Department of Agricultural and Applied Economics
College of Agricultural & Environmental Sciences
UNIVERSITY OF GEORGIA

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Cost of Center Pivot Irrigation

Ownership and Operating Costs through Irrigation Budgets for South Georgia

Aadesh Subedi[1], Yangxuan Liu[1], Robert Aaron Hrozencik[1],

Lusi Xie[1], Guy Hancock[1], Wesley Porter[2], and David Hall[3]

[1]Department of Agricultural & Applied Economics, University of Georgia

[2]Department of Crop and Soil Sciences, University of Georgia

[3]Southwest District Extension, University of Georgia

Disclaimer

The irrigation budgets, developed by the University of Georgia (UGA) Extension, are estimates of the costs of operating a center-pivot irrigation system in Southeast Georgia. Our intention is to provide flexible and user-friendly irrigation budgets with default values. Variations in farm conditions and operations affect investment and annual irrigation costs. Users are suggested to modify these default values and customize the irrigation budgets as per their specific field conditions. Please consult your irrigation providers for properly designed center pivot systems that match the well production to achieve your irrigation goal. This document serves as a user guide for the irrigation budgets, which illustrates how these budgets were developed and provides guidance for producers to modify the default values in the budgets.

Overview

Irrigation is widely adopted for managing production risk in crop production. Though there is a likelihood of increased yield, there are additional costs associated with owning and operating an irrigation system. Irrigation budgets developed by the University of Georgia (UGA) Extension help producers to estimate total investment costs, annual ownership costs, and annual operating costs for a center-pivot irrigation system.

These irrigation budgets are developed using the number of center pivot towers as a proxy for system size and irrigation acreage. Four irrigation budgets are created in Microsoft Excel to represent two center pivot configurations (five-tower and eight-tower systems) and two power sources (electric and diesel). The resulting budgets include 1) five-tower electric, 2) five-tower diesel, 3) eight-tower electric, and 4) eight-tower diesel center pivot irrigation budgets. The diesel-powered center pivot has a gear head system, while the electric-powered center pivot has a power unit. These irrigation budgets are designed to be flexible and can be applied to a wide range of cropping systems in Georgia. Users can modify the default input values to reflect the specific production conditions of their farm. The budgets are available to download at the UGA Department of Agricultural and Applied Economics Extension Budgets website (https://agecon.uga.edu/extension/budgets.html).

Inputs Needed to Tailor the Budget to Your Farm

The budget contains several default values as shown in Table 1, including the number of acres covered by the pivot (acreage covered), the amount of water applied per irrigation (average application rate), the pump flow rate (flow rate in gallons per minute), and the time required for the pivot to complete one full rotation (average time for full coverage). Users can modify these values and enter farm-specific information to estimate their own irrigation costs. The average application rate of 0.5 acre-inches per irrigation event is assumed in the budget calculations. Users

may modify this assumption as needed to better represent their irrigation management practices and field conditions.

The average time required for full field coverage is based on average application rate, acres covered, and flow rate, and is calculated using the formula:

Average Time for Full Coverage (hours) = (Acres Covered × Average Application Rate (inches) × (27,154)[1] / (60 × Flow Rate (GPM))

Irrigation costs also vary depending on whether soil moisture sensors are used. Users can specify whether soil moisture sensors are included by selecting the appropriate option from the drop-down menu. The budget will then account for the capital and operating costs associated with the sensor system.

Acreage Covered	160	Acres
Average Application Rate	0.5	Inches
Annual Acre Inch Applied	10	Inches
Flow Rate in Gallons Per Minute (GPM)	577	GPM
Average Time for Full Coverage	63	Hours
Soil Moisture Sensors	No	

Table 1. *Breakdown of the basic information inside the irrigation budget in an eight-tower center pivot irrigation system.[2]*

Components of the Irrigation Budget

Investment costs

Investment costs depend primarily on the number of towers and the power source used as shown in Tables 2 and 3. Major cost components include the pivot structure, pipe and fittings, power unit, well, pump, and power connection. If the soil moisture sensors drop-down option is selected as “Yes”, the cost of soil moisture monitoring equipment is added to the total investment.

The values for useful life, salvage value, quantity, and unit cost can be adjusted to reflect individual farm conditions. Salvage value represents the expected resale value of the equipment at the end of its useful life, while useful life refers to the number of years the equipment is expected to remain in operation before replacement. For the purposes of this budget, all salvage values are assumed to be zero.

