunker silos (concrete floor, sides, apron)	each	\$ 27,000	\$ 54,000
10,000	Commodity shed	per sq ft	\$ 3.50	\$ 35,000
3,000	Machinery service/repair shop	per sq ft	\$ 8.00	\$ 24,000
4,500	Machinery shed	per sq ft	\$ 3.00	\$ 13,500
1	Scales	each	\$ 8,500	\$ 8,500
			<b>Sub-total</b>	<b>\$ 135,000</b>
<b>I. Site Development</b>				
10,000	Fencing gates	per linear ft.	\$ 2.00	\$ 20,000
85	Pasture improvement & water (dry cows)	per acre	\$ 60	\$ 5,100
1,087	Waste pond excavation & lining	per cubic yd.	\$ 110	\$ 119,570
40	Site leveling & shaping, roads	per acre	\$ 2,250	\$ 90,000
			<b>Sub-total</b>	<b>\$ 234,670</b>
<b>J. Waste Management</b>				
500	Concrete (apron, settling/sand trap basin)	per cubic yd.	\$ 110	\$ 55,000
1	Manure solids separator	each	\$ 22,500	\$ 22,500
1	20 hp pump (for separator)	each	\$ 7,500	\$ 7,500
1	40 hp lagoon pump	each	\$ 18,500	\$ 18,500
1	4 arch, towable center pivot irrigation system	each	\$ 27,500	\$ 27,500
1	Piping, valves	each	\$ 12,500	\$ 12,500
			<b>Sub-total</b>	<b>\$ 143,500</b>
<b>K. Maternity and Calving Area</b>				
12	Maternity barn (12 pens), springer lot	per pen	\$ 775	\$ 9,300
12	Calf hutches	per pen	\$ 300	\$ 3,600
			<b>Sub-total</b>	<b>\$ 12,900</b>
<b>IV. Miscellaneous Equipment Costs</b>				
1	Feed truck w/weigh mixer	each	\$ 70,000	\$ 70,000
1	Front end loader	each	\$ 55,000	\$ 55,000
1	Skid steer loader	each	\$ 15,000	\$ 15,000
2	Silage trucks (also haul manure solids)	each	\$ 17,500	\$ 35,000
1	Tools, shop equipment	each	\$ 7,500	\$ 7,500
1	Misc. equipment (e.g. nuts & bolts, spare parts)	each	\$ 4,000	\$ 4,000
2	Fuel tanks (gasoline, diesel) w/roof	each	\$ 3,500	\$ 7,000
1	Silage chopper	each	\$ 45,000	\$ 45,000
1	100+ hp tractor	each	\$ 27,500	\$ 27,500
1	85 hp tractor	each	\$ 18,500	\$ 18,500
1	Cultivating & planting equipment	each	\$ 25,000	\$ 25,000



Quantity	Description	Units	Unit Cost	Total Estimated Cost
1	Bush-hog/mower	each	\$ 2,000	\$ 2,000
1	Lawnmower	each	\$ 250	\$ 250
2	Weed-eater (heavy duty)	each	\$ 150	\$ 300
1	Gooseneck livestock trailer	each	\$ 8,500	\$ 8,500
1	4wd pick up truck	each	\$ 17,500	\$ 17,500
1	Herdsman's equipment (refrig., semen tank, etc.)	each	\$ 3,000	\$ 3,000
2	Computer system (w/battery backup)	each	\$ 4,000	\$ 8,000
1	Maternity & calf equipment (calf bottles, medicine, obs. chains, etc.)	each	\$ 750	\$ 750
			<b>Sub-total</b>	<b>\$ 349,800</b>
<b>V. SUMMARY PER COW TOTAL ESTIMATED COST</b>				
-	Total real estate costs	-	\$ 840	\$ 1,008,000
-	Total livestock costs	-	\$ 1,140	\$ 1,368,000
-	Total construction costs	-	\$ 1,698	\$ 2,037,220
-	Total misc. equipment costs	-	\$ 292	\$ 349,800
-	Consulting, legal & administrative fees	1.50 %	\$ 60	\$ 71,445
-	Contingency allowance	1.50 %	\$ 60	\$ 71,445
-	<b>Grand Total</b>		<b>\$ 4,088</b>	<b>\$ 4,905,910</b>

Table 5. Input Data.

