# Guides for **Electric Cooperative Development and Rural Electrification**

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# Glossary of Abbreviations

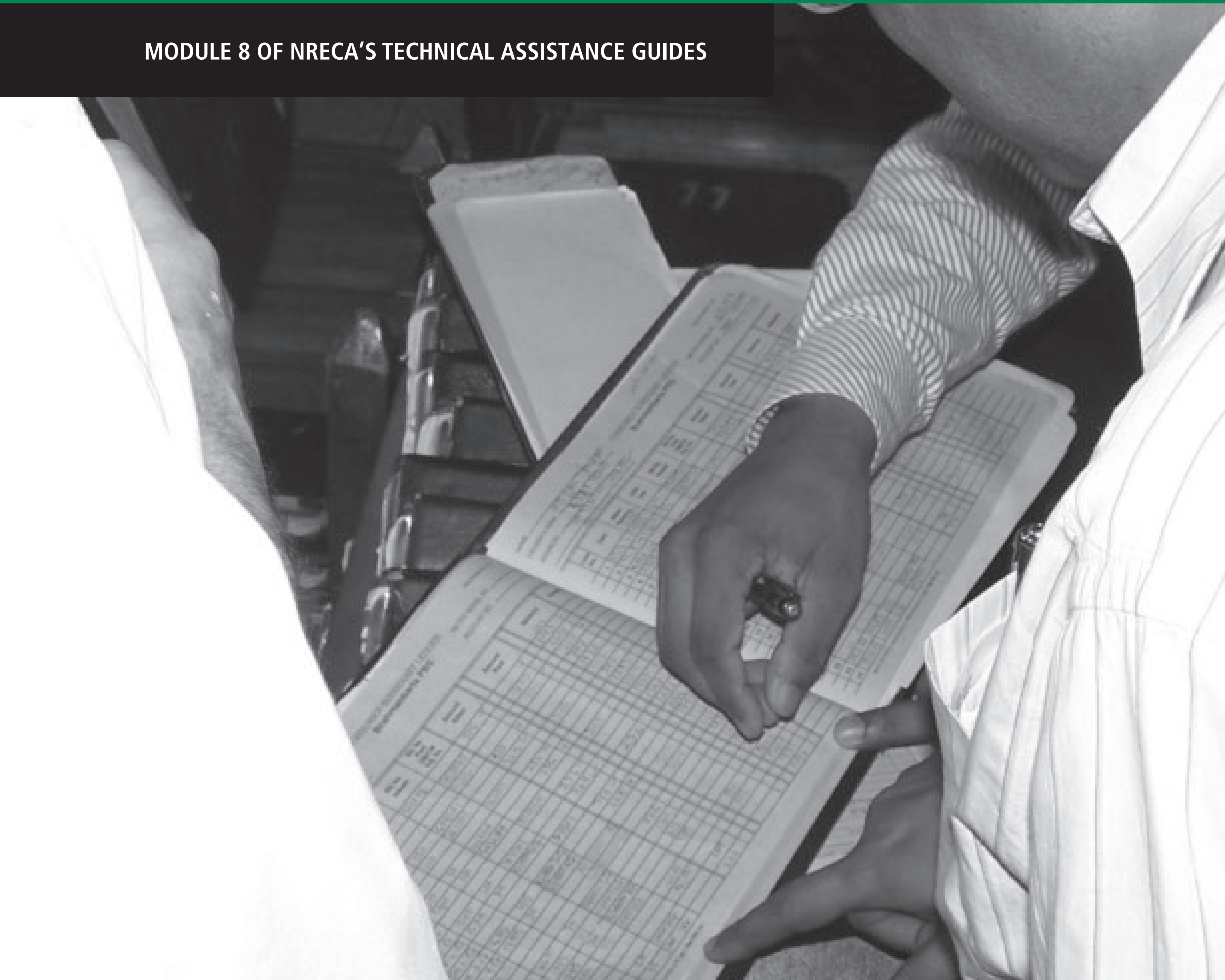
| | |
|---|---|
| **A** | Ampere |
| **AH** | Amp-hour |
| **AC** | Alternating current |
| **ACSR** | Aluminum conductor, steel reinforced |
| **A&G** | Administrative and general |
| **AWG** | American wire gauge |
| **CARES** | Central American Rural Electrification Support Program |
| **CCT** | Correlated color temperature |
| **CDA** | Cooperative Development Authority (Philippines) |
| **CEF** | Fronteriza Electric Cooperative (Dominican Republic)* |
| **CFC** | National Rural Utilities Cooperative Finance Corporation, also known as NRUCFC (U.S.) |
| **CFL** | Compact fluorescent light bulb |
| **CLARITY** | Cooperative Law and Regulation Initiative |
| **CONELECTRICAS** | National Consortium of Electrification Companies of Costa Rica (Costa Rica)* |
| **DC** | Direct current |
| **DISCEL** | Electric Distributor of the Hydroelectric Executive Commission of Rio Lempa (El Salvador)* |
| **EBIT** | Earnings before interest and taxes |
| **EBITDA** | Earnings before interest, taxes, depreciation and amortization. |
| **EEGSA** | Electric Company of Guatemala, PLC (Guatemala)* |
| **ESMAP** | Energy Sector Management Assistance Program (World Bank) |
| **FUNDAP** | Foundation for Economic Development |
| **G&T** | Generation and transmission cooperative |
| **GIS** | Geographic information system |
| **GPS** | Global positioning system |
| **HVD** | High voltage disconnection |
| **I** | Electrical current, measured in amperes |
| **ICE** | Costa Rican Institute of Electricity (Costa Rica)* |
| **IEC** | International Electro-technical Commission |
| **INDE** | National Institute of Electrification (Guatemala)* |
| **INE** | National Institute of Statistics (Bolivia)* |
| **IRR** | Internal rate of return |
| **ISPRA** | National Institute for Protection and Environmental Research (Italy) |
| **K** | Kelvin |
| **klmh** | Kilo-lumen hour |
| **kV** | Kilovolt |
| **kVA** | Kilovolt-ampere |
| **kVAR** | Reactive kilovolt-ampere |
| **kW** | Kilowatt |

| | |
|---|---|
| **kWh** | Kilowatt hour |
| **LED** | Light-emitting diode |
| **LPG** | Liquefied petroleum gas |
| **LVD** | Low voltage disconnection |
| **LVR** | Low voltage reconnection |
| **MRT** | Single wire earth return* |
| **MW** | Megawatt |
| **MWh** | Megawatt hour |
| **NEA** | National Electrification Administration (Philippines) |
| **NESC** | National Electrical Safety Code |
| **NGO** | Non-governmental organization |
| **NOAA** | United States National Oceanic and Atmospheric Administration |
| **NPV** | Net present value |
| **NRECA** | National Rural Electric Cooperative Association International, Limited |
| **OCDC** | Overseas Cooperative Development Council |
| **O&M** | Operations and maintenance |
| **PDB** | Power development board |
| **PUC** | Public utility commission |
| **PUE** | Productive use of electricity |
| **PV** | Photovoltaic |
| **PWM** | Pulse width modulation |
| **R** | Electrical resistance |
| **R&D** | Research and development |
| **RE** | Rural electrification |
| **REA** | Rural Electrification Administration, an agency of the Department of Agriculture of the United States, now known as RUS |
| **REB** | Rural Electrification Board (Bangladesh) |
| **RFP** | Request for proposal |
| **RFQ** | Request for quote |
| **ROE** | Return on equity |
| **RUS** | Rural Utilities Services, an agency of the Department of Agriculture of the United States, previously known as REA |
| **SWER** | Single wire earth return |
| **TAG** | Technical assistance guide |
| **UL** | Underwriters Laboratory |
| **USAID** | United States Agency for International Development |
| **USDA** | United States Department of Agriculture |
| **USTDA** | United States Trade and Development Agency |
| **V** | Volt |
| **W** | Watt |
| **WH** | Watt-hour |
| **Wp** | Watts peak |
| **WtP** | Willingness to pay |

*English translation of Spanish abbreviation

# Financial Analysis of Rural Electrification Projects

MODULE 8 OF NRECA'S TECHNICAL ASSISTANCE GUIDES



8

## EXECUTIVE SUMMARY

This module presents a discussion of the role of financial modeling in rural electric utility project analysis. It includes a description and user guide for the NRECA Financial Model software tool specifically developed to evaluate financial performance of rural electrification projects developed by NRECA team members in Latin America, Africa, and South and Central Asia.