[1] 27,154 is the number of gallons in one acre-inch of water.
[2] The shaded cells contain default values, which users can modify to reflect their own farm or system conditions.

Item	Useful Life (years)	Salvage Value	Quantity	Cost/Unit	Investment Cost	Cost Per Acre
Pipe and fittings (feet)	20	$0	500	$10.00	$5,000.00	$76.92
Pivot system (towers)	20	$0	1	$80,000.00	$80,000.00	$1,230.77
Pump	15	$0	1	$84,944.00	$84,944.00	$1,306.83
Power unit	15	$0	1	$18,000.00	$18,000.00	$276.92
Power connection	15	$0	1	$1,000.00	$1,000.00	$15.38
Well	20	$0	1	$104,650.00	$104,650.00	$1,610.00
Total Investment Costs					**$293,594.00**	**$4,516.83**

Table 2. *Breakdown of investment costs in the five-tower electric-powered center pivot irrigation budget.*

Item	Useful Life (years)	Salvage Value	Quantity	Cost/Unit	Investment Cost	Cost Per Acre
Pipe and Fittings (Feet)	20	$0	500	$10.00	$5,000.00	$31.25
Pivot System (Towers)	20	$0	1	$130,000.00	$130,000.00	$812.50
Pump	15	$0	1	$84,944.00	$84,944.00	$530.90
Fuel Tank	15	$0	1	$3,500.00	$3,500.00	$21.88
Gearhead System	15	$0	1	$69,000.00	$69,000.00	$431.25
Well	20	$0	1	$104,650.00	$104,650.00	$654.06
Total Investment Costs					**$397,094.00**	**$2,481.84**

Table 3. *Breakdown of investment costs in the eight-tower diesel-powered center pivot irrigation budget.*

Pipe and fittings and Pivot System

The budget assumes that the center pivot system is not located directly above the well, so pipe and fittings are required to transport water from the well to the pivot.

The center pivot system (Figure 1) itself consists of several major components: a central tower housing the pivot mechanism and main control panel; a long irrigation pipeline attached to the central tower and equipped with sprinklers and spray nozzles for water application; drive towers mounted on wheels that move the system across the field, with spans supported by steel trusses or cables carrying the pipeline; and an end gun sprinkler at the outer end of the pipeline to extend the irrigated area. Together, these components allow the system to distribute water efficiently across the field.

Figure 1*: A center pivot system irrigating a field in South Georgia. (Photo credit: David Hall)*

The cost of a center pivot irrigation system is closely related to its total length and the number of towers. The center pivots can range from single-tower units covering only a few acres to multiple towers irrigating several hundred acres (Evans & Sneed, 1996). As the number of towers increases, the length of the system, irrigated area, and equipment costs also go up. The irrigation budgets are developed for two center pivot system sizes: a five-tower system and an eight-tower system. The default irrigated acreage is assumed to be 65 acres for the five-tower system and 160 acres for the eight-tower system. These acreage assumptions can be modified as needed to reflect individual field and system characteristics.

Pumps

Two types of pumps are commonly used in agricultural irrigation systems: turbine pumps (Figure 2A) and submersible pumps (Figure 2B). For the irrigation budgets, a submersible pump is assumed as the default pumping system.

Turbine Pump: The motor is located above the ground, while the pump is installed below the water level. Turbine pumps typically require larger-diameter wells and are generally used in systems with pumping capacities of 800 gallons per minute (gpm) or greater.

Submersible Pump: Both the motor and pump are installed below the water level. Submersible pumps can operate in smaller-diameter wells and are commonly used in systems with pumping capacities of 600 gpm or less.

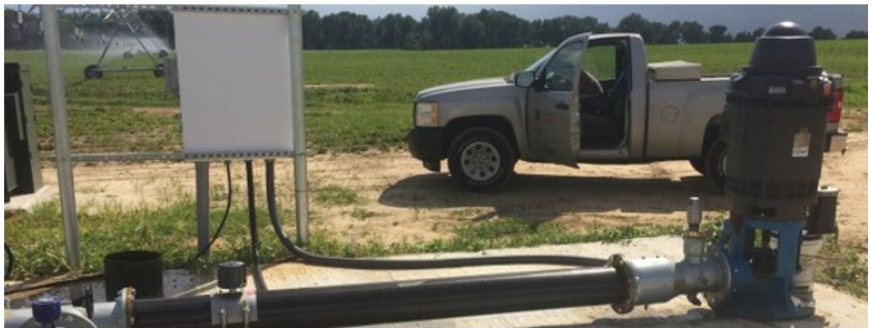

Figure 2A: Turbine pump system for agricultural irrigation. Photo Credit: David Hall.

