A Spreadsheet Algorithm for Determining the Economic Feasibility of Micro-CHP Systems in the Arkansas Manufacturing Sector

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A Spreadsheet Algorithm for Determining the Economic Feasibility of Micro-CHP Systems in the Arkansas Manufacturing Sector

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Mechanical Engineering

by

Ford Lewallen
University of Arkansas
Bachelor of Science in Mechanical Engineering, 2014

August 2017
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This thesis is approved for recommendation to the Graduate Council.

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Abstract

Combined heat and power (CHP) systems are not new to the market. However, advances in technology, specifically MicroTurbines, have presented new opportunities for installations of micro-CHP units - defined as 50 kWe to 300 kWe, specifically at small- to medium-sized industrial facilities. One pressing concern is whether or not an industrial plant has a high enough process thermal load requirement to fully utilize the energy output.

This thesis will discuss simulations that were run on several actual electric and thermal load combinations, which correspond to types of manufacturing facilities commonly found in Arkansas. Analysis of the plant usage profiles will identify economically feasible scenarios from CHP production based on electric and thermal loads, electric demand and energy costs, the cost of natural gas, and CHP unit size and efficiencies. The spreadsheet algorithm will be written in a form to allow a user to select utility rate structures from major utility companies in Arkansas, or customize their own rate schedule, and enter their monthly energy usages and demands. The user can then compare and contrast costs and savings of different CHP units, and then make informed decisions on whether a company would benefit from installing a CHP system.
# Table of Contents

Chapter 1: Background .................................................................................................................. 1

1.1 Introduction .......................................................................................................................... 1

1.2 History .................................................................................................................................. 3

1.3 CHP Today ............................................................................................................................ 6

1.3.1 Efficiency ......................................................................................................................... 6

1.3.2 Pollutant Emissions .......................................................................................................... 6

1.3.3 DOE Installations ............................................................................................................. 6

1.4 Types of CHP ....................................................................................................................... 7

1.5 Commercial and Residential Sectors .................................................................................. 8

1.6 Industry .................................................................................................................................. 10

1.6.1 Applications ..................................................................................................................... 10

1.6.2 MicroTurbines .................................................................................................................. 10

1.7 Arkansas’ Interconnection Laws ......................................................................................... 13

1.8 Justification for Study .......................................................................................................... 14

Chapter 2: Methodology ............................................................................................................. 16

2.1 CHP Analysis Algorithm Tool Instructions ....................................................................... 20

2.2 Customizable Rate Schedule Instructions .......................................................................... 37

2.3 Additional Instructions ........................................................................................................ 48

Chapter 3: Verification ................................................................................................................ 50

3.1 Cooper Union CHP System ............................................................................................... 50
3.1.1 No CHP System Operation ........................................................................................................... 50
3.1.2 Electrical Demand Recalculations .................................................................................................. 53
3.1.3 Peak Demand Charge ..................................................................................................................... 54
3.2 CHP System Operation ...................................................................................................................... 57
3.3 Retrofitted CHP System Operation .................................................................................................... 60
3.4 RFP CHP System Operation ............................................................................................................... 62
   3.4.1 RFP CHP System ......................................................................................................................... 62
   3.4.2 Simulation 4 ................................................................................................................................. 63
3.5 Verification Conclusion and Errors ..................................................................................................... 65
Chapter 4: Potential Savings Analysis & Discussion .................................................................................... 66
   4.1 Utility Rates Analysis and Discussion ............................................................................................... 66
   4.2 Impact on CHP Sizing ....................................................................................................................... 70
Chapter 5: Arkansas Case Studies’ Results and Discussion ......................................................................... 72
   5.1 Sweet Potato Plant .......................................................................................................................... 72
   5.2 Statewide Scenario Analysis ............................................................................................................ 78
   5.3 Discussion ........................................................................................................................................ 80
Chapter 6: Conclusions ............................................................................................................................. 84
References .................................................................................................................................................. 86
Appendix A: Validation ............................................................................................................................... 89
Appendix B: Detailed Algorithm Flowcharts .............................................................................................. 109
Appendix C: VBA Algorithm Code ........................................................................................................... 130
Select Electric Rate Schedule ................................................................. 131
Calculate Electric Utility Cost .................................................................. 136
Create Customizable Electric Rate Schedule Table and Inputs Cells ..................... 141
Calculate Customizable Rate Schedule Electric Utility Cost .................................. 177
Select Natural Gas Rate Schedule .................................................................. 216
Calculate Natural Gas Utility Cost ................................................................. 221
Create Customizable Natural Gas Rate Schedule Table and Inputs Cells ................. 225
Calculate Customizable Rate Schedule Natural Gas Utility Cost .............................. 255
Calculate CHP Thermal Inputs and Output ...................................................... 279
Calculate Proposed Utility Usages and Costs .................................................... 280
Calculate Economic Performance ................................................................ 332
Chapter 1: Background

1.1 Introduction

Combined Heat and Power (CHP) generation is defined as the sequential production of thermal and electrical energy from a single fuel source. CHP, also known as cogeneration, is not a technology but an approach, rather, which has been around for over a century in which separate technologies are integrated to achieve a high efficiency of energy production.

CHP systems are comprised of four main components. The prime mover produces mechanical energy by combustion of a fuel. This could be a reciprocating engine or a steam or gas turbine, among other several other options. An electricity generator converts the mechanical energy created by the prime mover into electricity. A heat recovery system uses a heat exchanger to recover heat (thermal energy) from exhaust gas or from a cooling jacket. Finally, each CHP system must have a control system to control individual components, such as exhaust gas flow temperature or pressure, to ensure synchronicity of the whole system.

Two types of general cycles are defined. The topping cycle (shown in Figure 1.1) uses a fuel as the prime mover to generate electricity or mechanical power as first means of work done. The system then recovers the waste or exhaust heat to provide process heat, hot water or steam, or provide space heat. Topping CHP systems are designed to meet a baseload thermal demand.
The second approach is the bottoming cycle (shown in Figure 1.2). In the bottoming cycle, also known as waste heat to power, the thermal demand of a furnace or other high temperature industrial process is met by the fuel first. Then the rejected/waste/exhaust heat is recovered for power production, typically in a boiler or steam turbine. Bottoming cycles are rarely economical due to the low efficiency of electricity generation with the low temperature heat [Rohrer, 1996].
In large systems it is possible to construct a combined cycle. In the combined cycle the first prime mover is a combustion turbine used to generate electricity. The waste heat is recovered and used to produce steam, which then powers a steam turbine. If the temperature of the steam is high enough after passing through the steam turbine it may be used to support process requirements.

1.2 History

Perhaps the first application of combined heat and power was in the 1882 at Thomas Eddison’s Pearl Street Station. The world’s first central power plant produced grid electricity while also distributing the waste heat thermal load in the form of steam to nearby industrial sites for manufacturing processes as well as to local buildings for space heat. By the early 20th century, most industrial plants generated their own electricity on-site. And it’s estimated that 58% of the total power produced in these plants utilized cogeneration (Aung, 2002).
As a result of the stock market crash in 1929 congress passed the Public Utility Holding Company Act (PUHCA) in 1935 to essentially prevent utility holding companies from holding shares of any other company. It did so by requiring any firm that sold electricity to another party, even in the smallest amount and unrelated to the firm’s primary line of business, to be subjected to profit regulation by the state (Fox-Penner, 1990). Utility holding companies had been relying on the consistent utility company income to sponsor riskier business ventures around the world. When the stock market crashed the banks asked for their loans from the holding companies and a total of 53 of these holding companies had to file for bankruptcy.

The development of large utility plants by the 1950’s provided cheaper energy costs than on-site production. Industrial plants had use for recovering the extra heat for steam and other processes. Power plants had no such use and could not effectively transport the heat to the industrial sites. Additionally, low fuel costs in this time drove industrial plants to ignore the energy conservation opportunity provided by cogeneration. Installing less costly and less efficient boilers were judged to be the most cost efficient option and were chosen in lieu of more energy efficient but more expensive boilers. Between 1950 and 1974 on-site cogeneration contributions fell from 15% to 4% of total electricity generated in the United States.

An increased regulation of electricity generation and the availability of low-cost liquid and gaseous fuels discouraged cogeneration. The most common CHP configuration was a bottoming cycle, using a boiler to generate steam and then recovering excess steam to power an electric generator. And due to the complexity and high capital expenses of this configuration, CHP systems were largely confined to 50 MWe and higher.

The oil crisis of 1974 pushed utility companies to invest in coal and nuclear power plants. The costs of the investments trickled down to the consumer in the form of high electricity rates.
In response, Jimmy Carter and Congress passed the Public Utility Regulated Policy Act (PURPA) was to promote alternative fuel options, establish a market for distributed generation, and to encourage high-energy efficiency standards. The act required the nearest utility to purchase all power added to the grid by a Qualifying Facility (QF) of cogeneration at a rate equal to the utility’s full avoided cost. This rate was previously mandated by the state. To be a QF of cogeneration, non-utility power generation must have met the following efficiency standards:

\[
42.5\% \leq \frac{(\text{Power Output} + \frac{1}{2} \text{Useful Thermal Output})}{\text{Energy input}}
\]

Equation 1.1

To be an Independent Power Producer (IPP) QF a non-utility power generating plant must produce its electricity via at least one of several renewable fuel sources, such as wind, solar, or hydro-electric energy.

The combination of mandating the possibility of connection and sale of electricity to the grid, plus reasonable rates for backup electricity provided a guaranteed market for on-site industrial power generators. America saw a 300% increase in non-utility generators from 1978 to 1992 (Kolanowski, 2000). CHP technology surged in this time period until the Energy Policy Act of 2005 (EPAct 2005) put a damper on the CHP development. Under the EPAct 2005 utility companies are no longer obliged to purchase power.

While this may discourage on-site CHP and distributed generation to some extent, the U.S. government has enacted several policies over the last couple of decades to promote technological advances in energy efficiency. Likewise, individual states have recognized their responsibility to promote energy efficiency by developing incentives, interconnection requirements, and simplifying environmental permitting procedures (Sweetser, 2015).
1.3 CHP Today

1.3.1 Efficiency. The desire to install CHP systems to provide on-site electric and thermal loads is driven by the overall efficiency of the system. Electricity generator efficiencies usually lie within the range of 30 to 35%. And the remaining thermal energy is wasted. Applying a heat recovery system to the exhaust gas raises the efficiency of the overall cogeneration system often times to between 80% and 90%. If the CHP generation site has a need for the recovered thermal load, and uses it, then it decreases the average energy rate. CHP boasts another advantage over traditional electricity generation because it minimizes distribution loss when the electricity is produced locally. Energy is lost by transforming the voltage up to the required level for transporting over distances, and then down again to the proper levels for end use. There are also the losses from the resistance over the wire, which is a function of distance. And, of course, it locally produces heat for space or process heating. And natural gas prices are regionally dependent due to the cost of transportation over long distances.

1.3.2 Pollutant Emissions. Using Natural Gas as the prime mover in energy production has lower CO2 emissions per unit of electricity in comparison to conventional thermal power plants (Mansour, 2007). Another environmental advantage of combining heat and power production is that often times at utility plants heat is pumped into lakes. Raising the water temperature has a negative effect on the aquatic habitat (Harris, 2014). Renewable energy sources, such as fuel cells, have no CO2 emissions.

1.3.3 DOE Installations. Europe and Asia have long been leading the way in taking advantage of the benefits and energy savings of on-site power generation and the applications of waste heat (Harris, 2014). North America has not been forced to invest in the infrastructure due to acceptable utility rates, whereas other parts of the world have been driven into higher
efficiency operations. However, this landscape in North America is changing. Electricity produced by CHP is expected to be 24% by 2030, twice the current capacity (DiCampli, 2013).