Projecting the financial viability of an electric system is essential in determining whether or not the project can attract financing and whether it will be able to reach financially sustainable operation. Determining financial viability involves weighing future cash outlays against projected revenues, with the goal of defining profit or loss attributable to the project.

The financial analysis process is iterative by nature, typically beginning with evaluating engineering design alternatives and their capital and operating cost estimates. In conjunction with preliminary engineering analysis, demand and sales models are developed, based on estimates of population and economic growth in the project area. The market assessment and engineering cost estimates influence one another so that any increase in expected sales may require increasing generation, transmission, and/or distribution capacity. In turn, the expected sales increases require increased capital and operating cost estimates. At the end of this iterative process, engineering and economic growth analyses optimize the project design to meet the best estimate of future market conditions. The base case projection helps planners evaluate project risks by varying key data values and underlying assumptions to determine project sensitivities and breakeven points.

The financial analysis process addressed in what follows includes input assumptions, scenario analysis, and model output. Note that the quality of the input assumptions to the model directly determine the quality of the output. Reasonable and accurate modeling requires attention to validating data values and verifying underlying assumptions. Scenario analysis tests data validity and can be used to bound future scenarios. So-called bandwidth analysis produces best, worst and most likely cases for the project. Sensitivity and breakeven analyses are further scenario analysis tools that can be help identify and evaluate project risks around ranges of possible values for certain key project parameters, such as the cost of debt, growth in sales, or the pricing of electricity. Detailed examination of financial model results facilitates evaluation of the base case and other scenarios.

This module presents a pro-forma model developed by the NRECA team as a means of providing a practical description of the concepts included in classical financial modeling.

The output section of the NRECA model has four main components:

1. Income Statement (showing revenues against expenses and resulting earnings)

2. Cash Flow Statement (comparing cash outlays against receipts)

3. Sources and Uses of Funds Statement (showing sources of cash across equity, subsidy, and debt against the destination of those funds for capital investment and operations)

**Projecting the financial viability of an electric system is essential in determining whether or not the project can attract financing and whether it will be able to reach financially sustainable operation.**

4. Project Indicators (showing project statistics and feasibility indicators including debt service coverage and internal rate of return)

The key data requirements of the NRECA model relate to the three categories of capital costs, market data, and operating costs, which are each discussed in some detail. The user guide provides step-by-step instructions on the use of the NRECA model. The output pages from a sample financial analysis (Cooperativa Electrica Fronteriza, Dominican Republic) are also included.

**Rural electrification projects are generally evaluated on a time horizon of 10 years or more, because these projects require several years to complete the design, procurement, and construction cycle.**

## PROJECTING FINANCIAL VIABILITY

A key reason for the formation of rural electric cooperatives is that profit-making utilities often cannot economically reach and serve remote areas, especially where industry is limited and electricity consumption is low. Rural electric infrastructure is costly, and the decision to extend electric service to rural areas requires a careful balancing of costs and benefits.

In financial analysis, the cost side of the equation comprises the expenditure for new or additional electric facilities required to extend service, together with the expenses associated with operating expenses. Benefits derive from revenues resulting as a function of sales of electricity to consumers. Financial analysis uses spreadsheet-based anticipation (modeling) of future cash outflow and income associated with the proposed project.

Simplistically viewed, if project income exceeds operating costs, the project is financially viable, and if operating costs exceed income generated, the project is not financially viable. Rural electrification projects are generally evaluated on a time horizon of 10 years or more, because these projects require several years to complete the design, procurement, and construction cycle. Thereafter, additional time is required to connect customers and to generate sufficient revenue to cover operating costs of running the utility.

Results of financial analysis are presented via discounted net revenue and/or investment return indicators (return on equity, internal rate of return). These indices allow a numerical comparison of investment returns over the project time horizon. A standardized financial model allows the analyst to create scenarios and perform sensitivity analyses, taking into account sales and expense estimates, cost of capital, debt and equity investment ratios, and the effect of governmental assistance in the form of grants or subsidies.

Financial modeling provides decision makers with a picture of the financial viability of the proposed project. As with all projections into the future, financial modeling is neither infallible nor completely accurate. Modeling accuracy improves with careful estimation of capital and operating costs, as well as well-documented and conservative sales forecasts: the better the input assumptions, the more accurate the model.

The goal of financial analysis is to evaluate the profit or loss attributable to the proposed project. For marginal projects, the analysis should include a subsidy component. Governmental assistance, usually in the form of sharing the initial capital costs of the project, is justified by demonstrating the larger benefits to society resulting from the project. Such benefits go beyond those captured in financial analysis. They typically include savings to consumers on energy expenditures as well as employment, health, and environmental benefits (or costs). This broader definition of costs and benefits takes place in economic analysis, which is a step normally performed in cooperation with a government entity or development bank. The first step, however, is projecting the financial viability of the project.

## THE FINANCIAL ANALYSIS PROCESS

Perform project financial analysis after capital and operating costs have been estimated for the project, and the business team has developed estimates of administrative operating costs and electricity sales.

It is common to evaluate multiple system design alternatives, which results in differing cost scenarios, which in turn can be evaluated in parallel with distinct sales projection scenarios. Sales projections are based on population and economic projections for the area. The sales projections may be affected by design alternatives that might extend electricity service to alternate villages and housing clusters.

Financial analysis is a method for evaluating and reviewing scenarios to determine the most viable system design for the community and for estimating the overall financial viability of the project. Analysts input data from the various scenarios into the financial model and tracking the relative viability of each design alternative.

Project analysis is therefore an iterative process. For example the financial model might show that the preferred system design is so costly that even the most optimistic market scenario does not generate enough income to support the project costs. When a given project shows very marginal returns, the analyst might choose to evaluate a design alternative that provides service to the most densely populated area only, with extensions to less financially viable areas to be added later. It may also be necessary to consult with project engineering personnel to request a re-evaluation of project design alternatives and costs, and thereafter reevaluate project viability.

Through this process, the most realistic market assumptions and the best project design become clear. Analysts can then focus on the financial analysis of the most attractive project scenario, then reconfirm all assumptions and cost estimates.

After refining the most viable scenario, the analyst can use the financial model to identify project risks and determine minimum feasibility requirements through sensitivity and breakeven analyses. At the end of the financial modeling process, the team has a higher degree of confidence in the viability of the project and is in a better position to discuss the project with the community and financial stakeholders.

Many analysts prefer to design and employ their own model and indeed often build a new model for each project to accurately capture the particularities of that project. There is no better way to fully understand the nature of the project than to spend hours structuring the financial calculations that describe the project cash flows. However, this approach runs the risk that the complexity of designing each new model may lead to undetected formulaic errors. Even an experienced financial analyst may work through several versions of a new model before clearing all errors. NRECA has balanced these issues by developing and making available a tested model specifically designed to analyze small rural electric grid extension projects.

**Financial analysis is a method for evaluating and reviewing scenarios to determine the most viable system design for the community and for estimating the overall financial viability of the project.**

### Input Assumptions

*"Garbage in, garbage out."* – Wilf Hey

This well-known computer axiom means that if inaccurate data is entered into a computer program, the resulting output will also be inaccurate. For a financial model, the data input must reflect as accurately as possible the scenario being analyzed.