Figure 2B: Submersible pump installation for agricultural irrigation. Photo Credit: David Hall.

Power Connection

Power connection costs depend on the distance from the nearest power source to the field and whether a phase converter is needed. If three-phase power is already available near the field, the connection cost is calculated by multiplying the cost per foot of line installation by the distance from the existing power source to the point where the electrical line goes underground to the irrigation pivot or well. If three-phase power is not available, the total connection cost includes both the cost of extending the power line to the site and the cost of installing a phase converter. These costs vary widely by location and power company, so producers should adjust them according to their specific situation.

Well

The cost of a well is primarily determined by its depth and diameter. In southern Georgia, irrigation water is mainly pumped from two major aquifers: the Floridan Aquifer and the Claiborne Aquifer. The Floridan Aquifer is generally shallower and is the most used groundwater source for agricultural irrigation.

This budget assumes a well that is 12 inches in diameter and 500 feet deep, with casing installed to a depth of 300 feet. It is also assumed that a single well supplies water to a single center pivot system.

Power Unit and Gearhead System

The power unit on an electric center pivot, or the gearhead assembly and engine on a diesel-powered pivot, supplies the mechanical power needed to operate the irrigation pump. The pump uses this power to lift water from the well and generate the pressure needed for distribution through the center pivot system. The irrigation budgets account for the costs of these components according to the power source.

Fuel Tank

A fuel tank is required to store diesel fuel for diesel-powered center pivot systems. Most producers use a 500-gallon tank to meet their seasonal fuel needs. Therefore, the irrigation budget assumes a 500-gallon tank as the default fuel storage capacity for the diesel-powered irrigation budgets. Users may adjust this assumption if a different tank size is used.

Soil Moisture Sensor

Soil moisture sensors (Figure 3 and Figure 4) continuously measure soil water content and transmit the data to a base station for processing. The resulting volumetric water content information can be used to improve irrigation scheduling and optimize water application. Two types of soil moisture sensors are commonly used in agricultural irrigation systems: tensiometric sensors and capacitance sensors.

Tensiometric Sensors: These sensors measure soil water potential (soil moisture tension), which reflects how strongly water is held in the soil. Tensiometric sensors generally require more time to stabilize and provide readings.

Capacitance Sensors: These sensors use probes to measure changes in the dielectric properties of the soil, which are directly related to volumetric water content. Capacitance sensors typically provide faster and more precise soil moisture measurements than tensiometric sensors.

Although capacitance sensors generally have higher initial costs, they offer real-time monitoring and improved irrigation management capabilities. The irrigation budget developed here assumes the use of a capacitance-based soil moisture sensor system that does not require a separate base

station. As a general guideline, a minimum of one soil moisture sensor is assumed for each irrigation budget.

Figure 3: Soil moisture sensor types used in SMS Plus irrigation scheduling: tensiometric sensors (top row) and capacitance sensors (bottom row).

Figure 4. CropX sensor in cotton (left) and Realm sensor in soybean (right). Photo credit: David Hall.

Ownership costs

Ownership costs are the fixed costs associated with owning an irrigation system, regardless of the level of system use. As shown in Tables 5 and 6, these costs include depreciation, intermediate interest on the original investment, and property tax and insurance on all the equipment and parts

used in the original investment. For electric-powered systems, the electricity service charge is also included as an ownership cost.

Ownership Costs					
	Depreciation	**Intermediate Interest (7.50%)**	**Tax & Insurance (2.50%)**	**Ownership Costs**	**Ownership Costs Per Acre**
Pipe and Fittings	$250.00	$187.50	$62.50	$500.00	$7.69
Pivot System	$4,000.00	$3,000.00	$1,000.00	$8,000.00	$123.08
Pump	$5,662.93	$3,185.40	$1,061.80	$9,910.13	$152.46
Power Unit	$1,200.00	$675.00	$225.00	$2,100.00	$32.31
Power Connection	$66.67	$37.50	$12.50	$116.67	$1.79
Well	$5,232.50	$3,924.38	$1,308.13	$10,465.00	$161.00
Electricity Service Charge				$410.00	$6.31
Total Ownership Costs				**$31,501.80**	**$484.64**

Table 4: *Breakdown of annual ownership costs in the Five-Tower Electric Powered Center Pivot Irrigation Budget.*