CHP schemes ranging from 15 kWe to 100 MWe have been applied for over one hundred years. Economic viability of combined heat and power schemes relies on highly utilizing the heat production. Most literature indicates both heat and power need to be fully utilized for 4,500 hours/year.

Currently, the majority of installed CHP systems in the range of 50 kWe to 300 kWe are supporting hospitals, educational buildings, hotels or multi-family housing, waste and waste water treatment. According to the Department of Energy (DOE) CHP Project Profiles Database (PPD) only one CHP installation in the manufacturing market sector was in this range. The manufacturing sector included the following installations: 280 kWe (Coffee and tea mfg.); 390 kWe (plastics); 750 kWe (plastics); and up to 200 MWe (anomaly) and 20 MWe. Pulp and paper market sector installed a 283 kWe biomass steam turbine.

1.4 Types of CHP

Steam turbines are a form of a topping cycle. This type of cogeneration is capital intensive, suitable only for large-scale process heat requirement. Steam turbines configurations are most suitable for industrial facilities where solid fuel feeds the boiler.

Natural gas (NG) combustion turbines ensure less capital costs compared to steam turbine due to lack of a boiler. NG is more environmentally friendly than the oil that steam turbines use. Some systems generate steam from exhaust gas, which can be used to generate extra work or electricity in Heat Recovery Steam Generator (HRSG) (Aung, 2002). Some generators are able to function on multiple fuel sources. They are designed to run on the most economic fuel at the time.
Fuel cells use hydrogen and water to generate electrical current with water and heat as byproducts. They offer no pollution, low maintenance, few moving parts, and high efficiency and a flexible heat to power ratio. The combination of reduced costs of fuel cell systems due to technological advances and progress of safety code infrastructure suggest fuel cell systems are the most feasible choice for residential, single-family CHP production. However, the technology is still being developed and initial costs could remain a drawback.

The Organic Rankine Cycle (ORC) is based on the process using an organic working fluid as opposed to water. Biomass is the world’s 4th largest energy source and a crucial fuel source for many developing countries. The ORC biomass-fired CHP units are now commercially available in the range of 400 kWe to 1.5 MWe. (Dong, 2009).

Reciprocating engines, typically stirling engines or internal combustion engines, offer a high efficiency for small scale applications such as 15 kWe or less. However there are many moving parts which typically require more maintenance. Stirling engines need maintenance every 5,000 to 8,000 hours (Onovwiona, 2004).

MicroTurbines have few moving parts, less pollution, comparable efficiency, low capital costs, low maintenance, and fuel flexibility. The absence of reciprocating and friction components means few balancing problems and the use of lubricating oil is low.

1.5 Commercial and Residential Sectors

Commercial sector buildings include healthcare buildings, institutional buildings, hotels, and more. The commercial sector includes CHP is a good match in the commercial sector because most commercial buildings are high volume (space heat), a high water heating load, and have a significant electric load; and a relatively constant one at that. CHP technology in commercial applications really began to emerge in the mid 2000’s. It was already relatively
common in industrial applications, however not at the micro-CHP scale yet (Zogg, 2005). Health care buildings dominate the commercial market with about 2/3 of the installations and over 90% of the capacity of those installations (Zogg, 2005). Most systems are in the range of 150-500 kWe. What makes CHP such a viable option in the commercial sector when compared to industry is that the buildings typically have a lower ratio of thermal to electric load.

Using extra waste heat to drive absorption chillers, known as trigeneration or Combined Cooling, Heat and Power (CCHP), is also a common application in the commercial sector in order to raise efficiency and help to meet the space cooling load.

Multi-family CHP (10-30kWe) and single-family (<10 kWe) CHP configurations consist of reciprocating internal combustion (IC) engines, MicroTurbines, fuel cells and external combustion Stirling engines. As of 2006 IC engines were the only cost effective option, but they operate at undesirably high emission levels. MicroTurbines have lower efficiencies at lower energy output sizes (Onovwiona, 2004). More are being developed below the 25-80 kWe range. Fuel cells, IC engines, and Stirling engines are suitable for single-family homes and MicroTurbines are suitable for multi-family residencies, commercial, and institutional applications.

Japan surely leads the exploration into single-family home sized CHP units, if not for all residential applications. While Europe is not far behind, North America simply does not have the market demand for the single-family home systems yet. In addition to the relatively warm climates and low fuel prices, single-family homes don’t typically have coinciding thermal and electric demands. But multi-family residential homes thermal and electric loads don’t fluctuate as much.
1.6 Industry

1.6.1 Applications. According to the U.S. Energy Information Administration (EIA), industrial energy consumption is the third largest end-use sector at 23% of the entire planet’s energy use. While the major end-use on the planet is transportation, second is energy lost in the generation and transmission of electricity.

Some of the most suitable industries for CHP installations include food processing, chemical processing, pulp and paper mills, and petroleum refining. The key to achieving a reasonable payback period is designing to the thermal load. Usually CHP units are selected to match the thermal base load of the facility. The electricity generation, which can be three to four times less than the usable thermal energy generated, serves as a reliable and consistent reduction of monthly electric utility bills. One major obstacle in earning back the investment of a CHP system is the fact that the thermal baseloads fluctuate seasonally. So while a manufacturing plant may have what seems to be an annual thermal load that can be addressed with a CHP unit, the system is not efficient enough if it is designed closer to peak thermal loads.

Food and chemical processing industries also have cooling loads. These plants can fully utilize their CHP system’s energy production by including an absorption chiller in a trigeneration configuration.

1.6.2 MicroTurbines. MicroTurbines run on what is known as a Brayton cycle. Air is compressed and then preheated by exhaust air in a recuperator to increase efficiency, thus increasing the expansion power from the combustion in the turbine. Fuel is burned at the same pressure as the air. A permanent magnet generator rotor is turned by spinning turbine, which converts mechanical energy into electrical energy.
In the early 2000’s many were looking to MicroTurbines as the future of the micro-CHP market. In comparison to reciprocating engines, gas turbines have fewer moving parts and less vibration, which translates into less maintenance costs. They have multi-fuel capabilities and a low noise output. At this time MicroTurbines on the market ranged from about 25 to 80 kWe, and for this size application, reciprocating engines were more efficient in terms of electrical energy production.

Now it is common for vendors to offer packages of multiple MicroTurbines integrated to form one CHP system. For example, AEGIS offers CHP systems up to 300 kWe by combining four of their 75 kWe MicroTurbines. Capstone offers the option as well, having combined five 60 kWe MicroTurbines to create a 300 kWe CHP system for Astor Chocolate. This helps the facility adhere to the state’s net metering rules by shutting down two of the MicroTurbines at night time to avoid over-production of electricity.

In 2005 advanced IC engines were considered more efficient in electricity production than MicroTurbines (42% vs 26-31%). However, new research predicts that a 500 kWe two-shaft intercooled and recuperated gas turbine is capable of efficiencies up to 45%. Aurelia Turbines and LUT were expected to test first prototype by the end of 2015. This shows that MicroTurbines are still being developed and that there is relatively little information on efficiency as well as maintenance.
<table>
<thead>
<tr>
<th>Company</th>
<th>Fuel</th>
<th>kWe</th>
<th>Btu/hr</th>
<th>Elec Eff</th>
<th>Therm Eff</th>
<th>Tot Eff</th>
<th>Modular</th>
<th>Hot Water</th>
<th>Steam</th>
<th>Exhaust</th>
<th>Fuel Input</th>
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<td>NG</td>
<td>75</td>
<td>523,000</td>
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<td>N/A</td>
<td>82%</td>
<td>YES</td>
<td>X</td>
<td>X</td>
<td>930</td>
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<td>Capstone</td>
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<td>30</td>
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<td>26%</td>
<td>64%</td>
<td>90%</td>
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<td>X</td>
<td>X</td>
<td>.31 kg/s</td>
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<td>61%</td>
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<td>X</td>
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<td>57%</td>
<td>90%</td>
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<td>X</td>
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<td>1.3 kg/s</td>
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<td>421,980</td>
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<td>54%</td>
<td>88%</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>840</td>
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<td>36%</td>
<td>54%</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>1620</td>
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<td>55%</td>
<td>91%</td>
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<td>X</td>
<td>X</td>
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<td>X</td>
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<td>80</td>
<td>426,518</td>
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<td>X</td>
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<td>X</td>
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<td>51%</td>
<td>86%</td>
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<td>X</td>
<td>X</td>
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<td>51%</td>
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<td>50%</td>
<td>86%</td>
<td>X</td>
<td>X</td>
<td></td>
<td>2537</td>
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<td>487,936</td>
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<td>50%</td>
<td>85%</td>
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<td>YES</td>
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<td>958,812</td>
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<td>50%</td>
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<td>Heat storage</td>
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<td>55%</td>
<td>91%</td>
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<td>Heat storage</td>
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<td>46%</td>
<td>85%</td>
<td>YES</td>
<td>Heat storage</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.1: Specifications of various available packaged CHP system
1.7 Arkansas’ Interconnection Laws

In July 2002, the Arkansas Public Service Commission (PSC) adopted net-metering rules allowing the interconnection of net-metered facilities to the existing electric utility grid. Eligible facilities include those that produce electric energy via solar, wind, hydroelectric, geothermal, or biomass resources including, but not limited to, fuel cells and MicroTurbines that generate electricity if the fuel source is entirely derived from renewable resources.

While the state created PSC to encourage CHP and clean energy, it did not include any updates that would apply to a CHP system where the prime mover is an ICE or MicroTurbine using natural gas or oil. The rules and regulations that apply to these types of CHP systems are described in the PURPA from 1968. Technological advances make it easy for CHP plant to qualify as a QF.

Each month the net-metering customer shall be billed the difference between the electricity supplied by an electric utility-this is measured in kilowatt-hours (kWh_e)-and the electricity generated by the net metering customer that is fed back into the grid. If the net metering customer has a net excess generation, in comparison to the electricity supplied by the electric utility, then the customer is credited with any accumulated kWh for the next monthly billing cycle. These credits shall roll over indefinitely into the succeeding annual and monthly billing cycles. It is required that the flow of electricity is metered in both directions.

The net-metering customer’s monthly peak demand is also offset by the power supplied by the CHP system. However, if a CHP system supplies more power than the customer’s monthly peak demand the customer will not receive any compensation.

If the net-metering customer has had net excess generation in their account for more than 24 months, the customer may choose to have the utility purchase the kWh at the electric utility’s
estimated average avoided cost rate for wholesale energy. But, the sum to be paid to the net-metering customer must be at least one hundred dollars ($100).

According to the Arkansas Public Commission’s Net Metering Rules a net-metering facility may redistribute their net excess kWh to one or more of the net-metering customer’s meters (additional meters). The meters must be in an account owned by the same customer. The customer shall provide the utility with a ranking of the meters to which the net excess generation shall be applied with at least 30 days’ notice.

In the case of industrial sized net metering facilities, equipment upgrades and their respective expenses usually incur, as required by the standard interconnection agreement.

If the net metering customer ceases to be a customer of the utility, ceases to operate the net-metered facility, or transfers the facility to another person, the utility will purchase any net excess generation accumulated according to the utility’s annual average avoided cost rate for wholesale energy.

1.8 Justification for Study

As stated in section 1.3, CHP installations are on the rise around the world and have begun to infiltrate their way into the North American markets. In the U.S., to this point, they are more common in Northern states and other areas with longer winters and higher utility rates. They are also generally larger applications. However, Arkansas is home to enough food processing plants, paper mills, and other types of manufacturing plants where micro-CHP systems often offer short payback periods. In addition, natural gas is inexpensive and the micro-CHP system types that consume natural gas continue to advance technologically-specifically MicroTurbines. Manufacturers are always trying to cut operating costs and government programs often looks favorably upon cutting emissions. Now is an appropriate time to explore the
Arkansas manufacturing sector’s CHP savings opportunities. A user friendly Excel VBA spreadsheet algorithm tool would be useful in providing manufacturers with a way to accurately determine the economic feasibility of a micro-CHP system.
Chapter 2: Methodology

If implementing micro-CHP systems in the state of Arkansas are proven economical, then there would be a need for an Arkansas-market inspired preliminary evaluation tool. This could save manufacturing leaders time before making a decision to hire a consultant.