A financial analyst should have the habit of questioning, checking, and rechecking every bit of input. This means not only verifying the value of all input data but also validating the underlying assumptions – a subtlety that is often overlooked.

For example, let's say that we are studying an un-electrified area, and we have determined from household energy-use surveys that the current non-electrical energy consumption would be equivalent, on average, to 100 kilowatt-hours (kWh) per month. We might then assume that we can multiply the number of households in the community by 100 kWh to arrive at total residential electric sales.

While the data value of 100 kWh appears logical in this example, it depends on two assumptions that need to be validated. First, 100 kWh per customer may be an overstatement of future electricity consumption because not all current energy use will necessarily be supplied by electricity in the future. The more likely scenario is that some portion of current cooking (wood), lighting (kerosene), and entertainment (radio batteries) will use electric power. However, many community members may continue to use wood or charcoal for cooking. The second underlying assumption in the example is that all households would be connected to the system immediately, when it is more likely that consumers will join the electric service gradually and in accordance with their ability to pay for it.

**The best and most accepted method of addressing uncertainties associated with projections and estimations is scenario analysis, also known as bandwidth analysis.**

Thus the financial analyst must not only validate all input data values, noting the data source, but also make a conscious effort to identify and verify all underlying assumptions. This practice should apply to data generated by the project team (such as capital costs) as well as to those external to the project (such as population growth projections). When possible the analysts should use multiple data sources as a verification tool.

Remember that just because the financial model results are calculated and printed by a computer, it does not necessarily yield correct results. Before inputting the data, the financial analyst must check and validate all values and assumptions, and when variables change, check again.

## Scenario Analysis

All rural electrification projects, and all investments in general, include some degree of uncertainty. Successfully bringing electric power to un-electrified communities is no exception. Success depends upon events and project participants who must come together in a coordinated and sustained fashion for the project to be successful. Any number of events can compromise project success, most likely not causing complete failure but resulting in only partially achieved targets. On the other hand, the project could go better than expected, with targets exceeded.

The best and most accepted method of addressing uncertainties associated with projections and estimations is scenario analysis, also known as bandwidth analysis. Scenario analysis consists of defining multiple, potential outcomes that will define a bandwidth around the most likely expectation of project performance. The analyst might evaluate a conservative case (e.g., high cost, low sales) and an aggressive case (e.g., low cost, high sales) that form a range of project results around the most likely outcome, or base case. This type of analysis adds comfort to the base case scenario that ultimately is presented in the business plan.

Typically, the business plan presents only the single, most likely scenario (referred to as the base case). However, it is sometimes beneficial to describe the low (conservative) and high (aggressive) cases in the business plan text to inform the reader of the range of possible project outcomes.

Analyzing a range of project outcomes helps to identify project risks. Since every project has some amount of risk, the best way to mitigate that risk is through evaluating and identifying mitigation strategies. For example, if it becomes clear that the most significant project risk is the industrial sales forecast, then this risk can be mitigated by coordinating the project with a community economic development program that supports industrial expansion through recruiting new businesses to the community.

In addition to bandwidth analysis, two other types of scenario analyses can help analyze risk, both of which are typically applied to the base case (not the high and low bandwidth cases). The first is sensitivity analysis where a single variable is changed among a range of possible values while all other variables are held constant, with observation of the resulting impact on the project outcome. The project outcome may be identified to be sensitive to changes in certain variables (those that produce a large change in project indicators) and not as sensitive to changes in other variables.

For example, the project outcome might vary little with changes in operation and maintenance expense (over a range of reasonable values) but vary greatly with possible shifts in the interest rate on project debt. As a logical follow-up, the analyst would increase the interest rate until the model shows revenues equating costs, that is, financial breakeven. Called breakeven analysis, this tool helps project promoters and prospective financiers understand the limits of the project with respect to specific key variables.

## Model Output

The particularities of each project dictate which combination of the evaluation tools (bandwidth, sensitivity, and breakeven analysis) the analyst employs. All analyses may not be appropriate or useful in every situation. In any event, whatever useful information emerges from scenario analysis should be incorporated in the financial model description in the business plan. The model description in the plan generally focuses on the model results, or output. The output section of the NRECA Financial Model includes four main components, described below.

**Income Statement**

The Income Statement shows revenue for the project broken down by customer class, from which expenses (by major categories, the largest of which is typically purchased power) are subtracted. The net of total income less operating expenses is referred to by the accounting acronym EBITDA, or earnings before interest, taxes, depreciation and amortization. This measures the operational profitability of the project. A project that cannot cover operating expenses will not survive without operating subsidies, support that is not likely to be provided to most projects.

Next on the Income Statement, depreciation and amortization expenses are subtracted, resulting in EBIT, or earnings before interest and taxes. While depreciation is a non-cash expense, recovering the depreciation allowance is critical, as this represents the utility's reserve for plant replacement. Revenues sufficient to fund depreciation will allow for plant replacement, while failing to cover depreciation calls into question the long-term sustainability of the project.

Then, interest is deducted from earnings resulting, in earnings before taxes. If the project cannot generate sufficient revenue to service debt, then some type of capital subsidy or debt deferment will be required. Finally on the Income Statement taxes are subtracted, resulting in projected net income.

The Income Statement shows revenue for the project broken down by customer class, from which expenses (by major categories, the largest of which is typically purchased power) are subtracted.

**Cash Flow Statement**

The Cash Flow Statement presents cash receipts and expenditures. The first block in the statement shows the cash expenditure on capital items – the actual cash equity outlay (not the borrowed or donated portion) for a new or expanded electric plant in any single year.

The second block on the statement shows other cash adjustments, both outlays and expenditures. First, net income is carried over from the Income Statement, from which the actual cash outlay for principal payments on debt is subtracted (principal payments are not shown on the Income Statement) and depreciation is added back (originally expensed on the Income Statement, but actually a non-cash item). The result of these adjustments is net cash from operations.

Net cash from operations less cash outlay on capital items results in the annual net project cash flow.

### Sources and Uses of Funds

The Sources and Uses of Funds statement presents a summary of the sources of project financing (equity, grant, or debt) and how/where funds are used (capital investment). This statement also presents a reconciliation of net cash from operations with cash sources from funding.

This statement begins with sources of funds and deducts uses of funds to result in net cash available, an amount that is carried over annually on the statement to show accumulated unburdened cash generated by the project (called "free cash flow").

### Project Indicators

The final output section of the model presents a mix of project status data and project feasibility indicators, as described below.

### Project Status

- *Energy Requirements (MWh)* – Annual amount of system energy requirements, defined as energy sales and energy losses
- *Coincident Peak (MW)* – Annual coincident peak demand, which is differentiated from billing or non-coincidental peak demand
- *Primary Line (km)* – Annual year-end number of kilometers of primary electric line constructed and operating
- *Households Served* – Annual year-end number of residential customers served
- *Population Coverage* – Annual year-end percentage of projected area population served

While the above data are intended primarily to provide descriptive statistics for the project over the forecast horizon, they can also serve as model integrity checks in that the existence of unexpected or outlier values generated by the model should be a signal that certain data or assumptions need to be checked.

### Project Feasibility Indicators

- *Cash Return on Equity* – Annual cash generated as a percent of initial equity investment
- *Debt Service Coverage Ratio* – Ratio of earnings plus interest to debt service payment
- *Additional Working Capital Requirement* – Amount of additional working capital needed to cover projected operating deficits. If this number is greater than zero the analyst must return to the input section of the financial model and re-enter a higher level of working capital until this project indicator returns to zero
- *Internal Rate of Return on Equity (IRR)* – Standard measure of project financial viability reflective of the average annualized rate of return on equity generated by the project

Some of these indicators (especially Cash Return and IRR) are not always meaningful in the analysis of rural electrification projects, as a low equity investment (denominator) can skew the ratio of investment return. However, together with careful analysis of the output statements as described above (including earnings projections, funding of depreciation, debt service coverage, and net cash flow) these indicators make a full picture of the project's financial performance available to decision makers.