Ownership Costs					
	Depreciation	**Intermediate Interest (7.50%)**	**Tax & Insurance (2.50%)**	**Ownership Costs**	**Ownership Costs Per Acre**
Pipe and Fittings	$250.00	$187.50	$62.50	$500.00	$3.13
Pivot System	$6,500.00	$4,875.00	$1,625.00	$13,000.00	$81.25
Pump	$5,662.93	$3,185.40	$1,061.80	$9,910.13	$61.94
Fuel Tank	$233.33	$131.25	$43.75	$408.33	$2.55
Gearhead System	$4,600.00	$2,587.50	$862.50	$8,050.00	$50.31
Well	$5,232.50	$3,924.38	$1,308.13	$10,465.00	$65.41
Total Ownership Costs				**$42,333.47**	**$264.58**

Table 5: *Breakdown of annual ownership costs in the Eight-Tower Diesel-Powered Center Pivot Irrigation Budget.*

Depreciation

It is the annual cost that reflects the reduction in an asset's value due to use, wear and tear, and aging. Although it does not involve a cash payment, it represents the real cost of owning and operating equipment. Depreciation spreads the initial investment cost of an asset over its expected useful life. The annual depreciation depends on the investment cost, salvage value, and useful life of the equipment, and can be calculated as:

$$Depreciation = \frac{investment\ cost - salvage\ value}{useful\ life}$$

Intermediate Interest

This cost represents the opportunity cost of capital invested in the irrigation system. In other words, it is the return that could have been earned if the funds invested in the equipment had been invested elsewhere. Because the value of the equipment declines over time, interest is calculated on the average value of the investment over its useful life. The average value is calculated by taking the average of the investment cost and the salvage value. In this budget, the intermediate interest rate is assumed to be 7.5 percent. Annual intermediate interest is then calculated as:

$$Intermediate\ interest = (investment\ cost + salvage\ value) / 2 \times interest\ rate$$

Tax and Insurance

Producers are required to pay property taxes and insurance on irrigation equipment. In this budget, the rate for property taxes and insurance is assumed to be 2.5%. Users can adjust the intermediate interest rate and the rate for property taxes and insurance to reflect their own costs. The annual property tax and insurance cost is calculated as:

$$Tax\ \&\ insurance = (investment\ cost + salvage\ value) / 2 \times tax\ \&\ insurance\ rate$$

Electricity Service Charge

The electricity service charge is the minimum fixed cost that customers pay to an electric provider to maintain access to electricity, regardless of their actual electricity usage. For the electric powered irrigation systems, the service charge is estimated in these budgets using a weighted average cost of Electric Membership Corporations (EMCs) across Georgia to provide a baseline estimate. The weights are based on the irrigated service area of each EMC, with providers serving larger irrigated acreages receiving greater weight in the calculation. Because electricity service charges vary among providers, users may adjust this value to reflect the specific rates charged by their local EMC to better represent their individual circumstances.

Operating costs

Operating costs are the variable costs that change with the amount of water use. As shown in Table 6 and Table 7, these costs include fuel or electricity costs, repairs and maintenance costs, and labor and management costs.

Operating Costs						
				Operating Costs	**Operating Costs Per Acre**	**Operating Costs Per Acre Inch**
Repairs and Maintenance				$2,188.88	$33.68	$3.37
	Horsepower	**Power Use**	**Cost Per kWh**			
Pump (Electricity)	60	0.746	$0.13	$2,992.21	$46.03	$4.60
		Hours	**Cost Per Hour**			
Labor		0.28	$14.47	$41.00	$0.63	$0.06
Management		10.00	$46.75	$467.50	$7.19	$0.72
Total Operating Costs				**$5,689.58**	**$87.53**	**$8.75**

Table 6: *Breakdown of annual operating costs in the Five-Tower Electric Center Pivot.*

Energy costs

A center pivot irrigation system uses a power unit to run the pump and move the pivot. The power unit uses fuel or electricity as the source of energy. The cost of the energy depends upon several factors such as the size of the pump and motors, fuel or electricity prices, duration for which the system runs, application rate, and the number of times irrigation is applied. The cost of energy can be calculated using the following formula:

$$Fuel\ Cost = 0.044 \times HP \times Fuel\ Price \times \left(\frac{Annual\ Water\ Applied\ (acre-inches)}{Application\ Rate\ (inches\ per\ irrigation)}\right) \times Time\ for\ Full\ Coverage$$

where:

0.044 = gallons of fuel used per horsepower per hour (0.746 for electric-powered pivot)

HP = total horsepower of the pump and motors

Fuel price = price of diesel (price of electricity for electric-powered pivot)

Operating Costs						
				Operating Costs	**Operating Costs Per Acre**	**Operating Costs Per Acre Inch**
Repairs and Maintenance				$10,810.30	$67.56	$6.76
	Horse Power	**Fuel Use Gals/HP-hr**	**Cost Per Gallon**			
Pump (Fuel)	60	0.044	$4.10	$13,638.24	$85.24	$8.52
Generator (Fuel)	25	0.044	$4.10	$5,682.60	$35.52	$3.55
		Hours	**Cost Per Hour**			
Labor		0.28	$14.47	$41.00	$0.26	$0.03
Management		15.00	$46.75	$701.25	$4.38	$0.44
Total Operating Costs				**$30,873.39**	**$192.96**	**$19.30**

Table 7: *Breakdown of annual operating costs in the Eight-Tower Diesel Center Pivot.*

Repair and maintenance

Cost factors are used to determine the repair and maintenance cost of the irrigation equipment. These factors are simply the percentage of the equipment's purchase price that is expected to be spent each year on repair and maintenance. The cost factor for the pump in the diesel-operated system and the electricity-operated system is assumed to be 6.60% and 2.00%, respectively (Bullen & Benson, 2007). Cost factors for each piece of equipment are provided in the irrigation budget, and they can be adjusted to better reflect the individual farming conditions. The repair and maintenance cost can be calculated as:

$$\textit{Repair and maintenance cost} = \textit{Initial cost} \times \textit{Cost factor}$$

The total repair and maintenance cost can then be calculated by adding the repair and maintenance cost of all the equipment.

Labor costs

Labor costs are determined by the amount of water applied and the labor cost per hour. Labor requirements are assumed to be 0.28 hours (approximately 17 minutes) per acre-inch of water applied, reflecting the time required for farm labor to manually turn the pivot system on and off. The hourly labor rate is assumed to be $14.47 per hour, and the total cost can be calculated as:

$$Labor\ cost = Labor\ Hours\ per\ acre\ inch \times Annual\ acre\ inch\ applied \times Labor\ cost\ per\ hour$$

Management cost

Management cost is the cost for the time spent by farm managers in making irrigation-related decisions. It depends on the number of management hours required per pivot system and the manager's hourly wage rate. In these budgets, the manager's wage rate is assumed to be $46.75 per hour, based on the 2025 average wage rate for farmers, ranchers, and other agricultural managers reported by the U.S. Bureau of Labor Statistics.

Annual Costs

Tables 7 and 8 summarize the annual costs in the irrigation budget, including the total ownership costs, the total operating costs, and total costs on a per pivot basis, per acre basis, and per acre inch basis. The total cost of the irrigation system is calculated as:

$$Total\ costs = total\ ownership\ costs + total\ operating\ costs$$

	Cost Per Pivot	**Cost Per Acre**	**Cost Per Acre Inch**
Total Ownership Costs	$31,501.80	$484.64	
Total Operating Costs	$5,689.58	$87.53	$8.75
Total Costs	**$37,191.38**	**$572.18**	

Table 8: *Summary of total annual irrigation costs in the Five-Tower Electric Center Pivot Irrigation Budget.*

	Cost Per Pivot	**Cost Per Acre**	**Cost Per Acre Inch**
Total Ownership Costs	$42,333.47	$264.58	
Total Operating Costs	$30,873.39	$192.96	$19.30
Total Costs	**$73,206.86**	**$457.54**	

Table 9: *Summary of total annual irrigation costs in the Eight-Tower Diesel Center Pivot Irrigation Budget.*

Summary

This user guide provides an overview of the center pivot irrigation budgets developed by UGA Extension to estimate the investment, ownership, and operating costs of irrigation systems. The budgets cover both five-tower and eight-tower center pivot systems powered by either diesel or electricity.

Investment costs differ due to variation in system size and power source. Ownership costs include depreciation, intermediate interest, property taxes and insurance, and electricity service charges. Operating costs include energy, repair and maintenance, labor, and management expenses based on actual water use.

Although cost levels vary by tower configuration and power source, all budgets follow a consistent structure and apply the same calculation methods. Producers can select the budget that best matches their pivot configuration and adjust the default values to reflect their own farm conditions.

A step-by-step summary of how to use the budget is provided in Figure 5 below.