An Excel VBA algorithm spreadsheet tool was created for manufacturing facilities to enter their utility information and run simulations with certain sizes and certain types of micro-CHP systems. The simulation uses electric energy savings, electric peak-demand reductions, and natural gas consumption increases to regenerate utility bills. In addition to utility cost savings, it also provides the Internal Rate of Return (IRR), SPP, and the ROI, which is the reciprocal of the SPP in percentage form.

\[
P : \text{Initial Investment}
\]
\[
n : \text{Life}
\]
\[
i : \text{Interest Rate}
\]
\[
C_i : \text{Cash Flow at the end of period } t
\]
\[
NPW = -P + \sum_{t=1}^{x} \frac{C_i}{(1+i)^t}
\]

**Figure 2.1:** Internal Rate of Return (listed as Interest Rate above) formula with variables, where NPW is the Net Present Worth

\[
SPP = \frac{(\text{Implementation Cost})}{(\text{Net Annual Savings})}
\]

**Equation 2.1**

\[
ROI = \frac{1}{(SPP)} \times 100
\]

**Equation 2.2**

To cater to manufacturers in the state, the tool includes models of appropriately sized rate schedules from local major electric and natural gas utility providers. In total, there are 10 electric utility rate schedules from Southwestern Electric Power Company (SWEPCO), Oklahoma Gas and Electric (OG&E), and Entergy built into the tool. In addition, there are nine natural gas
utility rate schedules from Black Hills Energy, Arkansas Oklahoma Gas Corporation (AOGC), and CenterPoint built into the tool. As the rates for each company are update, the user can access each company’s sheet in the spreadsheet file and change the values for any charge.

For each utility type there is also the option for the user to customize their own rate schedule. This is useful for manufacturing facilities located in smaller rural areas where electric co-ops and city-managed utilities are common.

Below is a generalized flowchart that begins with the plant’s usage profiles and the CHP’s operating specifications, uses the CHP information to create new usage profiles and calculates the associated savings, producing the IRR, SPP, and ROI. More detailed algorithm flowcharts can be found in Appendix B.
Figure 2.2: Algorithm flowcharts for calculating economic performance of CHP systems using algorithm spreadsheet tool (cont. on next page)
Figure 3.2: (Cont.) Algorithm flowcharts for calculating economic performance of CHP systems using algorithm spreadsheet tool.
2.1 CHP Analysis Algorithm Tool Instructions

The following sections will provide instructions for how to enter a year’s up to 12 months of a manufacturing facility’s electric and natural gas utility information, CHP system specifications, and implementation cost information to calculate economic performance measures, such as net annual savings, IRR, SPP, and ROI. These instructions show a scenario for a sweet potato products plant on utility rate schedules specific to Springdale, Arkansas.

1. Select electric and natural gas utility rate schedules on the first sheet, titled “Ground Zero.”
a. Click the “Begin with Main Userform” button

**Figure 2.3:** Step 1a of section 2.1
b. Select electric utility rate schedule; input taxes and fees; select service options; click “Next Page”

Figure 2.4: Step 1b of section 2.1
c. Select natural gas utility rate schedule; input taxes and fees; select service options; click “Next Page;” exit the userform

Figure 2.5: Step 1c of section 2.1
d. Enter utility information into the blue highlighted cells; click “Calculate Electric Cost;” click “Calculate NG Cost”

![Figure 2.6: Step 1d part one of section 2.1](image-url)
Figure 2.7: Step 1d part two of section 2.1
<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Total Consumption CCF</th>
<th>Total Consumption MMBtu</th>
<th>Monthly Demand MMBtu</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>April</td>
<td>21,788.9</td>
<td>2,229.0</td>
<td>N/A</td>
</tr>
<tr>
<td>2016</td>
<td>May</td>
<td>24,828.9</td>
<td>2,540.0</td>
<td>N/A</td>
</tr>
<tr>
<td>2016</td>
<td>June</td>
<td>5,914.0</td>
<td>605.0</td>
<td>N/A</td>
</tr>
<tr>
<td>2016</td>
<td>July</td>
<td>10,156.4</td>
<td>1,039.0</td>
<td>N/A</td>
</tr>
<tr>
<td>2016</td>
<td>August</td>
<td>20,185.7</td>
<td>2,065.0</td>
<td>N/A</td>
</tr>
<tr>
<td>2016</td>
<td>September</td>
<td>24,134.9</td>
<td>2,469.0</td>
<td>N/A</td>
</tr>
<tr>
<td>2016</td>
<td>October</td>
<td>28,797.7</td>
<td>2,946.0</td>
<td>N/A</td>
</tr>
<tr>
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<td>November</td>
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<td>3,529.0</td>
<td>N/A</td>
</tr>
<tr>
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<td>December</td>
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<td>3,410.0</td>
<td>N/A</td>
</tr>
<tr>
<td>2017</td>
<td>January</td>
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<td>861.0</td>
<td>N/A</td>
</tr>
<tr>
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<td>February</td>
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<td>1,741.0</td>
<td>N/A</td>
</tr>
<tr>
<td>2017</td>
<td>March</td>
<td>25,474.1</td>
<td>2,606.0</td>
<td>N/A</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>254,545.5</td>
<td>26,040.0</td>
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</tr>
</tbody>
</table>

**Figure 2.8**: Step 1d part three of section 2.1
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<th>Year</th>
<th>Month</th>
<th>Total Consumption CCF</th>
<th>Total Consumption MMBtu</th>
<th>Monthly Demand Charge $</th>
<th>Delivery Charge $</th>
<th>Cost of Gas $</th>
<th>Sum of Riders Costs $</th>
<th>Demand Cost $</th>
<th>Subtotal Cost $</th>
<th>Total Taxes &amp; Fran. Tax $</th>
<th>Total $</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>April</td>
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<td>2,229.0</td>
<td>N/A</td>
<td>3,758.58</td>
<td>8,665.43</td>
<td>540.13</td>
<td>N/A</td>
<td>13,192.63</td>
<td>1,385.23</td>
<td>14,577.86</td>
</tr>
<tr>
<td>2016</td>
<td>May</td>
<td>24,828.9</td>
<td>2,540.0</td>
<td>N/A</td>
<td>4,282.99</td>
<td>9,874.47</td>
<td>501.54</td>
<td>N/A</td>
<td>14,987.49</td>
<td>1,573.89</td>
<td>16,561.18</td>
</tr>
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<td>June</td>
<td>3,914.0</td>
<td>625.0</td>
<td>N/A</td>
<td>1,020.16</td>
<td>2,351.99</td>
<td>119.46</td>
<td>N/A</td>
<td>3,820.10</td>
<td>401.11</td>
<td>4,221.21</td>
</tr>
<tr>
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<td>July</td>
<td>10,156.4</td>
<td>1,059.0</td>
<td>N/A</td>
<td>1,751.98</td>
<td>4,039.20</td>
<td>205.16</td>
<td>N/A</td>
<td>6,329.83</td>
<td>864.11</td>
<td>5,193.94</td>
</tr>
<tr>
<td>2016</td>
<td>August</td>
<td>20,185.7</td>
<td>2,065.0</td>
<td>N/A</td>
<td>4,482.04</td>
<td>8,027.86</td>
<td>407.75</td>
<td>N/A</td>
<td>12,246.14</td>
<td>1,285.85</td>
<td>13,531.99</td>
</tr>
<tr>
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<td>September</td>
<td>24,134.9</td>
<td>2,469.0</td>
<td>N/A</td>
<td>4,163.27</td>
<td>9,598.45</td>
<td>487.52</td>
<td>N/A</td>
<td>14,577.73</td>
<td>1,550.66</td>
<td>16,128.39</td>
</tr>
<tr>
<td>2016</td>
<td>October</td>
<td>28,797.7</td>
<td>2,946.0</td>
<td>N/A</td>
<td>4,967.60</td>
<td>11,432.83</td>
<td>581.71</td>
<td>N/A</td>
<td>17,330.62</td>
<td>1,819.72</td>
<td>19,150.34</td>
</tr>
<tr>
<td>2016</td>
<td>November</td>
<td>54,496.6</td>
<td>3,529.0</td>
<td>N/A</td>
<td>5,550.56</td>
<td>13,719.29</td>
<td>696.83</td>
<td>N/A</td>
<td>20,695.27</td>
<td>2,173.00</td>
<td>22,868.27</td>
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<tr>
<td>2016</td>
<td>December</td>
<td>53,333.3</td>
<td>3,410.0</td>
<td>N/A</td>
<td>5,750.00</td>
<td>13,256.67</td>
<td>673.33</td>
<td>N/A</td>
<td>20,008.49</td>
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<td>22,111.38</td>
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<tr>
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<td>January</td>
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<td>861.0</td>
<td>N/A</td>
<td>1,451.83</td>
<td>3,347.21</td>
<td>170.01</td>
<td>N/A</td>
<td>5,297.55</td>
<td>556.24</td>
<td>5,853.79</td>
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<tr>
<td>2017</td>
<td>February</td>
<td>17,018.6</td>
<td>1,741.0</td>
<td>N/A</td>
<td>2,935.70</td>
<td>6,768.29</td>
<td>343.78</td>
<td>N/A</td>
<td>10,376.26</td>
<td>1,089.51</td>
<td>11,465.76</td>
</tr>
<tr>
<td>2017</td>
<td>March</td>
<td>25,474.1</td>
<td>2,506.0</td>
<td>N/A</td>
<td>4,594.28</td>
<td>10,151.05</td>
<td>514.58</td>
<td>N/A</td>
<td>15,268.40</td>
<td>1,613.68</td>
<td>16,882.08</td>
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<tr>
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<td>254,545.5</td>
<td>26.040.0</td>
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<td>$3,401.52</td>
<td>$43,369.09</td>
<td>$101,232.73</td>
<td>$5,141.82</td>
<td></td>
<td>$154,225.52</td>
<td>$16,193.68</td>
<td>$170,419.20</td>
</tr>
</tbody>
</table>

**Figure 2.9:** Step 1d part three part four of section 2.1
e. Click “Return to Main Userform” button to continue to enter CHP specifications

Figure 2.10: Step 1e of section 2.1
2. If you arrive at the “CHP Info” sheet via the Main Userform, the CHP System Information tab of the userform will be visible. Otherwise, click the “Return to Main Userform” button and the CHP System Information tab of the userform will be visible.
a. Enter the CHP system information and click “Apply CHP Info”

Figure 2.12: Step 2a of section 2.1
b. The following two tables are produced from the CHP system information. They include CHP system information calculations and summaries of utility usage before and after CHP implementation, which are located on the CHP Info sheet.