Rural electric cooperatives or utilities are sometimes established even when profits cannot meet the hurdles of commercial rates of return. Thus, the objective often results in identifying the means by which projects can successfully eliminate or minimize the need for governmental grant assistance.

## FINANCIAL MODEL DATA REQUIREMENTS

Data collection is the first step in preparing the financial model for project analysis. This section provides an overview of the key data required by the NRECA Financial Model. Following this section is a user guide that offers specific step-by-step instructions for data input and model operation.

### Capital Costs

Data in this category define the cost of constructing the proposed electric system. Arriving at this cost requires identifying the major system components, the number of each component required, and the cost of the component. All cost figures must include construction and installation as well as the cost of any land and civil work required (line right of way and substation). Note that these costs vary from project to project and should be adjusted to account for local material and labor costs.

Another item contributing to capital cost and required by the financial model is the cost of engineering design. In addition to engineering design costs, estimate any required pre-operating costs (preliminary engineering studies, etc.), in addition to projecting the tools, equipment, and vehicles that will be purchased for the project.

Finally, the model requires estimation of the capital structure of the project, identifying the grant, equity, and debt portions of the capital cost, along with loan terms.

The capital cost data must come from project-specific engineering studies, which include current local costs for materials and construction. Working together with the engineers, the financial analyst needs to pull the relevant data from the design studies and input it into the model. If costs for several design alternatives are presented, the analyst may use this data to evaluate multiple financial model scenarios.

### Market Data

Market data define the target population and the size of the project market. The model requires a projection of the project population at the end of the planning horizon and an estimate of average household size. Population data are generally found at the government agency responsible for demographic statistics. Since government demographic data rarely identically match the geographical boundaries of a proposed project, interpolation of the data may be necessary.

Historical and projected population growth statistics provide the analyst a context for projections of residential customer growth. The model applies those projections to the initial customer connection estimates in the engineering study.

Data on the agricultural, commercial, and industrial segments of the market must be also be estimated and inserted into the model. These data are typically gathered through market surveys and/or studies on willingness to pay or energy end-use.

Data required by the model for each customer class include the number of customers, customer growth rates, and average monthly electricity usage.

Finally, tariffs for each customer class must be estimated and inserted, including customer, fixed monthly and energy usage charges. Pricing data are determined by such factors as customer willingness and ability to pay, the cost of providing service, the price of alternative fuels, neighboring utility pricing standards, and regulatory considerations.

### Operating Costs

Data in this final input category define project operating costs. These include the cost of purchased power, customer expense, variable and fixed operations and maintenance expense, administrative and general expense, and professional services expense. The project engineer should provide estimates of operating costs, especially operations and maintenance expenses.

**The capital cost data must come from project-specific engineering studies, which include current local costs for materials and construction.**

The analyst generally estimates remaining costs through the "bottom up" method of identifying staff positions, applying competitive wages, and projecting related expenses.

Data from any existing area utilities of a comparable size and market situation may provide a useful guide. The model also requires data on projected collection efficiency, insurance costs, and corporate taxes (if applicable).

## Summary

The analyst collects data in three categories: capital cost, market data, and operating costs. If the financial model analyzes multiple scenarios, then the values for certain variables will change accordingly, requiring supporting information for each new value of the variable.

Financial modeling requires systematic estimates based upon data collection, as well as estimates based upon experience.

Financial modeling requires systematic estimates based upon data collection, as well as estimates based upon experience. Arriving at reasonable estimates and relevant solutions is often an iterative process. After evaluating the data and the underlying assumptions, often after analyzing multiple scenarios, the analyst gains a "feel" for the project. This intuitive understanding of what drives the project results up or down, and identification of key sensitivities, should be used to determine which additional scenarios should be examined, with the goal of developing the optimal project structure.

# FINANCIAL MODEL USER GUIDE

The NRECA Financial Model is an Excel-based spreadsheet developed as a part of this module. It analyzes the financial feasibility of proposed small, grid-connected rural electrification projects.

## General Information

In the spreadsheet, white boxes indicate cells that require user input. Be careful to input data only in the white boxes and not in any other cells in the spreadsheet in order to avoid overwriting formulas. The spreadsheet cells are not edit-protected. However, a few of the input boxes are error-protected in the sense that a message appears if input is required but not yet entered.

The model is comprised of four sheets. The first is the Input sheet for entering nearly all the data required by the model. All input for monetary variables should be in U.S. dollars. The second is the Calculations sheet, an intermediate calculations section that allows the user to follow the model's logic and gain a better understanding of the financial projections. By illustrating the key drivers behind the numbers, the model also makes it easier to backtrack and locate input errors. The Results sheet follows the Calculations sheet, showing the financial projections in U.S. dollars, followed by the fourth and final sheet, Results Local, which shows the same results in local currency.

This module explains each sheet sequentially with primary attention on explaining the input required by the model. For best results, read the preceding modules of this publicaiton before using the model to carry out a financial analysis.

Following an explanation of the model presented here is a sample analysis of a rural electrification project in the Dominican Republic.

## Input Sheet

**SCENARIO NAME**

The user should input a name for each scenario. The input name carries through the remainder of the sheets to differentiate the various models in scenario analysis.

**A-1 Input Block: FEEDER, SECONDARY AND SERVICE COSTS**

The total cost of materials and construction for single and three-phase line, in dollars per

## Table 1. The A-1 input block

| | A | B | C | D | E |
|---|---|---|---|---|---|
| | A-1 FEEDER, SECONDARY AND SERVICE COSTS | | | | |
| 7 | Feeder Line | | Single Phase | Three Phase | Notes |
| 8 | Total Cost Constructed (per km) | | 6,294 | 10,766 | |
| 9 | | | | | |
| 10 | Secondary and Service | | | | |
| 11 | Meter and Base | | 69 | | Service drop total (new and repaired equipment) |
| 12 | Duplex | | | | |
| 13 | Cuadruplex | | | | |
| 14 | Secondary and Transformer | | 179 | | |
| 15 | Transformer Bank | | | 480 | Three phase service drops |
| 16 | SECONDARY AND SERVICE TOTAL | | $ 248 | $ 480 | |

kilometer, goes into the A-1 input block, illustrated in Table 1. Note that values for medium voltage (Feeder Line) and low voltage (Secondary and Service) must be entered for single and three-phase components. These costs depend upon the quantity of material purchased and local construction costs.

### Feeder Line

Enter the total cost, in dollars per kilometer, of constructing feeder, or primary line here.

### Secondary and Service

Enter here, in dollars, the installed costs of the components of secondary and service drop – meter and base, duplex, quadruplex, secondary and transformer unit costs and transformer bank. The analyst can change the names of the components to fit the particular situation in Column A and add notes in Column E.

### A-2 Input Block: TOTAL ELECTRIC PLANT COST

Enter here the remaining cost of the electric plant, excluding feeder, secondary and service costs already inputted in the A-1 block, along with other basic information needed to define the project. For each line item or component, be sure to enter the unit quantity and unit costs, unless already entered in block A-1.