OPERATING INFORMATION		OK <sup>1</sup>	1,200
Herd size			
<b>REVENUES</b>			
Milk	Milk sold/cow (lbs)		19,300
	Milk price (per cwt)		\$ 15.60
	Milk sold/cow trend?		yes
	Trend value (% milk sold per cow, per year)		1.00 %
Cull cows	Culling rate (per year)		33 %
	Average cull cow weight (lbs)		1,350
	Cull cow price (per lb)		\$ 0.40
	Annual death loss		1.00 %
Calves	Annual death loss		5.00 %
	Average bull calf weight (per lb)		75
	Bull calf price (per lb)		\$ 0.65
	Average heifer calf weight (lbs)		65
	Heifer calf price (per lb)		\$ 1.60
<b>VARIABLE EXPENSES</b>			
<b>MAJOR</b>			
Purchased commodities	Average cost (per cow/day) <sup>2</sup>		\$ 3.20
Silage	Market price (per ton, ass-fed)		\$ 25.00
	Average silage consumption (lbs/cow per day, as-fed)		60.00
Replacements	Replacement cost (per head)		\$ 1,140
Labor	Number of employees		22
	Average hours worked/week		45
	Wage rate (per hour)		\$ 10.30
Utilities	Utilities (per cwt/year)		\$ 0.41
<b>LIVESTOCK</b>			
Vet & Medicine	Vet & Medicine expense (per cow/month)		\$ 3.65
Breeding	Services per conception		3.20
	Average semen cost (per unit)		\$ 6.00
DHIA	DHIA (per cow/month)		\$ 1.06
<b>MILK MARKETING</b>			
	Milk hauling rate (per cwt)		\$ 0.57
	Coop dues (per cwt)		\$ 0.17
	Advertising (per cwt)		\$ 0.15
	CCC (per cwt)		\$ 0.05
<b>FACILITIES/EQUIPMENT</b>			
	Facility repair (per cow/month)		\$ 7.61
<b>MISCELLANEOUS</b>			
Crops	Variable silage production (per acre/year)		\$ 249.63
	Variable silage harvesting (per acre/year)		\$ 35.76
	Silage yield (tons per acre, as-fed)		24.00
	Silage storage and feeding losses (% , as-fed basis)		8.00 %
Overhead	Variable overhead rate (per cow/month)		\$ 3.33

OPERATING INFORMATION			
Herd size		OK <sup>1</sup>	1,200
FIXED EXPENSES			
OTHER	Insurance (per cow/month)		\$ 2.05
	Property tax (per cow/month)		\$ 1.10
	Fixed overhead rate (per cow/month)		\$ 1.96
FINANCING INFORMATION			
% DEBT FINANCED			
Capital replacement	Real estate		100 %
	Livestock		80 %
	Construction <sup>3</sup>		100 %
	Misc. equipment		80 %
	Parlor equipment		100 %
	Milking equipment		100 %
	Milk storage & eqpmt. room		100 %
	Water system		100 %
	Housing system		100 %
	Feeding system		100 %
	Waste mgmt. system		100 %
	Misc. equipment		100 %
TERMS & INTEREST RATES		Terms (yrs.)	Rate
Capital replacement	Real estate (1-20)	20	8.50 %
	Livestock (1-20)	5	9.00 %
	Construction (1-20)	20	8.50 %
	Misc. equipment (1-20)	5	9.00 %
	Parlor equipment (1-10)	10	9.00 %
	Milking equipment (1-5)	5	9.00 %
	Milk storage & eqpmt. Room (1-10)	10	9.00 %
	Water system (1-10)	10	9.00 %
	Housing system (1-10)	10	9.00 %
	Feeding system (1-10)	10	9.00 %
	Waste mgmt. system (1-10)	10	9.00 %
	Misc. equipment (1-5)	5	9.00 %
Capital replacement		Replaced at end of year	% of Initial investment replaced
Capital replacement	Parlor equipment	10	50 %
	Milking equipment	5, 10, 15	50 %
	Milk storage & eqpmt. room	10	50 %
	Water system	10	15 %
	Housing system	10	15 %
	Feeding system	10	15 %
	Waste mgmt. system	10	15 %
	Misc. equipment	5,10,15	50 %