![Table]

**Figure 2.13:** Step 2b part one of section 2.1
<table>
<thead>
<tr>
<th>Month</th>
<th>Total Charged kWh</th>
<th>Total Charged kW-mo</th>
<th>Actual Peak Demand kWh</th>
<th>Actual Peak Demand kW-mo</th>
<th>Total Charged MM-Btu</th>
<th>Peak Day Consumption MM-Btu Demand</th>
<th>Daily Peak Demand MM-Btu Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>635,400</td>
<td>2,599</td>
<td>2,599</td>
<td>2,229</td>
<td>N/A</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>May</td>
<td>618,840</td>
<td>2,599</td>
<td>2,599</td>
<td>2,540</td>
<td>N/A</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>June</td>
<td>597,480</td>
<td>2,584</td>
<td>2,584</td>
<td>605</td>
<td>N/A</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>July</td>
<td>621,400</td>
<td>2,592</td>
<td>2,592</td>
<td>1,039</td>
<td>N/A</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>August</td>
<td>664,400</td>
<td>2,582</td>
<td>2,582</td>
<td>2,065</td>
<td>N/A</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>September</td>
<td>711,180</td>
<td>2,412</td>
<td>2,412</td>
<td>2,469</td>
<td>N/A</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>October</td>
<td>782,520</td>
<td>2,411</td>
<td>2,411</td>
<td>2,946</td>
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<td>8</td>
<td>10</td>
</tr>
<tr>
<td>November</td>
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<td>2,413</td>
<td>3,520</td>
<td>N/A</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>December</td>
<td>613,640</td>
<td>2,412</td>
<td>2,412</td>
<td>3,410</td>
<td>N/A</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>January</td>
<td>568,360</td>
<td>2,414</td>
<td>2,414</td>
<td>861</td>
<td>N/A</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>February</td>
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<td>2,415</td>
<td>2,415</td>
<td>1,741</td>
<td>N/A</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>March</td>
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<td>2,423</td>
<td>2,606</td>
<td>N/A</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Totals</td>
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<td>29,856</td>
<td>26,609</td>
<td>N/A</td>
<td>71,3</td>
<td>4,898,800</td>
</tr>
</tbody>
</table>

**With CHP**

<table>
<thead>
<tr>
<th>Month</th>
<th>Total Charged kWh</th>
<th>Total Charged kW-mo</th>
<th>Total Charged kWh</th>
<th>Total Charged kW-mo</th>
<th>Total Charged MM-Btu</th>
<th>Peak Day Consumption MM-Btu Demand</th>
<th>Daily Peak Demand MM-Btu Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>412,400</td>
<td>0</td>
<td>2,299</td>
<td>N/A</td>
<td>3,301</td>
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<td>6</td>
</tr>
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<td>May</td>
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<td>3,612</td>
<td>5</td>
<td>3</td>
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<td>3</td>
<td>2</td>
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<td>2,292</td>
<td>N/A</td>
<td>2,283</td>
<td>4</td>
<td>3</td>
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<td>August</td>
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<td>N/A</td>
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<td>5</td>
<td>4</td>
</tr>
<tr>
<td>September</td>
<td>492,180</td>
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<td>2,112</td>
<td>N/A</td>
<td>3,541</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
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<td>563,520</td>
<td>0</td>
<td>2,111</td>
<td>N/A</td>
<td>4,018</td>
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<td>6</td>
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<tr>
<td>November</td>
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<td>0</td>
<td>2,113</td>
<td>N/A</td>
<td>4,601</td>
<td>7</td>
<td>5</td>
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<tr>
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<td>584,640</td>
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<td>2,112</td>
<td>N/A</td>
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</tr>
<tr>
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<td>38,164</td>
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</table>

*Figure 2.14: Step 2b part two of section 2.1*
c. The monthly utility costs before and after CHP implementation, and the monthly savings or losses are calculated when clicking the “Apply CHP Info” button. This table is displayed on the Costs and Savings sheet.

<table>
<thead>
<tr>
<th>Month</th>
<th>Without CHP</th>
<th></th>
<th></th>
<th>With CHP</th>
<th></th>
<th></th>
<th>Utility Cost Savings</th>
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<td>Natural Gas Utility Cost</td>
<td>Total Cost</td>
<td>Electric Utility Cost</td>
<td>Natural Gas Utility Cost</td>
<td>Total Cost</td>
<td></td>
</tr>
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<td>April</td>
<td>$51,489.18</td>
<td>$14,577.86</td>
<td>$66,067.04</td>
<td>$37,707.28</td>
<td>$22,395.39</td>
<td>$60,102.67</td>
<td>$5,964.36</td>
</tr>
<tr>
<td>May</td>
<td>$63,863.28</td>
<td>$16,561.18</td>
<td>$80,424.46</td>
<td>$46,503.51</td>
<td>$24,470.37</td>
<td>$70,973.87</td>
<td>$9,450.59</td>
</tr>
<tr>
<td>June</td>
<td>$62,252.39</td>
<td>$4,221.21</td>
<td>$66,513.60</td>
<td>$44,932.62</td>
<td>$14,850.52</td>
<td>$59,783.15</td>
<td>$6,730.46</td>
</tr>
<tr>
<td>July</td>
<td>$63,982.42</td>
<td>$6,988.94</td>
<td>$70,971.36</td>
<td>$46,622.65</td>
<td>$15,558.84</td>
<td>$62,221.49</td>
<td>$8,749.87</td>
</tr>
<tr>
<td>August</td>
<td>$66,808.24</td>
<td>$13,531.99</td>
<td>$80,340.23</td>
<td>$49,448.47</td>
<td>$21,318.02</td>
<td>$70,766.48</td>
<td>$9,573.75</td>
</tr>
<tr>
<td>September</td>
<td>$68,528.66</td>
<td>$16,108.40</td>
<td>$84,637.06</td>
<td>$51,168.89</td>
<td>$23,965.52</td>
<td>$75,165.40</td>
<td>$9,471.65</td>
</tr>
<tr>
<td>October</td>
<td>$58,155.76</td>
<td>$19,150.34</td>
<td>$77,306.10</td>
<td>$44,373.86</td>
<td>$27,180.00</td>
<td>$71,553.86</td>
<td>$5,752.24</td>
</tr>
<tr>
<td>November</td>
<td>$53,047.39</td>
<td>$22,868.27</td>
<td>$75,915.66</td>
<td>$39,265.49</td>
<td>$31,070.93</td>
<td>$70,336.42</td>
<td>$5,579.25</td>
</tr>
<tr>
<td>December</td>
<td>$49,072.57</td>
<td>$22,109.38</td>
<td>$71,181.95</td>
<td>$35,290.67</td>
<td>$30,276.72</td>
<td>$65,567.39</td>
<td>$5,614.56</td>
</tr>
<tr>
<td>January</td>
<td>$46,651.73</td>
<td>$5,853.79</td>
<td>$52,505.52</td>
<td>$32,869.83</td>
<td>$15,070.59</td>
<td>$47,940.42</td>
<td>$4,659.10</td>
</tr>
<tr>
<td>February</td>
<td>$44,521.11</td>
<td>$11,465.76</td>
<td>$55,986.87</td>
<td>$30,739.21</td>
<td>$19,268.51</td>
<td>$50,007.72</td>
<td>$5,979.16</td>
</tr>
<tr>
<td>March</td>
<td>$42,893.11</td>
<td>$16,982.08</td>
<td>$59,875.19</td>
<td>$29,111.22</td>
<td>$24,910.85</td>
<td>$54,022.07</td>
<td>$5,853.12</td>
</tr>
<tr>
<td>Totals:</td>
<td>$671,305.84</td>
<td>$170,419.20</td>
<td>$841,725.04</td>
<td>$488,033.70</td>
<td>$270,407.25</td>
<td>$758,440.95</td>
<td>$83,284.09</td>
</tr>
</tbody>
</table>

**Figure 2.15:** Step 2c of section 2.1
3. After clicking the “Apply CHP Info” button on the CHP System Information tab in the Main Userform, the Costs and Savings tab will be activated and the user will be brought to the Cost Savings sheet.

Figure 2.16: Step 3 image one of section 2.1

Figure 2.17: Step 3 image two of section 2.1
a. Input the CHP unit prime mover type, the unit’s additional cost, parts and labor costs, and select whether or not a federal MicroTurbine incentive is to be applied. Click “Calculate Cost Savings”

**Figure 2.18**: Step 3a of section 2.1
b. The table created by clicking the “Calculate Cost Savings” button presents the IRR, SPP, and ROI (in this case, the IRR cell displays, “Error,” because the CHP implementation will not pay for itself within 25 years.

![Table]

**Figure 2.19**: Step 3b of section 2.1
2.2 Customizable Rate Schedule Instructions

Instructions are given on how to create your own rate schedule. This set of instructions will create an electric rate schedule, which is nearly identical to the process for creating a natural gas rate schedule.

1. The customizable electric and natural gas rate schedule userforms can be activated by going to the “DIY El. Rates” sheet and the “DIY NG Rates” sheet, respectively. They can also be activated when selecting rate schedule in the Main Userform. After selecting this type of rate schedule, skip the Taxes, Fees, and Service Options and click “Next Page.”
Figure 2.20: Step 1 of section 2.2
2. The user is brought to the next page, which provides instructions, and then must click “Customize Electric Rate Schedule.” This tab can be reached via the previous step of the instructions, or simply by changing the tab at the top of the Main Userform.

Figure 2.21: Step 2 part one of section 2.2
Figure 2.22: Step 2 part two of section 2.2
3. The Customizable Electric Rate Schedule gives you the following options:

a. Energy

1. Seasonal rates
2. Peak time rates (variable by season if applicable)
3. Block expander rates (This cannot be combined with peak rates, but can be seasonal)
   a. Block sizes based on monthly peak demand
   b. Fixed block sizes

4. Up to 8 miscellaneous riders

b. Demand

1. Seasonal rates
2. Peak time rates (variable by season if applicable)
3. Minimum billed peak demand
4. Ratchet clause
   a. Ratchet percentage value
   b. Number of previous months the ratchet clause includes

5. Up to 8 miscellaneous riders

c. Miscellaneous

1. Taxes
2. Franchise Fee/Municipal Adjustment
3. First month of utility bills
4. First month of summer
5. Number of summer months
4. The Customizable Natural Gas Rate Schedule gives you the following options:

a. Energy
   1. Seasonal rates
   2. Peak time rates (variable by season if applicable)
   3. Block expander rates (This cannot be combined with peak rates, but can be seasonal)
      a. Block sizes based on monthly peak demand
      b. Fixed block sizes
   4. Up to 8 miscellaneous riders

b. Demand
   1. Seasonal rates
   2. Minimum billed peak demand
   3. Ratchet clause
      a. Ratchet percentage value
      b. Number of previous months the ratchet clause includes
   4. Up to 8 miscellaneous riders

c. Miscellaneous
   1. Taxes
   2. Franchise Fee/Municipal Adjustment
   3. First month of utility bills
   4. First month of summer
   5. Number of summer months
5. Once finished selecting all options, click “Create Utility Table and Input Cells.”

Figure 2.23: Step 5 of section 2.2
6. Input cells for rates, taxes, minimum-billed demand amounts, etc. are created as applicable. A table is created below these cells to input monthly usages.

![Excel Table]

**Figure 2.24:** Step 6 of section 2.2
7. After entering all information, click “Calculate Electric Costs”

![Excel Sheet with Calculations]

**Figure 2.25**: Step 7 of section 2.2
8. Clicking “Calculate Electric Costs” creates a table of summarized costs below the button. Next, click “Return to Select NG Rate Schedule” to apply the usage and cost information to the simulation going forward.