### New Construction

In column A, list all construction components for transmission and distribution construction with corresponding cost estimate for each. The user can change these construction components

## Table 2. The A-2 input block

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| | A-2 TOTAL ELECTRIC PLANT COST | | | | | | |
| 21 | | Materials, | | | | Number | Extended |
| 22 | New Construction | Land, Civil ($) | | Unit Definition | | of Units | Cost ($) |
| 23 | Transmission Line | | | km 69 kV | | - | - |
| 24 | Subtransmission Line | 15,073 | | km 34.5 kV | | 18.0 | 271,314 |
| 25 | Substations | 560,200 | | 1 @ 69/34.5 kV 1@ 69/12.5 kV | | 1.0 | 560,200 |
| 26 | Step Banks/Regulators | 161,843 | | 2 @ 34.5/12.5 kV, regulator | | 1.0 | 161,843 |
| 27 | 3 Phase Primary | 10,766 | | km 34.5, 19 kV | | 74.6 | 803,144 |
| 28 | 1 Phase Primary | 6,294 | | km 7.2 kV | | 140.5 | 884,307 |
| 29 | 3 Phase Secondary/Service | 480 | | secondary, service drop/meter | | 54 | 25,920 |
| 30 | 1 Phase Secondary/Service | 248 | | secondary, service drop/meter | | 16000 | 3,971,894 |
| 31 | | | | | | | |
| 32 | Average Depreciation Life | 25 | years | | Existing System Acquired | | - |
| 33 | | | | | Design and Engineering | | |
| 34 | | Year | $ Amount | | Other Fees | | - |
| 35 | Capacity Addition Required | 7 | 1,000,000 | | Subtotal | | 6,678,621 |
| 36 | | | | | Contingency % | | 0% |
| 37 | Plant Sized to Distribute to | 16,000 | # residential customers | | Cost Contingency ($) | | - |
| 38 | Total Projected Population | 134,000 | at end of planning horizon | | Total Initial Fixed Assets ($) | | 6,678,621 |
| 39 | Average Household Size | 5.5 | | | % Year 1, Trunk System | | 80% |
| 40 | Remaining Customer Base | 8,364 | unserved by initial plant | | % Year 2, Balance of Plant | | 20% |

or define them more specifically. Enter the per-unit cost for each item applicable to the project under "New Construction" in column B. In the "Unit Definition" (column D), enter a definition, or description, of the unit. For each line item, enter the number of units required by the project under "Number of Units" (column F). The resulting calculation, called the extended cost, automatically appears in "Extended Cost" (column G).

Where line item costs are not available and the analyst has only a total project cost, the total project sum should be entered in block A-1, cell C8 along with the value "1" in block A-2, cell F28. The total project cost will then be carried over to cell G28 by the formula. It is important that this convention be followed so that plant expansion costs are properly calculated. The plant expansion costs are based on initial construction costs, taken from cells G28 and G30 (single phase feeder line, secondary and service drop costs).

**Existing System Acquired**

Enter the acquisition cost (in dollars) of any existing electric assets that are purchased and that will become a part of the project in cell G32.

**Design and Engineering**

Enter the cost of system design and engineering (if not covered outside of the project) in cell G33. Enter any other fees and contingencies in cells G34 and G36.

**% Year 1, Trunk System**

The model assumes that the plant will be built within two years with, at a minimum, the trunk system built in the first year and the balance of the plant in the following year. Accurately calculating depreciation allowance requires the user to enter a value for the percentage of the plant completed in the first year in cell G39. Enter the value of 100% if construction will be completed in the first year.

**Average Depreciation Life**

Enter the number of years over which the electric plant should be depreciated in cell B32.

**Capacity Addition Required**

The model provides an option to include an additional, one-time discrete investment (e.g., for additions to the primary, backbone distribution line) in cells B35 and C35. In consultation with the project engineer, the modeler typically first examines customer growth projections. Later the analyst returns to this variable to enter the year and dollar amount of any additional investment required to expand the system backbone above and beyond the automatic investment additions made by the model so as to cover the cost of residential feeder extensions and service drops.

**Number of Consumers**

Enter the number of residential consumers in cell B37 (estimated from combining the acquisition of the existing system and new construction) to whom the electric system will provide service. Note that once projected customer growth surpasses the number of customers, the model automatically adds expansion investment, based on the ratio of the initial estimate of residential customers to the initial project investment in single-phase primary, transformers, secondary and service drop.

**Total Projected Population**

Estimate the total population of the service area projected by the end of the ten-year horizon in cell B38. Combined with an estimate of average household size (cell B39), this variable is used to calculate the remaining customer base (cell B40) in the service area. Cell B40 provides the number of residential customers that the project will not be able to supply in year ten of operations without further expansion.

The purpose of the estimate in cell B40 is two-fold. First, this indicates the portion of the market the project will serve in ten years without significant additional investment, and second, it can help prevent runaway customer growth projections resulting from invalid initial assumptions. Note that, as the model is structured to stop the growth of the number of residential class customers one year after the population cap is reached, it is important to review the interaction of this cap with the annual customer growth rate assumptions and adjust both as necessary.

### A-3 Input Block: ADDITIONAL CAPITAL REQUIREMENTS AND CAPITAL STRUCTURE

In this block, enter additional capital costs of the project, along with data describing the means of project financing.

#### Equity per Member

Although this model was designed for electric cooperatives, it also applies to other, non-cooperative utilities. Part A-3 thus applies to cooperatives and non-cooperatives alike. Many rural electrification projects require member or consumer equity participation, often referred to as counterpart contributions to project funding. For projects that require membership equity or counterpart contributions, the analyst should enter the contribution here. Note that contributions can be received by the electric utility in a lump sum in the first year of the project or over time. If counterpart contributions are received over time, the terms of the contributions should be included here. Enter the dollar amount of individual membership dues/counterpart, followed by the payment term, annual interest rate, and the estimated percentage of residential customers who will contribute equity to the project.

#### Pre-Operating Costs

Enter any pre-operating costs that need to be capitalized, including project development expenses, consulting expenses, and other project "soft" costs, in cell G46 along with the number of years in the amortization period for this asset (cell D46).

#### Vehicles and Equipment

Enter the cost of utility vehicles and equipment (including office equipment and furnishings in cell G47, along with the amortization period (in number of years) in cell D47.

#### Initial Working Capital

Initial working capital is the amount of funds the utility needs to begin commercial operations, and that is "turned over" in one production cycle. Typically, the analyst leaves this cell blank until the model has been run with all other variables. Then, working iteratively by entering different amounts in this cell and reviewing the resulting project indicators on the Results page, the user can get a feel for the financial sensitivities of the project. Understanding gained by successive model iterations will likely suggest changes required to the capital structure of the project (the financial resources required by the project from equity, loans, or subsidies and grants), not simply the amount of working capital required.

**Many rural electrification projects require member or consumer equity participation, often referred to as counterpart contributions to project funding.**

**Table 3. The A-3 input block**

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| | A-3 ADDITIONAL CAPITAL REQUIREMENTS AND CAPITAL STRUCTURE | | | | | | |
| 45 | | | | | | | |
| 46 | Equity per Member | 250.00 | Amortization | 5 | < Pre-Operating Costs > | | - |
| 47 | Payment Term (Years) | 5 | Depreciation | 7 | < Vehicles and Equipment > | | 343,097 |
| 48 | Interest Rate % | 5% | | | Initial Working Capital | | |
| 49 | Member/Customer Signup | 20% | | | Total Project Financing | | 7,021,718 |
| 50 | | % | | | | | |
| 51 | Grant | 78% | | | | | |
| 52 | Co-op Member Equity | 1% | | | 78% | Grant | 5,476,940 |
| 53 | Private Equity | 0% | Term | Rate | 1% | Equity | 70,217 |
| 54 | Low Interest Debt | 20% | 15 | 6.0% | 21% | Debt | 1,474,561 |
| 55 | Commerical Debt | 0% | 15 | 6.0% | 100% | Total | 7,021,718 |

**Grant, Counterpart Contributions/Member Equity, Private Equity, Low Interest Debt, and Commercial Debt**

The analyst distributes herein the total funds required for the project among five distinct sources: Grant, Co-op Member Equity, Private Equity, Low Interest Debt, and Commercial Debt. Also enter the loan term (number of years allowed to repay the loan) and the rate (annual interest rate, as a percentage). Even if the initial capital structure assumes no low interest debt, the user must enter the loan term and interest rate of such debt here, as these terms are used by the model to calculate the terms of financing for the future investment required to expand the system.

**A-4 Input Block: ELECTRICITY SALES**

In this block, illustrated in Table 4, enter sales data for each customer class and associated electricity usage and tariffs. The model allows for five customer classes, as well as street light sales.