OPERATING INFORMATION			
Herd size		OK <sup>1</sup>	1,200
<b>Depreciation<sup>4</sup></b>		<b>SLN (yes) or SYD (no) ?<sup>5</sup></b>	<b>EUL<sup>6</sup> (years)</b>
	Livestock(3)	no	3
	Parlor eqpmt.(10)	no	10
	Milking eqpmt.(5)	no	5
	Milking storage & eqpmt. room(10)	no	10
	Misc. equipment (3 or 5)	no	3
	Physical plant <sup>7</sup> (15 or 20)	no	15
	Capital replacement <sup>8</sup>	no	NA
<b>Other</b>			
	Discount rate		9.00 %
	Income tax rate		34.00 %
<b>INVESTMENT RETIREMENT</b>		<b>Retirement Option</b>	<b>Total Retirement value<sup>9</sup></b>
Real Estate	Does real estate have a retirement value (yes or no)?	yes	
	Did real estate appreciate (yes or no)?	yes	
	Percent appreciation	25 %	\$ 1,260,000
Livestock	Does livestock have a retirement value (yes or no)?	yes	
	Enter retirement value (\$/cow)	\$ 1,200	\$ 1,425,600
Fixed Assets <sup>10</sup>	Do fixed assets have a retirement value (yes or no)?	yes	
	Fair market value equals X % of original investment?	25 %	\$ 596,755
<p>Notes:</p> <p><sup>1</sup>This message tells user if herd size in capital expenditures (Exhibit 1) matches (OK) herd size in cash income calculations (Exhibit 3).</p> <p><sup>2</sup>Enter average cost per day necessary to produce initial milk sold per cow. If milk yield trend is selected, this component of feed cost is automatically increased to meet increased milk production.</p> <p><sup>3</sup>Consulting, legal &amp; administrative fees and contingency allowance are amortized as a construction cost.</p> <p><sup>4</sup>Enter "yes" for straight-line depreciation, enter "no" for sum-of-the-year's-digits-depreciation.</p> <p><sup>5</sup>SLN=straight line depreciation, SYD=sum-of-the-years'-digits depreciation.</p> <p><sup>6</sup>EUL=expected useful life.</p> <p><sup>7</sup>Physical plant=milking barn, water, electrical, housing, feeding system, and waste management system; site development; maternity area; consulting, legal, administrative fees; contingency allowance.</p> <p><sup>8</sup>Capital replacement does not include replace misc. eqpmt. Misc. eqpmt. that is replaced is depreciated separately.</p> <p><sup>9</sup>Retirement values are undiscounted and before tax. Retirement values are adjusted for capital gains/losses, taxes and time value of money in IRR and NPV calculations in Exhibit 4.</p> <p><sup>10</sup> Fixed assets includes all buildings and equipment.</p>			



Table 6. Cash income statement

[illegible]

Year	1	2	3	4	5	20	per cow	per cwt	% of Revenue	% of Category
Overhead	\$ 28,224	\$ 28,224	\$ 28,224	\$ 28,224	\$ 28,224	\$ 28,224	\$24	0.10	0.61	5.50
Insurance	\$ 29,520	\$ 29,520	\$ 29,520	\$ 29,520	\$ 29,520	\$ 29,520	\$25	0.11	0.63	5.75
Property tax	\$ 15,840	\$ 15,840	\$ 15,840	\$ 15,840	\$ 15,840	\$ 15,840	\$13	0.06	0.34	3.08
<b>Total Fixed Cash Expenses</b>	<b>\$ 763,781</b>	<b>\$ 763,781</b>	<b>\$ 763,781</b>	<b>\$ 763,781</b>	<b>\$ 763,781</b>	<b>\$ 513,559</b>	<b>\$ 428</b>	<b>\$ 1.84</b>	<b>11.02</b>	<b>100.00</b>
<b>Total Cash Expenses</b>	<b>\$ 4,064,616</b>	<b>\$ 4,073,668</b>	<b>\$ 4,082,831</b>	<b>\$ 4,092,108</b>	<b>\$ 4,101,498</b>	<b>\$ 4,006,481</b>	<b>\$ 3,339</b>	<b>\$ 14.32</b>	<b>85.99</b>	
Cash income, before taxes	(\$ 157,229)	(\$ 130,151)	(\$ 102,825)	(\$ 75,240)	(\$ 47,408)	\$ 652,796	\$ 544	\$ 2.33	14.01	
<b>FIXED NON-CASH EXPENSES</b>										
<b>Depreciation Expenses</b>										
Livestock	\$ 360,000	\$ 280,800	\$ 228,500	\$ 194,000	\$ 194,000	\$ 194,000	\$ 162	\$ 0.69	4.16	74.63
Construction	\$ 307,159	\$ 280,819	\$ 254,480	\$ 228,141	\$ 201,801	\$ 0	\$ 0	0.00	0.00	0.00
Equipment	\$ 174,900	\$ 116,600	\$ 58,300	\$ 0	\$ 0	\$ 0	\$ 0	0.00	0.00	0.00
Capital Replacement	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 8,569	\$ 7	0.03	0.18	3.30
<b>Other</b>										
Loss (gain) on culled & dead cows	\$ 128,880	\$ 75,080	\$ 57,380	\$ 57,380	\$ 57,380	\$ 57,380	\$ 48	0.21	1.23	22.07
<b>Total fixed non-cash expenses</b>	<b>\$ 970,939</b>	<b>\$ 753,299</b>	<b>\$ 598,660</b>	<b>\$ 479,521</b>	<b>\$ 453,181</b>	<b>\$ 259,949</b>	<b>\$ 217</b>	<b>\$ 0.93</b>	<b>5.58</b>	<b>100.00</b>
<b>TAXABLE INCOME</b>	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 797,917	\$ 665	\$ 2.85	17.13	
Income tax	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 271,292	\$ 226	\$ 0.97	5.82	
<b>NET CASH INCOME</b>	<b>(\$ 157,229)</b>	<b>(\$ 130,151)</b>	<b>(\$ 102,825)</b>	<b>(\$ 75,240)</b>	<b>(\$ 47,408)</b>	<b>\$ 381,504</b>	<b>\$ 318</b>	<b>\$ 1.36</b>	<b>8.19</b>	
<b>BREAK-EVEN ANALYSIS</b>										
Herd size	1,511	1,446	1,387	1,331	1,279	807				
Milk sold/cow (lbs)	20,140	20,188	20,237	20,287	20,337	21,279				
Milk price (per cwt)	\$ 16.28	\$ 16.16	\$ 16.04	\$ 16.01	\$ 15.80	\$ 14.24				