<table>
<thead>
<tr>
<th></th>
<th>Summer On-peak</th>
<th>Summer Off-peak</th>
<th>Winter</th>
<th>Summer On-peak Actual Demand</th>
<th>Summer Off peak Actual Demand</th>
<th>Winter Actual Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kWh</td>
<td>kWh</td>
<td>kWh</td>
<td>kw-mo</td>
<td>kw-mo</td>
<td>kw-mo</td>
</tr>
<tr>
<td>April</td>
<td>495,072</td>
<td>123,758</td>
<td>638,400</td>
<td>2,679.0</td>
<td>519.8</td>
<td>2,199.2</td>
</tr>
<tr>
<td>June</td>
<td>477,984</td>
<td>119,495</td>
<td>2,087.2</td>
<td>518.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>497,120</td>
<td>124,280</td>
<td>2,060.9</td>
<td>516.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>531,320</td>
<td>132,880</td>
<td>2,065.9</td>
<td>516.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2,412.6</td>
<td>2,412.2</td>
<td>2,412.8</td>
<td>2,412.0</td>
</tr>
<tr>
<td>September</td>
<td>713,180</td>
<td>2,414.4</td>
<td>2,414.8</td>
<td>2,414.8</td>
<td>2,414.8</td>
<td>2,414.8</td>
</tr>
</tbody>
</table>

![Figure 2.26: Step 8 image one of section 2.2](image-url)
<table>
<thead>
<tr>
<th>Month</th>
<th>Summer On-peak kWh</th>
<th>Summer Off-peak kWh</th>
<th>Winter kWh</th>
<th>Summer On-peak Actual Demand kW-mo</th>
<th>Summer Off-peak Actual Demand kW-mo</th>
<th>Winter Actual Demand kW-mo</th>
<th>kWh Cost ($)</th>
<th>kW-mo Cost ($)</th>
<th>Subtotal ($)</th>
<th>Taxes &amp; Fees ($)</th>
<th>Total ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>635,602</td>
<td>123,768</td>
<td>2,079</td>
<td>520</td>
<td>2,599</td>
<td>2,599</td>
<td>270,045.00</td>
<td>19,182.10</td>
<td>289,627.10</td>
<td>30,412.95</td>
<td>320,060.05</td>
</tr>
<tr>
<td>May</td>
<td>495,072</td>
<td>123,768</td>
<td>2,067</td>
<td>517</td>
<td>2,579</td>
<td>2,579</td>
<td>275,383.80</td>
<td>19,037.74</td>
<td>294,421.54</td>
<td>31,518.96</td>
<td>325,940.50</td>
</tr>
<tr>
<td>June</td>
<td>477,984</td>
<td>123,768</td>
<td>2,074</td>
<td>518</td>
<td>2,599</td>
<td>2,599</td>
<td>265,878.80</td>
<td>19,237.92</td>
<td>285,116.72</td>
<td>30,306.33</td>
<td>315,423.05</td>
</tr>
<tr>
<td>July</td>
<td>497,120</td>
<td>123,768</td>
<td>2,066</td>
<td>516</td>
<td>2,599</td>
<td>2,599</td>
<td>276,523.00</td>
<td>19,316.71</td>
<td>295,839.71</td>
<td>31,652.27</td>
<td>327,491.98</td>
</tr>
<tr>
<td>August</td>
<td>531,520</td>
<td>132,800</td>
<td>2,412</td>
<td>411</td>
<td>3,221</td>
<td>3,221</td>
<td>302,243.00</td>
<td>17,797.61</td>
<td>320,040.61</td>
<td>33,948.36</td>
<td>354,997.27</td>
</tr>
<tr>
<td>October</td>
<td>782,520</td>
<td>132,800</td>
<td>2,411</td>
<td>411</td>
<td>3,221</td>
<td>3,221</td>
<td>332,571.00</td>
<td>17,794.66</td>
<td>350,365.66</td>
<td>36,832.49</td>
<td>387,218.15</td>
</tr>
<tr>
<td>November</td>
<td>687,400</td>
<td>132,800</td>
<td>2,413</td>
<td>413</td>
<td>3,223</td>
<td>3,223</td>
<td>292,145.00</td>
<td>17,806.46</td>
<td>310,951.46</td>
<td>32,589.00</td>
<td>343,540.46</td>
</tr>
<tr>
<td>December</td>
<td>613,640</td>
<td>132,800</td>
<td>2,412</td>
<td>412</td>
<td>3,221</td>
<td>3,221</td>
<td>260,797.00</td>
<td>17,800.58</td>
<td>278,607.58</td>
<td>29,290.84</td>
<td>308,191.44</td>
</tr>
<tr>
<td>January</td>
<td>568,350</td>
<td>132,800</td>
<td>2,414</td>
<td>414</td>
<td>3,224</td>
<td>3,224</td>
<td>241,533.00</td>
<td>17,818.27</td>
<td>259,351.27</td>
<td>27,278.08</td>
<td>287,629.35</td>
</tr>
<tr>
<td>February</td>
<td>528,720</td>
<td>132,800</td>
<td>2,415</td>
<td>415</td>
<td>3,227</td>
<td>3,227</td>
<td>224,706.00</td>
<td>17,821.22</td>
<td>242,527.22</td>
<td>25,509.46</td>
<td>268,036.68</td>
</tr>
<tr>
<td>March</td>
<td>497,480</td>
<td>132,800</td>
<td>2,423</td>
<td>423</td>
<td>3,233</td>
<td>3,233</td>
<td>231,429.00</td>
<td>17,888.26</td>
<td>249,317.26</td>
<td>24,123.57</td>
<td>273,440.83</td>
</tr>
<tr>
<td>Sum</td>
<td>2,001,696</td>
<td>500,424</td>
<td>5,024,680</td>
<td>8,286</td>
<td>20,072</td>
<td>20,072</td>
<td>2,458,932.40</td>
<td>241,655.42</td>
<td>2,699,587.82</td>
<td>366,977.01</td>
<td>3,066,565.73</td>
</tr>
</tbody>
</table>

**Figure 2.27**: Step 8 image two of section 2.2
2.3 Additional Instructions

1. Once the user completes all calculations, the user can restart entirely, or jump back in at almost any point. Wherever the new starting point is, the user must complete every step after that. The information in the previous steps will remain pertinent (see part c).

2. If restarting from “Ground Zero” the user can select a new electric or natural gas utility rate schedule without needing to redo the other utility rate schedule and cost calculation. The user will need to re-enter the utility usage information of utility that is being reselected.
   a. Selecting a new non-customizable rate schedule (electric or natural gas) will erase any corresponding usage and cost information.
   b. If selecting a customizable rate schedule, no values will be erased until the “Return to Select NG Rate Schedule” button (on DIY El. Rates sheet) or the “Return to Main Userform” button (on DIY NG Rates sheet) are clicked.

3. The user can recalculate costs for different usage information simply by replacing the original usage input information and clicking the relevant cost calculation button.

4. If a customizable rate schedule is selected for either utility type, the original utility usage information must be re-entered and the costs must be recalculated before applying different CHP system information (SPP, IRR, ROI etc. can be recalculated without recompleting the customizable rate schedule utility costs).

5. When using the customizable rate schedules, the user must take note of the following:
   a. If there are seasonal rates, the second answer in the left and center columns must be “N/A”
b. “N/A” cannot be selected to the summer and winter peak questions, if there are seasonal rate variations within the rate schedules.

c. There cannot be any peak variances for energy if there is a block expander.

d. If there are seasons applied, the number of summer months does not need to be adjusted/selected. The first summer month also does not need to be adjusted/selected.
Chapter 3: Verification

3.1 Cooper Union CHP System

In order to verify that the algorithm tool created is a sufficient means to estimate economic performance for a proposed CHP system, external validation was performed. The algorithm tool was used to accurately reproduce multiple CHP analysis simulations, which were performed by Jonathan O. Rodriguez and documented in his thesis, “Technical and Economic Assessment of a Cogeneration System in an Urban Academic Building,” (Rodriguez, 2014). This building is located at 41 Cooper Square, at Cooper Union in New York City and had the CHP system commissioned in December 2011. The four simulations of utility cost estimates that were repeated with the algorithm tool are: no CHP system operation (Simulation 1), the current 250 kWe CHP system operation (Simulation 2), retrofitted CHP system operation (Simulation 3), and an original Request for Proposal (RFP) 390 kWe CHP system operation-this proposal was revised due to higher than anticipated pricing (Simulation 4).

In order to quantify the economic performance of each scenario, Rodriguez(2014) uses the average electric and natural gas rates listed below in Table 3.1 and applies them to monthly and weekly usage profiles, which are established and/or explained in the following sections.

<table>
<thead>
<tr>
<th>Utility Rates</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>$0.176/kWh</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>$1.029/therm</td>
</tr>
</tbody>
</table>

3.1.1 No CHP System Operation. Because the CHP system was first commissioned in 2011, and the study was performed in 2013-2014, there is no available utility information on the building without the CHP system operating. Before the first simulation, Rodriguez(2014) calculates the electric and heating demand profiles for solely the building based on data obtained...
from the Cogeneration Management System (CMS) and utility bills from January 2013 to December 2013, which reflect the CHP system savings. Table 2.2 tabulates the electrical and natural gas consumption from the utility bills since January 2013. (Figures in this table are directly from Table G-2 of (Rodriguez, 2014).

**Table 3.2: Electrical and Natural Gas Consumption at 41 Cooper Square**

<table>
<thead>
<tr>
<th>Month</th>
<th>Electrical Consumption (kWh)</th>
<th>Natural Gas Consumption (therms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-13</td>
<td>288,400</td>
<td>35,934</td>
</tr>
<tr>
<td>Feb-13</td>
<td>290,400</td>
<td>35,819</td>
</tr>
<tr>
<td>Mar-13</td>
<td>279,600</td>
<td>50,862</td>
</tr>
<tr>
<td>Apr-13</td>
<td>316,200</td>
<td>15,275</td>
</tr>
<tr>
<td>May-13</td>
<td>330,600</td>
<td>23,484</td>
</tr>
<tr>
<td>Jun-13</td>
<td>340,600</td>
<td>24,334</td>
</tr>
<tr>
<td>Jul-13</td>
<td>349,800</td>
<td>20,387</td>
</tr>
<tr>
<td>Aug-13</td>
<td>306,200</td>
<td>17,428</td>
</tr>
<tr>
<td>Sep-13</td>
<td>320,000</td>
<td>15,483</td>
</tr>
<tr>
<td>Oct-13</td>
<td>295,800</td>
<td>24,403</td>
</tr>
<tr>
<td>Nov-13</td>
<td>292,200</td>
<td>32,705</td>
</tr>
<tr>
<td>Dec-13</td>
<td>284,200</td>
<td>23,423</td>
</tr>
</tbody>
</table>

Electrical production, fuel use, and heat use by the CHP system are shown in Table 3.2 (Figures in this table are directly from Table G-3 of (Rodriguez, 2014). The fuel used by the CHP system is equivalent to the natural gas consumed by the CHP system in order to produce electricity (electrical production). The heat use refers to the amount heat recovered for heating in the CHP system’s hot water heat exchanger (HWHX). February 2013 is grey to show that information was not available for this month and is replaced by information from February 2012.
Table 3.3: Electricity Produced, Fuel Used, and Heat Used by CHP System at 41 Cooper Square

<table>
<thead>
<tr>
<th>Month</th>
<th>Electrical Production (kWh)</th>
<th>Fuel Used (therms)</th>
<th>Heat Used (therms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-13</td>
<td>96,052</td>
<td>11,212</td>
<td>3,039</td>
</tr>
<tr>
<td>Feb-13</td>
<td>131,769</td>
<td>15,308</td>
<td>5,909</td>
</tr>
<tr>
<td>Mar-13</td>
<td>157,816</td>
<td>18,776</td>
<td>2,911</td>
</tr>
<tr>
<td>Apr-13</td>
<td>70,938</td>
<td>8,362</td>
<td>1,180</td>
</tr>
<tr>
<td>May-13</td>
<td>122,920</td>
<td>14,610</td>
<td>0</td>
</tr>
<tr>
<td>Jun-13</td>
<td>164,622</td>
<td>19,096</td>
<td>0</td>
</tr>
<tr>
<td>Jul-13</td>
<td>142,811</td>
<td>16,695</td>
<td>0</td>
</tr>
<tr>
<td>Aug-13</td>
<td>149,501</td>
<td>16,441</td>
<td>1,544</td>
</tr>
<tr>
<td>Sep-13</td>
<td>128,767</td>
<td>15,730</td>
<td>4,881</td>
</tr>
<tr>
<td>Oct-13</td>
<td>157,642</td>
<td>18,500</td>
<td>4,334</td>
</tr>
<tr>
<td>Nov-13</td>
<td>132,539</td>
<td>15,376</td>
<td>3,597</td>
</tr>
<tr>
<td>Dec-13</td>
<td>112,842</td>
<td>13,228</td>
<td>4,460</td>
</tr>
</tbody>
</table>