For each customer class, the user must define the following tariff information. Note that it is acceptable to have no, or zero, charge in certain boxes, depending upon the project tariff structure.

**Connect $/customer**

This is the connection charge that each customer requesting and receiving a service connection must pay. It is a one-time charge assessed by the utility to all consumers.

**Fixed Charge $/month**

This is a fixed amount, in dollars per month, charged to every customer to cover customer-related fixed costs, and with no associated allowance for minimum energy usage. It does not include any minimum amount of energy usage.

**Energy $/kWh/month**

This is the amount charged per kWh consumed (in dollars per month).

**Demand $/kW/month**

Although not typically used in rural electrification in the developing world, the model allows the analyst to include a charge assessed per kW demanded per month, for all classes but the residential customer class. The charges may apply to a large industrial class and in situations where the utility will itself be subject to demand charges from its wholesale supplier.

For each customer class the user must define certain customer information.

**Initial Customers**

Enter here the number of customers served by the end of the first year. The number of residential customers is estimated by dividing the population of the project area by the average household size. There is no need to adjust the number of industrial and agricultural customers.

**First Year Customers Average Months of Service**

Enter the average number of months of electricity service received by customers in their first year as a member of the electric cooperative in cell I74.

**No. of Customers % Increase per Year**

Enter the estimated annual increase in the number of customers in three stages (Years 2-3, 4-6, and 7-10), to allow the model to project energy sales growth over the project life. Note that the growth rates are applied to the number of customers at the end of previous year.

**Monthly Usage (kWh)**

Enter the average monthly energy usage of each customer class.

## Table 4. The A-4 input block

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | A-4 ELECTRICITY SALES | | | | | | | |
| | | Connection $/customer | Fixed Charge $/month | Energy $/kWh/month | Demand $/kW/month | Initial Customers | Number of Customers % Increase per Year | | | Monthly Usage (kWh) | % Increase Usage/yr | Load Factor | Non-Coincident Demand (KW) | Coincidence Factor | Coincident Peak (KW) |
| 60 | | | | | | | Years 2-3 | Years 4-6 | Years 7-10 | | | | | | |
| 61 | Residential | | 2.10 | 0.17 | | 12,000 | 3% | 7% | 3% | 121 | 3% | 0.3 | 6,722 | 0.95 | 6,386 |
| 62 | Commercial | | 3.26 | 0.17 | | 450 | 3% | 7% | 4% | 408 | 4% | 0.3 | 850 | 0.75 | 638 |
| 63 | Agricultural | | 3.26 | 0.17 | | 50 | 2% | 6% | 1% | 1,000 | 0% | 0.4 | 174 | 0.75 | 130 |
| 64 | Small Industrial (<50KVA) | | 3.26 | 0.14 | 22.40 | 2 | 3% | 3% | 2% | 10,000 | 1% | 0.5 | 56 | 0.80 | 44 |
| 65 | Large Industrial (>50KVA) | | 5.62 | 0.14 | 10.95 | 2 | 3% | 3% | 2% | 25,000 | 1% | 0.6 | 116 | 0.85 | 98 |
| 66 | Street Lights | | 3.26 | 0.12 | | | | Street Lights kWh/residential customer/mo. | | 0.7 | | 0.5 | 24 | 0.95 | 23 |
| 67 | | | | | | | | | | | | | 7,941 | 0.92 | 7,319 |
| 68 | Local Currency Name | Pesos | /US$ ex. rate | 29.0 | | | | | | Initial Sytem Energy Sales (kWh) | 211,700,880 | | | | |
| 69 | | | Pesos | | | | | | | Energy Losses (kWh) | 9,073,234 | | Losses Converted to C- peak KW | | 2,954 |
| 70 | Residential | - | 60.90 | 4.93 | | | | | | Initial Energy Requirement (kWh) | 30,244,114 | | | | |
| 71 | Commercial | - | 94.50 | 4.93 | - | | | | | | | | Initial System C-Peak Demand (KW) | | 10,273 |
| 72 | Agricultural | - | 94.50 | 4.93 | - | | | | | | | | *(estimated - before reducing for customer phase-in)* | | |
| 73 | Small Industrial (<50KVA) | - | 94.50 | 3.94 | 649.600 | | | First Year Customers Average Months of Service | | | | | | | |
| 74 | Large Industrial (>50KVA) | - | 163.05 | 3.94 | 317.680 | | | | 12 | | | | | | |
| 75 | Street Lights | - | 94.50 | 3.51 | | | | *(applied to first year residential revenue for customer phase-in)* | | | | | | | |

## Table 5. The A-5 input block

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A-5 OPERATION COSTS | | | | | | | |
| 81 | | Cost/kWh | Cost/Peak-KW | | Insurance as % | | Non-Pass Through | | Applicable | | | | |
| 82 | Purchased Power | 0.1 | 9.9 | U$ | of Plant Cost | | Sales Tax | | Income Tax | | | | |
| 83 | | 2.2 | 287.7 | Pesos | 1.0% | | 3% | | 0% | | | | |
| 84 | | | | | | | | | | | | | |
| 85 | Customer & Variable O&M | 9.00 | $/customer | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 |
| 86 | Fixed O&M | 83,000 | $ annual | | | | | Billing Collections Efficiency | | | | | |
| 87 | Fixed A&G | 24,000 | $ annual | 60% | 80% | 90% | 92% | 93% | 94% | 95% | 96% | 96% | 96% |
| 88 | Fixed Professional Services | 20,000 | $ annual | | | | Technical and Non Technical Energy Losses as % of Total Supply | | | | | | |
| 89 | Fixed Cost Real Inflator | 3.0% | % annual | 30% | 15% | 12% | 12% | 12% | 12% | 12% | 12% | 12% | 12% |

**% Increase Usage/Yr**

Enter the estimated annual increase in average monthly electricity usage for each customer class.

**Load Factor and Coincidence Factor**

This section asks for information related to load factor and coincidence factor. Note that this data is not likely to be available for a new project. Therefore, unless the analyst can obtain reasonable estimates for the specific project under review, we recommend that the values in the spreadsheet be used without further changes. These figures are based on experience and are within normal limits of rural utilities. To discourage changes to these values, these cells have been shaded.

The spreadsheet uses these values to calculate the project's estimated annual revenue from four customer classes – Residential, Commercial, Agricultural, and Small Industrial.

These variables allow the model to produce estimates of billing demand and coincident system peak demand. Helpful indicators (e.g., peak load) on this input block provide real-time feedback as to the characteristics of the system being modeled.

Finally, the analyst can include the name of the local currency and its exchange rate with respect to the U.S. dollar. This allows the user to view tariffs in local currency as well as in U.S. dollars, and to produce an output page in local currency.

**A-5 Input Block: OPERATION COSTS**

The final input block, shown in Table 5, allows the user to define the utility's operating costs.

**Purchased Power**

Enter the cost of purchased power in dollars (incorporating any wheeling charges) in cells B82 and C82, for energy and, if applicable, monthly peak demand, respectively.

**Customer & Variable O&M**

Enter customer expense and variable operations and maintenance expense (calculated in dollars per customer, per year) in cell B85.

**Fixed Costs**

In cells B86-87, the analyst should enter the annualized fixed operations and maintenance costs (Fixed O&M), fixed administrative and general costs (Fixed A&G), and the fixed cost of professional services, such as legal and accounting services (Fixed Professional Services). The spreadsheet program inflates each of these categories by the amount entered in cell B89 (Fixed Cost Real Inflator) to produce annual figures for each year in the planning period. The fixed cost real inflator is the estimated average rate of inflation for the period in question.

**Insurance as % of Plant Value**

The figure entered in cell E83 represents the cost of insurance as a percentage of the value of the assets insured. The program applies this figure to the value of the initial insurable electric plant to calculate annual insurance expense.