Table 7. Investment analysis summary.

1.Total, after-tax, net cash income			\$ 7,157,454		2. Average ROR <sup>1</sup> : 6.71 %				
3. Sources of initial invested capital					%				
Debt		\$ 4,562,350		93					
Equity		\$ 343,560		7					
4. Yearly, after-tax, net cash income					5. Breakeven analysis <sup>2</sup>				
					<u>Herd size</u>	<u>Milk/cow</u>	<u>Milk Price</u>	<u>Actual Milk Sold/Cow</u>	<u>Actual Milk Price</u>
Year 1		\$ 15,715		1,176	19,216	\$ 15.53	19,300	\$ 15.60	
Year 2		\$ 42,793		1,136	19,264	\$ 15.42	19,493	\$ 15.60	
Year 3		\$ 70,119		1,099	19,313	\$ 15.30	19,688	\$ 15.60	
Year 4		\$ 97,704		1,064	19,363	\$ 15.19	19,885	\$ 15.60	
Year 5		\$ 95,678		1,071	19,573	\$ 15.20	20,084	\$ 15.60	
Year 6		\$ 430,797		637	17,983	\$ 13.83	20,285	\$ 15.60	
Year 7		\$ 427,782		657	18,202	\$ 13.86	20,487	\$ 15.60	
Year 8		\$ 424,554		677	18,424	\$ 13.89	20,692	\$ 15.60	
Year 9		\$ 420,945		697	18,650	\$ 13.92	20,899	\$ 15.60	
Year 10		\$ 427,199		703	18,826	\$ 13.91	21,108	\$ 15.60	
Year 11		\$ 456,739		684	18,879	\$ 13.81	21,319	\$ 15.60	
Year 12		\$ 452,287		703	19,116	\$ 13.85	21,532	\$ 15.60	
Year 13		\$ 447,498		721	19,357	\$ 13.89	21,748	\$ 15.60	
Year 14		\$ 442,326		739	19,602	\$ 13.92	21,965	\$ 15.60	
Year 15		\$ 446,633		747	19,799	\$ 13.92	22,185	\$ 15.60	
Year 16		\$ 492,555		713	19,775	\$ 13.77	22,407	\$ 15.60	
Year 17		\$ 491,731		726	20,004	\$ 13.79	22,631	\$ 15.60	
Year 18		\$ 490,363		739	20,238	\$ 13.81	22,857	\$ 15.60	
Year 19		\$ 488,388		752	20,477	\$ 13.84	23,086	\$ 15.60	
Year 20		\$ 495,647		756	20,669	\$ 13.83	23,317	\$ 15.60	
6. Payback period (PP) <sup>3</sup>		6.50							
7. Internal rate of return (IRR) <sup>4</sup>		13.45 %							
8. Net present value (NPV) <sup>4</sup>		\$ 1,996,159							
Notes:									
<sup>1</sup> Average ROR bases rate of return on average, undiscounted, after-tax, net cash flow. Investment outlay equals total initial investment plus the present value of all replaced capital.									
<sup>2</sup> Break-even points based on inputs required to produce a net cash income of \$ 0. If break-even herd size gives the message “NO B.E. PT.!”; there is no break-even point due to a negative contribution margin per cow.									
<sup>3</sup> Payback period calculated to nearest half year. Annual cash receipt for PP adjusted for income taxes but not for principal or interest payments. Investment value for PP includes only the total initial investment, no capital replacement is considered. If cell contains the message “NO PP!”, the PP is not reached by the end of year 20.									
<sup>4</sup> IRR and NPV are after-tax. In both calculations investment outlay equals total investment plus the present value of all replaced capital. Retirement values (adjusted for capital gains and income taxes) for real estate, livestock, and fixed assets are included if the investment retirement options are selected in Exhibit 2.									