The thesis back-calculates the building’s actual demand profile, CHP system generation omitted. The electrical demand of the building is said to be the sum of the utility bill electrical energy consumption and the electrical production by the CHP system. In calculating the heat demand of the building, the fuel used by the boiler with the CHP running is calculated as the difference between the utility bill natural gas consumption and the fuel consumed by the CHP system. The heat use of the building is said to be the sum of the fuel used by the boiler, and the heat use by the cogeneration system (heat recovered by the CHP system HWHX). These calculations produce the following table of values, according to Rodriguez(2014).
Table 3.4: Electrical and Natural Gas Consumption at 41 Cooper Square

<table>
<thead>
<tr>
<th>Month</th>
<th>Electrical Demand (kWh)</th>
<th>Heat Demand (therms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-13</td>
<td>329,675</td>
<td>25,288</td>
</tr>
<tr>
<td>Feb-13</td>
<td>283,847</td>
<td>24,494</td>
</tr>
<tr>
<td>Mar-13</td>
<td>320,934</td>
<td>31,789</td>
</tr>
<tr>
<td>Apr-13</td>
<td>357,565</td>
<td>7,401</td>
</tr>
<tr>
<td>May-13</td>
<td>371,995</td>
<td>7,987</td>
</tr>
<tr>
<td>Jun-13</td>
<td>382,026</td>
<td>4,714</td>
</tr>
<tr>
<td>Jul-13</td>
<td>391,256</td>
<td>3,323</td>
</tr>
<tr>
<td>Aug-13</td>
<td>347,687</td>
<td>2,433</td>
</tr>
<tr>
<td>Sep-13</td>
<td>361,518</td>
<td>4,658</td>
</tr>
<tr>
<td>Oct-13</td>
<td>337,348</td>
<td>9,646</td>
</tr>
<tr>
<td>Nov-13</td>
<td>333,779</td>
<td>19,193</td>
</tr>
<tr>
<td>Dec-13</td>
<td>325,809</td>
<td>13,636</td>
</tr>
</tbody>
</table>

While the heat demand values are consistent, the electrical demand values are not, according to the definition of the values as described in the thesis. They result in significantly lower monthly total utility costs than provided by Table 6-3 of the thesis (Rodriguez, 2014). The following adjustments were made to more accurately represent 41 Cooper Square’s demand profile without the CHP system: recalculate monthly electrical demand numbers, add peak demand charge.

3.1.2 Electrical Demand Recalculations. As stated in the thesis, “the electrical demand is the sum of the electricity produced by the cogeneration system [Table 3.3 Column 2] and the electrical consumption from the utility bill, [Table 3.2 Column 2],” (Rodriguez, 2014). The calculation for January 2013 monthly electrical demand should go as follows:

\[
(\text{January Electrical Demand}) = (\text{CHP Electricity Production}) + (\text{Billed Electrical Consumption})
\]

\[
(\text{January Electrical Demand}) = (288,400 \text{ kWh}_e) + (96,052 \text{ kWh}_e)
\]

Equation 2.1

Equation 2.2
The new electrical demand values are shown in Appendix A.

3.1.3 Peak Demand Charge. After making the above correction to each month, the newly calculated total monthly utility costs are still significantly less than the utility costs provided by Table 6-3 of the thesis. The only component of the electric utility cost given is the average price per kWh_e of consumption. However, the report also states that, “electric bills are more complicated because two quantities are measured; the energy consumption, billed on a per-kWh_e rate and the peak power demand during the month, billed on a per kW_e rate.” Peak demand charges are common in utility rates that apply to non-residential customers. Rodriguez(2014) continues to explain that, “The peak power is billed because both utilities need to have some reserve or standby power available based on the peak power as the electrical demand fluctuates throughout the day,” but does not offer any insight to the nature of this charge in 41 Cooper Square’s electric rate schedule. Considering the importance of this component of the electric bill and the fact that the average $/kWh_e and average $/therm_t, when applied to the electrical and heat demands, respectively, don’t add up to the total monthly costs given by Rodriguez(2014), an average $/kW_e is developed to account for the difference in total monthly costs by the following method:

\[
\text{(Calculated Annual Utility Cost)} = (\text{Annual Electrical Demand} \times \text{Average cost per kWh}_e) + (\text{Annual Heat Demand} \times \text{Average cost per therm}_t)
\]

\[
\text{(Calculated Annual Utility Cost)} = (5,262,219 \text{ kWh}_e \times 0.176/\text{kWh}_e) + (154,438 \text{ therm}_t \times 1.029/\text{therm}_t)
\]

\[
\text{Calculated Annual Utility Cost} = \$1,085,067
\]

\[
\text{(Average Electric Peak Demand Rate)} = \frac{\text{(Given Annual Utility Cost)} - \text{(Calculated Annual Utility Cost)}}{\text{(Estimated Annual Charged Peak Demand)}}
\]

\[
\text{(Average Electric Peak Demand Rate)} = \frac{1,176,000 - 1,085,067}{10,405 \text{ kW} - \text{ mmo}_e}
\]

\[
\text{Average Electric Peak Demand Rate} = \$8.739/\text{kW} - \text{ mmo}_e
\]
The estimated annual charged peak demand is estimated by viewing the typical weekly electrical demand figures for each month of the year. These figures are found in Appendix G of Rodriguez’s thesis and can be found in Appendix A along with the estimations used for the validation (Rodriguez, 2014).

To estimate the amount of heat that can be usefully recovered for processes, Rodriguez(2014) also develops heat demand profiles for a typical week for each month throughout the year. These figures, which can be found in Appendix A, are used to estimate monthly peak heat demands. Then, a weighted average annual thermal load factor is calculated as a ratio of monthly heat demand to what monthly heat demand would be if it were equal to the peak heat demand for the entire month. Each monthly thermal load factor is weighted by the percentage of that month’s heat demand compared to the annual heat demand. A calculation for January’s thermal load factor and its weight on the annual thermal load factors are shown below and the rest of the numbers can be found in Appendix A.

\[(\text{January Thermal Load Factor})\]

\[= \frac{(\text{January Heat Demand})}{(\text{January Estimated Peak Heat Demand}) \times (\text{January Hours of Operation})}\]

Equation 3.10

\[(\text{January Thermal Load Factor}) = \frac{(25,289 \, \text{therm}_t)}{(51 \, \text{therms/hr}) \times (31 \, \text{days} \times 24 \, \text{hr/day})}\]

Equation 3.11

\[\text{January Thermal Load Factor} = 0.666\]

Equation 3.12
\[
(January \ Weighted \ Thermal \ Load \ Factor) \\
= (January \ Thermal \ Load \ Factor) \times \frac{(January \ Heat \ Demand)}{(Annual \ Heat \ Demand)} \\
\text{Equation 3.13}
\]

\[
(January \ Weighted \ Thermal \ Load \ Factor) \\
= (January \ Thermal \ Load \ Factor) \times \frac{(January \ Heat \ Demand)}{(Annual \ Heat \ Demand)} \\
\text{Equation 3.14}
\]

\[
(January \ Weighted \ Thermal \ Load \ Factor) = (0.666) \times \frac{(25,289 \ therm_t)}{(154,438 \ therm_t)} \\
\text{Equation 3.15}
\]

\[
\text{January Weighted Thermal Load Factor} = 0.109 \\
\text{Equation 3.16}
\]

While Rodriguez’s thesis utilizes a typical weekly usage profile for each month, my algorithm tool establishes a different daily usage profile for each month (Rodriguez, 2014). The user of my algorithm tool can enter an average thermal load factor, which is then applied to each month to calculate heat demand in 15-minute intervals for a typical day in each month. This difference in monthly usage profile approximations should result in a smaller deviation in monthly utility costs using my algorithm tool (for simulations in this validation) than the actual monthly utility costs. However, over the course of a year, the utility costs should even out.

3.1.4 Simulation 1. The first simulation calculates monthly utility costs as if there were no CHP system. Remember, the only utility information available is after the CHP system was commissioned.

Figure 3.1 compares the utility cost calculations from my algorithm tool (Simulation 1) to those of Rodriguez’s(2014) method (No Cogen).
The simulation with my model and my algorithm tool resulted in an annual utility cost of $1,175,996, compared to Rodriguez’s(2014) $1,176,000 per year utility cost.

3.2 CHP System Operation

3.2.1 CHP System Deficiencies. As described by Rodriguez(2014), there are a number of deficiencies prohibiting the CHP system from achieving maximum savings.

1. Partial Loading During Overnight Hours

Between 12 a.m. and 8 a.m. the CHP unit must be throttled down to 175 kW \(_e\) (70% of full load) due to a, “design oversight of the electrical system oversight,” (Rodriguez, 2014).
2. Part Load During Fall and Spring

For 3 months in both Fall and Spring the CHP unit is throttled down to 220 kW\textsubscript{e} to keep it from being starved of fuel and shutting off. In these seasons the boilers cycle on and off. When the boilers start-up they require extra fuel, which can deny the CHP unit sufficient fuel to operate at full load.

3. Gas Meter Not Commissioned

The NYC Department of buildings has not allowed the CHP unit’s gas consumption to be sub-metered and qualify for a 20% discount.

4. Undersized Hot Water Heat Exchanger

The current hot water heat exchanger used in the CHP system can only recover 9.2 therm/hr-much less than the 15.68 therm/hr that is recovered from the CHP unit’s engine jacket.

Although the building’s heat demand is low during the summer, heat can be recovered to supply the absorption chiller with hot water. Running the absorption chiller instead of the centrifugal chiller saves 35.0 kW\textsubscript{e} during the daytime and 27.0 kW\textsubscript{e} during the nighttime (see deficiency #1 above).

The last adjustment made for Simulation 2 was to the daily hours of CHP operation. The generating electricity with an average CHP output of 215 kW\textsubscript{e} for 24 hours a day, 7 days a week, 365 days a year does not add up to an annual electricity generation of 1,568,219 kWh\textsubscript{e} given by Rodriguez(2014). Therefore, the daily hours of CHP operation was limited to 19.98 hours per day to match.

3.2.2 Simulation 2. Table 3.5 shows the CHP System Information and Cost & Savings input values used in my algorithm tool for my simulation.
Table 3.5: CHP System Scenario Inputs for 41 Cooper Square

<table>
<thead>
<tr>
<th>Simulation 2 Inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy cost</td>
<td>$0.176 per kWh</td>
</tr>
<tr>
<td>Peak Demand cost</td>
<td>$8.739 per kW-mo</td>
</tr>
<tr>
<td>Natural Gas cost</td>
<td>$10.290 per MMBtu</td>
</tr>
<tr>
<td>CHP Power</td>
<td>223.083 kWe</td>
</tr>
<tr>
<td>CHP Input</td>
<td>734.775 kWt</td>
</tr>
<tr>
<td>CHP Input</td>
<td>2.507 MMBtu/hr</td>
</tr>
<tr>
<td>Maintenance cost</td>
<td>$0.0446 per kWh</td>
</tr>
<tr>
<td>Length of Shift</td>
<td>19.98 hr/day</td>
</tr>
<tr>
<td>Thermal L.F.</td>
<td>0.5791</td>
</tr>
</tbody>
</table>

Figure 3.2 shows monthly utility cost savings of my simulation compared to Rodriguez’s(2014) simulation.