**Non-Pass-Through Sales Tax**

The figure entered in cell G83, expressed as a percentage, denotes sales tax levied against the cooperative's total revenue. Do not fill this in if the utility will simply charge customers for sales tax and pass on the tax received to the government authority.

**Applicable Income Tax**

The figure entered in cell I83, expressed as a percentage, is the rate that will be applied to any positive net income to calculate corporate income tax expense.

**Collections Efficiency**

The figures entered (as a percentage) in cells D87 through M87 represent the amount of revenue collected as a proportion of the total amount billed to customers. The spreadsheet uses these values to calculate the project's estimated annual revenue from four customer classes – Residential, Commercial, Agricultural, and Small Industrial.

### Technical and Non-Technical Energy Losses

The figures entered in cells D89-M89 reflect total estimated energy losses, calculated (and entered into the spreadsheet) as a percentage of total energy purchases.

## Calculations Sheet

Most of the major calculations are performed on this page, although some are also carried out on the Results page. The formulas for the calculations are not error-protected. However, changes to the formulas are not recommended. If changes are required, take extreme care to ensure that the implications of the change throughout the entire model have been thoroughly considered.

### B-1 CUSTOMER GROWTH

This calculation block tallies customer growth per year and by customer class. New customers are italicized so that their connection charge can be applied later in the revenue calculations section. The customer numbers in this block do not show the application of the population cap, which appears elsewhere.

### B-2 ANNUAL kWh SALES

This block calculates annual energy sales before any reductions for first-year customer phase-in. (The reductions, based on the first-year customers' average months of service, occur on the Results page.)

### B-3 MONTHLY N-C BILLING DEMAND

This block calculates non-coincidental peak, or billing, demand. The model then applies it to the appropriate customer class.

### B-4 MONTHLY C-PEAK DEMAND

In this block, the system coincidental peak demand is applied to the wholesale power tariff for non-residential customers, where appropriate.

### B-5 POPULATION SERVED

The number of residential customers is multiplied by the average household size to calculate the population served. This figure is used on the Results page as a cap on estimates of customer growth.

### B-6 KM LINE

This block calculates the ratio of initial kilometers of line constructed to the initial number of customers. The resulting indicator appears on the Results sheet. This indicator is subsequently used to determine the additional kilometers of line required to serve additional customers once the full capacity of the original system has been reached.

### B-7 PLANT VALUE

This block calculates the value (in dollars) of plant expansion required by the increase in customers beyond the initial system capacity. This value forms the basis for calculating depreciation of the plant, or the project's fixed assets. Note that plant value, for the purpose of calculating depreciation, is that portion of the plant acquired through equity and debt financing, not any contribution to plant acquisition financed through grants or subsidies.

### B-8 PAYMENTS ON EXPANSION PLANT DEBT

This block uses the values calculated in Block B-7 to calculate additional interest and principal repayments resulting from debt-financed expansion of the electric plant.

### B-9 IRR STREAM

The project's Internal Rate of Return (IRR) is calculated here and copied to the Results sheet.

### B-10 MEMBER EQUITY PAYMENTS

This final block calculates equity capital contributions by cooperative members.

### Results Sheet Reminders

The Results sheet was discussed earlier. Items worthy of mention, or repetition, include the following:

- The results sheet is calculated in both U.S. dollars and in local currency. Note that in the local currency version, the user must enter how values expressed in local currency should be displayed. For example, to show 1,000 units of the local currency in nominal terms, the user should input "1" and 1,000 will be displayed. To express 1,000 units as a multiple of 10, enter "10," and 100 will be displayed. The same 1,000 units will appear as 10 if the number 100 is entered, and so on.

- On the Income Statement, the acronym EBITDA stands for "earnings before interest, taxes, depreciation, and amortization." EBIT stands for "earnings before interest and taxes."

- In the Project Indicators box, the analyst should note that any nonzero value for the variable "Additional Working Capital Requirement" signifies a cash requirement for operations that is not included in the project capital structure entered earlier. As noted in the commentary above, the user must work iteratively with this and other indicators to structure the project's financing so as to fund the project's entire cash requirement (working capital).

- Since there is a one-year delay in stopping the growth of the number of customers in the residential class (based on the preset population cap), the Project Indicators box may show a population coverage that exceeds 100 percent. It is also possible that residential sales will continue to increase after the population cap is reached if the "average sales per customer" variable is set to increase annually in the Input sheet. As long as increases in average usage per customer were intended, the continued increase in total sales is correct even after surpassing the population cap.

## NRECA FINANCIAL MODEL – SAMPLE PROJECT

Tables 6, 7, 8 and 9 illustrate one of several scenarios analyzed for the Cooperativa Electrica Fronteriza in the Dominican Republic. This scenario projects a significant unfunded working capital requirement. Part of the purpose of the scenario was to identify that amount so as to be able to negotiate various possible solutions, including increased grant assistance, softer loan terms, and preferential power rates.

## Table 6. Results: Income Statement (Cooperativa Electrica Fronteriza)

| SCENARIO — Fronteriza - Indexed Tariffs — US$ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| INCOME STATEMENT | | | | | | | | | | |
| Revenue | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 |
| Residential | 1,958,688.0 | 2,763,154.0 | 3,289,197.0 | 3,696,106.0 | 4,107,507.0 | 4,564,477.0 | 4,882,432.0 | 5,222,288.0 | 5,527,957.0 | 5,851,870.0 |
| Commercial | 235,284.0 | 335,469.0 | 403,601.0 | 458,373.0 | 514,827.0 | 578,200.0 | 631,130.0 | 688,866.0 | 744,090.0 | 803,780.0 |
| Agricultural | 62,373.0 | 84,827.0 | 97,339.0 | 105,473.0 | 113,016.0 | 121,085.0 | 123,147.0 | 126,147.0 | 127,409.0 | 128,683.0 |
| Small Industrial | 28,591.0 | 39,657.0 | 46,411.0 | 49,354.0 | 51,900.0 | 54,571.0 | 56,816.0 | 59,147.0 | 60,933.0 | 62,772.0 |
| Large Industrial | 96,949.0 | 100,720.0 | 104,779.0 | 109,002.0 | 113,395.0 | 117,964.0 | 121,525.0 | 125,195.0 | 128,976.0 | 132,871.0 |
| Street Lights | 12,584.0 | 12,961.0 | 13,348.0 | 14,280.0 | 15,277.0 | 16,344.0 | 16,833.0 | 17,336.0 | 17,855.0 | 18,390.0 |
| Total Revenue | 2,394,470.0 | 3,336,790.0 | 3,954,678.0 | 4,432,592.0 | 4,915,927.0 | 5,452,647.0 | 5,831,890.0 | 6,238,987.0 | 6,607,229.0 | 6,998,376.0 |
| Expenses | | | | | | | | | | |
| Purchased Power | 3,264,624.0 | 2,958,446.0 | 3,051,679.0 | 3,357,145.0 | 3,693,720.0 | 4,064,601.0 | 4,312,783.0 | 4,576,634.0 | 4,857,166.0 | 5,155,452.0 |
| Operations & Maintenance | 83,000.0 | 85,490.0 | 88,055.0 | 90,096.0 | 93,417.0 | 96,220.0 | 99,106.0 | 102,080.0 | 105,142.0 | 108,296.0 |
| Customer & Variable O&M | 112,545.0 | 115,917.0 | 119,389.0 | 127,740.0 | 136,674.0 | 146,234.0 | 150,662.0 | 155,224.0 | 159,926.0 | 164,771.0 |
| Administration & General | 24,000.0 | 24,720.0 | 25,462.0 | 26,225.0 | 27,012.0 | 27,823.0 | 28,657.0 | 29,517.0 | 30,402.0 | 31,315.0 |
| Professional Services | 20,000.0 | 20,600.0 | 21,218.0 | 21,855.0 | 22,510.0 | 23,185.0 | 23,881.0 | 24,597.0 | 25,335.0 | 26,095.0 |
| Insurance | 66,786.0 | 66,786.0 | 66,786.0 | 66,786.0 | 66,786.0 | 66,786.0 | 66,786.0 | 66,786.0 | 66,786.0 | 66,786.0 |
| Sales Tax | 71,834.0 | 100,104.0 | 118,640.0 | 132,978.0 | 147,478.0 | 163,579.0 | 174,970.0 | 187,170.0 | 198,217.0 | 209,951.0 |
| Total Expenses | 3,642,789.0 | 3,372,063.0 | 3,491,229.0 | 3,822,825.0 | 4,187,597.0 | 4,588,428.0 | 4,856,845.0 | 5,142,008.0 | 5,442,974.0 | 5,762,666.0 |
| EBITDA | (1,248,319) | (35,273) | 463,449.0 | 609,767.0 | 728,330.0 | 864,219.0 | 975,495.0 | 1,096,980.0 | 1,164,255.0 | 1,235,710.0 |
| Depreciation & Amortization | 87,468.0 | 97,081.0 | 97,081.0 | 97,081.0 | 97,081.0 | 97,081.0 | 137,854.0 | 94,691.0 | 100,717.0 | 106,924.0 |
| EBIT | (1,335,787) | (132,354) | 366,368.0 | 512,686.0 | 631,249.0 | 767,138.0 | 837,641.0 | 10,002,289.0 | 1,063,537.0 | 1,128,786.0 |
| Interest on Initial System | 88,474.0 | 84,673.0 | 80,643.0 | 76,373.0 | 71,845.0 | 67,047.0 | 61,960.0 | 56,568.0 | 50,853.0 | 44,794.0 |
| Interest on Expansion System | - | - | - | - | - | 60,548.0 | 66,634.0 | 72,453.0 | 77,967.0 | |
| EARNINGS BEFORE TAXES | (1,424,260) | (217,026) | 285,726.0 | 435,713.0 | 559,402.0 | 700,091.0 | 715,134.0 | 879,087.0 | 940,232.0 | 1,006,025.0 |
| Income Taxes | - | - | - | - | - | - | - | - | - | - |
| **NET INCOME** | **(1,424,260)** | **(217,026)** | **285,726.0** | **435,713.0** | **559,402.0** | **700,091.0** | **715,134.0** | **879,087.0** | **940,232.0** | **1,006,025.0** |