Acknowledgments

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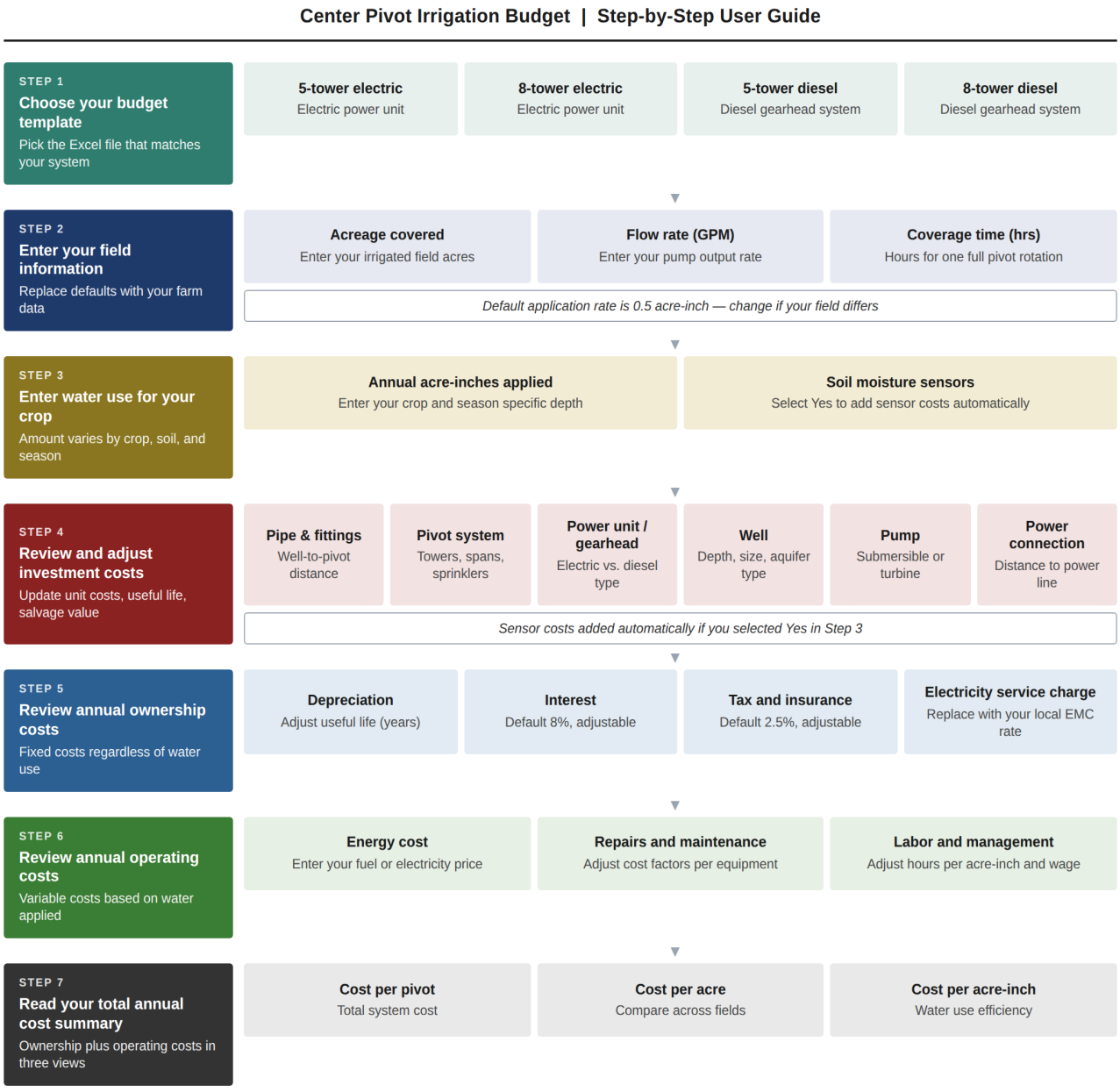

Figure 5: *Step-by-step summary of the process for preparing the budget for a center-pivot system (Designed with the help of Claude AI)*

References

Bullen, G., & Benson, G. (2007). *Irrigation Cost Spreadsheet* . Raleigh, NC: Department of Agricultural and Resource Economics, NC State University .

Evans, R., & Sneed, R. (1996). *Selection and management of efficient center pivot and linear move irrigation systems.* North Carolina Cooperative Extension Service Publication EBAE-91-151.

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