![Figure 3.2: Comparison of monthly utility cost savings simulations of 41 Cooper Square the CHP system](image-url)

59
The simulation with my model and my algorithm tool resulted in annual savings of $109,589, compared to $101,000 from Rodriguez’s (2014) simulation. Considering a capital investment of $1,200,000, and a $70,000 yearly maintenance contract, the SPP is 10.95 years which yields a 9.13% ROI according to my simulation, and a SPP of 11.88 years with an 8.42% ROI according to Rodriguez’s (2014) simulation.

3.3 Retrofitted CHP System Operation

3.3.1 CHP System Retrofits. In Simulation 3, the current deficiencies of the CHP system (listed in the previous section) are theoretically corrected for in the following ways:

1. Partial Loading During Overnight Hours
   Between 12 a.m. and 8 a.m. the CHP unit must be is not throttled down to 175 kW\textsubscript{e} and is run at 250 kW\textsubscript{e} by combining utility meters.

2. Part Load During Fall and Spring
   A natural gas pressure issue is resolved. The boilers can now cycle on and off without choking the CHP unit of fuel. The CHP system is run at 250 kW\textsubscript{e} during the Fall and Spring.

3. Gas Meter Not Commissioned
   The CHP system’s natural gas meter is commissioned. The new average price of natural gas is $0.932/therm\textsubscript{t}.

4. Undersized Hot Water Heat Exchanger
   A new HWHX replaces the undersized HWHX. 1.568 therm\textsubscript{t}/hr can now be recovered from the engine jacket.
The daily hours of CHP operation input remains the same, as does the average thermal load factor. By resolving the first issue listed above, supplying hot water to the absorption chiller in the summer now saves 35.0 kW during the day and the night.

3.3.2 Simulation 3. Table 2.6 shows the CHP System Information and Cost & Savings input values used in my algorithm tool for my simulation.

<table>
<thead>
<tr>
<th>Simulation 3 Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy cost</td>
</tr>
<tr>
<td>Peak Demand cost</td>
</tr>
<tr>
<td>Natural Gas cost</td>
</tr>
<tr>
<td>CHP Power</td>
</tr>
<tr>
<td>CHP Input</td>
</tr>
<tr>
<td>CHP Input</td>
</tr>
<tr>
<td>CHP Output</td>
</tr>
<tr>
<td>Maintenance cost</td>
</tr>
<tr>
<td>Length of Shift</td>
</tr>
<tr>
<td>Thermal L.F.</td>
</tr>
</tbody>
</table>

Figure 3.3 shows monthly utility cost savings of my simulation compared to Rodriguez’s (2014) simulation.
Figure 3.3: Comparison of monthly utility cost savings simulations of 41 Cooper Square the CHP system

The simulation with my model and my algorithm tool resulted in annual savings of $191,391, compared to $206,000 from Rodriguez’s(2014) simulation. Considering the same capital investment of $1,200,000, and the same $70,000 annual maintenance contract, the simple payback period is 6.27 years (SPP) which yields a 15.95% return on investment (ROI) according to my simulation, and a SPP of 5.83 years with an 17.17% ROI according to Rodriguez’s(2014) simulation.

3.4 RFP CHP System Operation

3.4.1 RFP CHP System. Simulation 4 assumes the current CHP system deficiencies are resolved just like they are in Simulation 3. The purpose of this scenario is to explore the potential economic performance of a 390 kW_\text{e} CHP system made up of two 195 kW_\text{e} CHP units. The
original RFP package includes a 120 ton absorption chiller, instead of the 80 ton absorption chiller chosen, which provides an extra 13.75 kWₑ of savings when avoiding the use of the centrifugal chiller in the summer.

New capital investment costs and maintenance contract costs are based on the ratio of the new CHP system electric power output to the old CHP system electric power output.

\[
(RFP \text{ Capital Investment}) = (Initial \text{ Capital Investment}) \times \left(\frac{390 \text{ kW}_e}{250 \text{ kW}_e}\right) \\
\text{Equation 3.17}
\]

\[
(RFP \text{ Capital Investment}) = ($1,200,000) \times \left(\frac{390 \text{ kW}_e}{250 \text{ kW}_e}\right) \\
\text{Equation 3.18}
\]

\[
RFP \text{ Capital Investment} = $1,880,000 \\
\text{Equation 3.19}
\]

\[
(RFP \text{ Annual Maintenance Cost}) = (Initial \text{ Annual Maintenance Cost}) \times \left(\frac{390 \text{ kW}_e}{250 \text{ kW}_e}\right) \\
\text{Equation 3.20}
\]

\[
(RFP \text{ Capital Investment}) = ($70,000) \times \left(\frac{390 \text{ kW}_e}{250 \text{ kW}_e}\right) \\
\text{Equation 3.21}
\]

\[
RFP \text{ Capital Investment} = $109,200 \\
\text{Equation 3.22}
\]

3.4.2 Simulation 4. Table 3.7 shows the CHP System Information and Cost & Savings input values used in my algorithm tool for my simulation.
Table 3.7: RFP CHP System Scenario Inputs for 41 Cooper Square

<table>
<thead>
<tr>
<th>Simulation 4 Inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy cost</td>
<td>$0.176 per kWh</td>
</tr>
<tr>
<td>Demand cost</td>
<td>$8.739 per kW-mo</td>
</tr>
<tr>
<td>Natural Gas cost</td>
<td>$10.290 per MMBtu</td>
</tr>
<tr>
<td>CHP Power</td>
<td>403.75 kWe</td>
</tr>
<tr>
<td>CHP Input</td>
<td>1,270 kWt</td>
</tr>
<tr>
<td>CHP Input</td>
<td>4.334 MMBtu/hr</td>
</tr>
<tr>
<td>CHP Output</td>
<td>2.445 MMBtu/hr</td>
</tr>
<tr>
<td>Maintenance cost</td>
<td>$0.0398 per kWh</td>
</tr>
<tr>
<td>Length of Shift</td>
<td>19.98 hr/day</td>
</tr>
<tr>
<td>Thermal L.F.</td>
<td>0.5791</td>
</tr>
</tbody>
</table>

Figure 3.4 shows monthly utility cost savings of my simulation compared to Rodriguez’s(2014) simulation. The simulation with my model and my algorithm tool resulted in annual savings of $269,924, compared to $286,000 from Rodriguez’s(2014) simulation. The capital investment of and maintenance contract cost were scaled up by a ratio of 390 kW<sub>e</sub> to 250 kW<sub>e</sub>. The resulting capital
investement is $1,880,000, and the annual maintenance contract is $109,200. The SPP is 6.96 years, which yields a 14.36% ROI according to my simulation. In comparison, Rodriguez (2014) calculates a SPP of 6.57 years with a 15.21% ROI.

3.5 Verification Conclusion and Errors

After reviewing all of the simulations the annual utility costs, utility cost savings, and economic performance measurements (NAS, SPP, and ROI) are in good agreement with Rodriguez’s (2014), but there are some discrepancies. Monthly net cost savings are typically higher toward the summer months, when Rodriguez (2014) calculates lower monthly savings, and lower toward the winter months, when Rodriguez (2014) calculates higher monthly savings. These values are closer to the averages than Rodriguez’s (2014) values are. This is a result of Rodriguez (2014) using a typical weekly profile for each month, and then extrapolating data for that entire month, compared to my simulation that uses a typical daily profile and then extrapolating that data for each corresponding month. The result is less seasonal variability in my monthly utility savings and utility cost savings calculations.
Chapter 4: Potential Savings Analysis & Discussion

The most important factors for whether or not a facility can implement a CHP system with a positive economic performance are: electric utility costs, natural gas utility costs, and the size of the CHP system compared to the size and nature of the plant’s usage profile.

4.1 Utility Rates Analysis and Discussion

Manufacturing plants with high electric utility rates are more likely to be viable candidates for CHP technology. Electricity is the more expensive of the two energy utilities. The utility company uses natural gas or other fuels to produce electricity. The efficiency of large power plants is generally below 40%. So naturally, electricity rates are higher than those of natural gas.

Second, but maybe not as critical as the following factor, is the price of natural gas. The CHP system can only be economical with the recovery of the exhaust heat from the electricity production. However, generating the electricity still requires an overall monthly increase in natural gas consumption. The cheaper the natural gas utility rates are, the less the natural gas utility bills will increase.

SWEPCO and Black Hills are available to the Northwest Arkansas region, OG&E and AOGC are available in Fort Smith, and Entergy and CenterPoint are available in Little Rock. These three locations are shown in Figure 4.1.
Figure 4.1: Map of Arkansas highlighting the three locations of the utility companies represented in the spreadsheet algorithm tool

The following tables show a fictional plant’s usage profile with 12 months of utility data, and compares the resulting annual utility costs on each of the rates that are built into the CHP algorithm tool. The first table shows electric usage information for rate schedules that charge the customer based on total monthly consumption and monthly peak demand. The next table shows the annual electric utility costs.

The monthly peak demand (kW<sub>e-mo</sub>) chosen for the fictional plant is simply based on typical small- to medium- sized manufacturing plants’ monthly peak demands. The peak demand is higher in the summer, due to air conditioning, and lower in the winter. The electric consumption (kWh<sub>e</sub>) is calculated based on a plant load factor of 0.5 and annual plant operating hours from 16 hours per day and five days per week. The load factor is defined as the
energy consumption for a period of time divided by the product of the peak consumption and the hours of operation.

**Table 4.1: Fictional Plant Electric Usage Profile**

<table>
<thead>
<tr>
<th></th>
<th>Total kWh</th>
<th>Total kW-mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr-16</td>
<td>180,762</td>
<td>1,040</td>
</tr>
<tr>
<td>May-16</td>
<td>184,238</td>
<td>1,060</td>
</tr>
<tr>
<td>Jun-16</td>
<td>187,714</td>
<td>1,080</td>
</tr>
<tr>
<td>Jul-16</td>
<td>191,190</td>
<td>1,100</td>
</tr>
<tr>
<td>Aug-16</td>
<td>194,667</td>
<td>1,120</td>
</tr>
<tr>
<td>Sep-16</td>
<td>198,143</td>
<td>1,140</td>
</tr>
<tr>
<td>Oct-16</td>
<td>194,667</td>
<td>1,120</td>
</tr>
<tr>
<td>Nov-16</td>
<td>191,190</td>
<td>1,100</td>
</tr>
<tr>
<td>Dec-16</td>
<td>187,714</td>
<td>1,080</td>
</tr>
<tr>
<td>Jan-17</td>
<td>184,238</td>
<td>1,060</td>
</tr>
<tr>
<td>Feb-17</td>
<td>180,762</td>
<td>1,040</td>
</tr>
<tr>
<td>Mar-17</td>
<td>177,286</td>
<td>1,020</td>
</tr>
<tr>
<td>Totals:</td>
<td>2,252,571</td>
<td>12,960</td>
</tr>
</tbody>
</table>

**Table 4.2: Electric rates for fictional plant profile**

<table>
<thead>
<tr>
<th>Company</th>
<th>Rate Schedule</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entergy</td>
<td>LGS</td>
<td>$312,005</td>
</tr>
<tr>
<td></td>
<td>LPS</td>
<td>$312,474</td>
</tr>
<tr>
<td></td>
<td>PL-1</td>
<td>$184,562</td>
</tr>
<tr>
<td></td>
<td>PL-2</td>
<td>$211,652</td>
</tr>
<tr>
<td></td>
<td>PL-3</td>
<td>$213,247</td>
</tr>
<tr>
<td></td>
<td>PL-4</td>
<td>$213,089</td>
</tr>
<tr>
<td></td>
<td>PL-5</td>
<td>$220,544</td>
</tr>
<tr>
<td></td>
<td>LP-primary</td>
<td>$230,631</td>
</tr>
<tr>
<td></td>
<td>LP-secondary</td>
<td>$246,114</td>
</tr>
<tr>
<td>SWEPCO</td>
<td>LLP-primary</td>
<td>$1,023,089</td>
</tr>
<tr>
<td></td>
<td>LLP-secondary</td>
<td>$1,138,414</td>
</tr>
</tbody>
</table>

The following two tables show 12-month natural gas usage consumption of the fictional plant and the annual costs associated with each rate schedule. The natural gas consumption is based on typical small- to medium- sized manufacturing plants’ monthly consumption. The consumption is higher in the winter, due to space heating, and lower in the summer. The peak
day demand for each month is calculated as twice that of the average day consumption for 5 days per week of plant operation.