## Table 7. Results: Cash Flow Statement (Cooperativa Electrica Fronteriza)

| C-2 CASH FLOW STATEMENT | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Capital Expense | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 |
| Initial Plant | 70,217.0 | - | - | - | - | - | | | | |
| Expansion Plant | - | - | - | - | - | - | 10,193.0 | 1,463.0 | 1,507.0 | 1,552.0 |
| Total Cash Equity Expense | 70,217.0 | - | - | - | - | - | 10,193.0 | 1,463.0 | 1,507.0 | 1,552.0 |
| Cash Adjustments | | | | | | | | | | |
| Net Income | (1,424,260) | (217,026) | 285,726.0 | 435,713.0 | 559,402.0 | 700,091.0 | 715,134.0 | 879,087.0 | 940,232.0 | 1,006,025.0 |
| Less Principal Payments | | | | | | | | | | |
| Initial System | 63,351.0 | 67,152.0 | 71,181.0 | 75,452.0 | 79,979.0 | 84,778.0 | 89,865.0 | 95,257.0 | 100,972.0 | 107,031.0 |
| Expansion System | - | - | - | - | - | - | 43,355.0 | 52,177.0 | 61,716.0 | 72,019.0 |
| Plus Depreciation | 87,468.0 | 97,081.0 | 97,081.0 | 97,081.0 | 97,081.0 | 97,081.0 | 137,854.0 | 94,691.0 | 100,717.0 | 106,924.0 |
| Net Cash from Operations | (1,400,143) | (187,097) | 311,625.0 | 457,341.0 | 576,504.0 | 712,393.0 | 719,768.0 | 826,343.0 | 878,261.0 | 933,900.0 |
| ANNUAL CASH FLOW | (1,470,360) | (187,097) | 311,625.0 | 457,341.0 | 576,504.0 | 712,393.0 | 709,575.0 | 824,881.0 | 876,754.0 | 932,348.0 |

## Table 8. Sources and Uses of Funds (Cooperativa Electrica Fronteriza)

| C-3 SOURCES AND USES OF FUNDS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Project Financing | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 |
| Grant | 5,476,940.0 | - | - | - | - | - | - | - | - | - |
| Equity/Capital Reserve | 70,217.0 | - | - | - | - | - | 10,193.0 | 1,463.0 | 1,507.0 | 1,552.0 |
| Debt | 1,474,561.0 | - | - | - | - | - | 1,009,126.0 | 144,803.0 | 149,147.0 | 153,621.0 |
| Total | 7,021,718.0 | - | - | - | - | - | 1,019,319.0 | 146,266.0 | 150,654.0 | 155,173.0 |
| Member Equity Payments | 12,934.0 | 86,477.0 | 90,331.0 | 99,799.0 | 110,041.0 | 37,966.0 | 29,580.0 | 39,799.0 | 35,790.0 | 31,172.0 |
| Cash from Operations | (1,400,143) | (187,097) | 311,625.0 | 457,341.0 | 576,504.0 | 712,393.0 | 719,768.0 | 826,343.0 | 878,261.0 | 933,900.0 |
| TOTAL SOURCES | 5,634,509 | (100,620) | 401,956 | 557,140 | 686,545 | 750,359.0 | 1,768,667.0 | 1,012,408.0 | 1,064,705.0 | 1,120,245.0 |
| CAPITAL INVESTMENT | 7,021,718 | - | - | - | - | - | 1,019,319.0 | 146,266.0 | 150,654.0 | 155,173.0 |
| NET CASH | (1,387,209) | (100,620) | 401,956.0 | 557,140.0 | 686,545.0 | 750,359.0 | 749,348.0 | 866,142.0 | 914,051.0 | 965,072.0 |
| ACCUMULATED CASH | (1,387,209) | (1,487,829) | (1,085,873) | (528,733) | 157,812.0 | 908,171.0 | 1,657,519.0 | 2,523,661.0 | 3,437,712.0 | 4,402,784.0 |

## Table 9. Results: Project Indicators (Cooperativa Electrica Fronteriza)

| C-4 PROJECT INDICATORS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 |
| Cash Return on Equity | -1975.6% | -143.3% | 572.4% | 793.5% | 977.7% | 1068.6% | 1052.7% | 1231.4% | 1299.6% | 1372.2% |
| Debt Service Coverage Ratio | (8.2) | (0.2) | 3.1 | 4.0 | 4.8 | 5.7 | 3.8 | 4.1 | 4.1 | 4.1 |
| Energy Requirements (MWH) | 30,244.0 | 26,397.0 | 27,025.0 | 29,718.0 | 32,684.0 | 35,951.0 | 38,139.0 | 40,466.0 | 42,939.0 | 45,569.0 |
| Coincident Peak (MW) | 8.4 | 8.2 | 8.6 | 9.5 | 10.4 | 11.5 | 12.2 | 13.0 | 13.7 | 14.6 |
| Primary Line (km) | 215.0 | 215.0 | 215.0 | 215.0 | 215.0 | 215.0 | 216.0 | 222.0 | 229.0 | 236.0 |
| Households Served | 12,000.0 | 12,360.0 | 12,731.0 | 13,622.0 | 14,575.0 | 15,596.0 | 16,064.0 | 16,546.0 | 17,042.0 | 17,553.0 |
| Population Coverage | 49% | 51% | 52% | 56% | 60% | 64% | 66% | 68% | 70% | 72% |
| Additional Working Captial Requirement | 1,487,830 <<Caution! This cash requirement is not funded. Iteratively adjust Initial Working Capital on Input sheet | | | | | | | | | |
| Internal Rate of Return on Equity | 23.7% | | | | | | | | | |