**Table 4.3:** Fictional Plant Natural Gas Usage Profile

<table>
<thead>
<tr>
<th></th>
<th>CCF</th>
<th>MCF</th>
<th>MMBtu</th>
<th>MMBtu Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr-16</td>
<td>37,000</td>
<td>3,700</td>
<td>3,785</td>
<td>261</td>
</tr>
<tr>
<td>May-16</td>
<td>34,000</td>
<td>3,400</td>
<td>3,478</td>
<td>240</td>
</tr>
<tr>
<td>Jun-16</td>
<td>31,000</td>
<td>3,100</td>
<td>3,171</td>
<td>219</td>
</tr>
<tr>
<td>Jul-16</td>
<td>28,000</td>
<td>2,800</td>
<td>2,864</td>
<td>198</td>
</tr>
<tr>
<td>Aug-16</td>
<td>31,000</td>
<td>3,100</td>
<td>3,171</td>
<td>219</td>
</tr>
<tr>
<td>Sep-16</td>
<td>34,000</td>
<td>3,400</td>
<td>3,478</td>
<td>240</td>
</tr>
<tr>
<td>Oct-16</td>
<td>37,000</td>
<td>3,700</td>
<td>3,785</td>
<td>261</td>
</tr>
<tr>
<td>Nov-16</td>
<td>40,000</td>
<td>4,000</td>
<td>4,092</td>
<td>283</td>
</tr>
<tr>
<td>Dec-16</td>
<td>43,000</td>
<td>4,300</td>
<td>4,399</td>
<td>304</td>
</tr>
<tr>
<td>Jan-17</td>
<td>46,000</td>
<td>4,600</td>
<td>4,706</td>
<td>325</td>
</tr>
<tr>
<td>Feb-17</td>
<td>43,000</td>
<td>4,300</td>
<td>4,399</td>
<td>304</td>
</tr>
<tr>
<td>Mar-17</td>
<td>40,000</td>
<td>4,000</td>
<td>4,092</td>
<td>283</td>
</tr>
<tr>
<td>Totals:</td>
<td>444,000</td>
<td>44,400</td>
<td>45,421</td>
<td>3,136</td>
</tr>
</tbody>
</table>

**Table 4.4:** Natural gas rates for fictional plant profile

<table>
<thead>
<tr>
<th>Company</th>
<th>Rate Schedule</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOGC-Ark</td>
<td>Med Business</td>
<td>$342,514.94</td>
</tr>
<tr>
<td></td>
<td>Large Business</td>
<td>$306,612.18</td>
</tr>
<tr>
<td>Black Hills</td>
<td>Business 3</td>
<td>$489,137.40</td>
</tr>
<tr>
<td></td>
<td>Business 4</td>
<td>$467,254.42</td>
</tr>
<tr>
<td></td>
<td>Business 5</td>
<td>$466,136.63</td>
</tr>
<tr>
<td>CenterPoint</td>
<td>SCS-1</td>
<td>$401,103.86</td>
</tr>
<tr>
<td></td>
<td>SCS-2</td>
<td>$403,823.82</td>
</tr>
<tr>
<td></td>
<td>LCS-1</td>
<td>$389,710.59</td>
</tr>
</tbody>
</table>

Table 4.2 shows that OG&E provides the lowest rates for electricity. The total costs vary based on the means of distribution and voltage size. Entergy has the next lowest rates. The two rate schedules are designed based on size, but yield very similar total costs in this case, and the utility consumer can choose its rate schedule. For SWEPCO, the LLP rate schedules are much more expensive. However, this fictional plant would not be on these rate schedules because the
peak demand is too low, and the total costs are so high because of a minimum billed demand that would apply.

Table 4.4 shows that AOGC has lower rates than Black Hills. Each company’s rate schedules shown in Table 4.4 differ based on the annual consumption of the natural gas consumer. The fictional plant would actually be on AOGC’s Large Business rate schedule or on Black Hills’ Business 4 rate schedule. The annual usage is just over the cutoff point for CenterPoint’s smaller usage rate schedules (SCS-1 and SCS2). This makes the total costs all very close. Since the annual usage is high enough, though, the fictional plant would be allowed on the LCS-1 rate schedule with lower rates.

According to the tables above, Entergy in Little Rock charges the most for electricity and Black Hills, which is located in NWA, charges more for natural gas. AOGC typically provides natural gas in areas that overlap OG&E electricity service areas (Fort Smith, Arkansas). Fort Smith has higher lower electric rates and natural gas rates. Areas with a better opportunity for CHP are expected to have higher electric rates and lower natural gas rates. While Little Rock has the highest electric rates, it has the second highest natural gas rates (Entergy and CenterPoint, respectively). NWA has the second highest electric rates and the highest natural gas rates, but the electric rates are expected to have more of an impact on the economic viability of CHP implementation. CHP implementations are expected to be more economically feasible in these two regions.

4.2 Impact on CHP Sizing

Electric utility companies in Arkansas are required to purchase electricity from CHP plants as long as the plants are QFs, as defined by PURPA. First, any electricity produced by a CHP system offsets the CHP plant’s monthly electricity usage. If more electricity is produced
than is consumed, the electric utility company must compensate the CHP plant for the extra electricity provided to the grid.

However, the nature of taking economical advantage of the CHP system’s thermal output is different. No company is required to purchase waste heat from the CHP plant. And not only that, but in this study it is assumed that the CHP plant does not even have the option to sell waste heat to any neighboring facilities. Any heat exhausted by the CHP unit must be recovered and used for either space heat or process heat.

Considering these two factors, it can be expected that maximum savings occur when the CHP system is sized to meet the CHP plant’s thermal base demand. Any exhaust heat recovered by heat exchangers can be used for space heat or process heat. All of this heat is reused to assist in meeting the plant’s thermal demand. If the CHP system’s thermal output were larger than the plant’s baseload, more heat would be wasted than necessary. The CHP system would not be operating at its maximum rate thermal efficiency. Meanwhile, any electricity produced by the CHP system will accounted for on the monthly electric bill. This is true even if at any given time the CHP plant is producing more electricity than it is consuming.

As a general rule, once a manufacturing facility is determined to be a viable candidate for implementing a CHP system, the system size should be fine-tuned so that the thermal output matches the CHP plant’s thermal baseload.
Chapter 5: Arkansas Case Studies’ Results and Discussion

This chapter evaluates three actual Arkansas manufacturing plants and their opportunity for CHP systems. First, a sweet potato products plant (known as Sweet Potato Plant) is evaluated at its actual location. Following this scenario, Sweet Potato Plant, a frozen yogurt products plant (known as Frozen Yogurt Plant), and a poultry products plant (known as Poultry Plant) are evaluated using NWA’s, Fort Smith’s, and Little Rock’s combinations of utility rate companies. Each evaluation calculates the economic performance of implementing a range of both MicroTurbines and ICE. After all of the evaluations are discussed, the criteria for a good CHP opportunity are explained.

5.1 Sweet Potato Plant

Due to the sanitation requirements of the food industry, Sweet Potato Plant has a high thermal demand compared to its electric demand. The small municipality in which the plant is located has its own electric and natural gas utility company for the city. The local natural gas company has gas transported in from another company. The rates used for the simulation and the plant’s electric and natural gas utility usage profiles are shown below.
**Table 5.1:** Sweet Potato plant’s current electric utility rates & input information for CHP algorithm tool simulation

<table>
<thead>
<tr>
<th>Electric Utility Rates</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cust Charge</td>
<td>$200.00 per mo</td>
<td></td>
</tr>
<tr>
<td>NL Charge</td>
<td>$132.99 per mo</td>
<td></td>
</tr>
<tr>
<td>1st 100 hr</td>
<td>$0.0276 /kWh</td>
<td></td>
</tr>
<tr>
<td>Next 260 hr</td>
<td>$0.0233 /kWh</td>
<td></td>
</tr>
<tr>
<td>Remaining</td>
<td>$0.0215 /kWh</td>
<td></td>
</tr>
<tr>
<td>Fuel Adj</td>
<td>$0.04227 /kWh</td>
<td></td>
</tr>
<tr>
<td>Demand</td>
<td>$3.50 /kW-mo</td>
<td></td>
</tr>
<tr>
<td>Franchise</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Discount</td>
<td>-5%</td>
<td></td>
</tr>
<tr>
<td>State Tax</td>
<td>6.50%</td>
<td></td>
</tr>
<tr>
<td>County Tax</td>
<td>1.00%</td>
<td></td>
</tr>
<tr>
<td>City Tax</td>
<td>2.00%</td>
<td></td>
</tr>
<tr>
<td>Small Account Averages</td>
<td>$333.71 per mo</td>
<td></td>
</tr>
<tr>
<td>Total Charges</td>
<td>$666.70 per mo</td>
<td></td>
</tr>
</tbody>
</table>

**Table 5.2:** Sweet Potato Plant’s current natural gas utility rates & input information for CHP algorithm tool simulation

<table>
<thead>
<tr>
<th>Natural Gas Utility Rates</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>$4.148 /MMBtu</td>
<td></td>
</tr>
<tr>
<td>Trans City Tax</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Trans County Tax</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Trans State Tax</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>Effective Trans Taxes</td>
<td>6.19%</td>
<td></td>
</tr>
<tr>
<td>Fuel Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Charge</td>
<td>$240.98 per mo</td>
<td></td>
</tr>
<tr>
<td>TA Charge</td>
<td>$97.68 per mo</td>
<td></td>
</tr>
<tr>
<td>Delivery Charge</td>
<td>$1.46212 /MMBtu</td>
<td></td>
</tr>
<tr>
<td>Avg EECR</td>
<td>$0.15739 /MMBtu</td>
<td></td>
</tr>
<tr>
<td>Act 310</td>
<td>$0.03591 /MMBtu</td>
<td></td>
</tr>
<tr>
<td>Main Rep. Rider</td>
<td>$0.00037 /MMBtu</td>
<td></td>
</tr>
<tr>
<td>Franchise Fee</td>
<td>4.0%</td>
<td></td>
</tr>
<tr>
<td>Effective Franch Fee</td>
<td>1.05%</td>
<td></td>
</tr>
<tr>
<td>Small Account Average</td>
<td>$1,235.38</td>
<td></td>
</tr>
<tr>
<td>Total Effective Tax</td>
<td>7.24%</td>
<td></td>
</tr>
<tr>
<td>Total Monthly Charge</td>
<td>$1,574.04 per mo</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.3: Sweet Potato Plant’s electric and natural gas utility information

<table>
<thead>
<tr>
<th>Month</th>
<th>Electricity kWh</th>
<th>kW-mo</th>
<th>Natural Gas MMBtu</th>
</tr>
</thead>
<tbody>
<tr>
<td>May-14</td>
<td>635,400</td>
<td>2,599</td>
<td>2,229</td>
</tr>
<tr>
<td>Jun-14</td>
<td>618,840</td>
<td>2,599</td>
<td>2,540</td>
</tr>
<tr>
<td>Jul-14</td>
<td>597,480</td>
<td>2,584</td>
<td>605</td>
</tr>
<tr>
<td>Aug-14</td>
<td>621,400</td>
<td>2,592</td>
<td>1,039</td>
</tr>
<tr>
<td>Sep-14</td>
<td>664,400</td>
<td>2,582</td>
<td>2,065</td>
</tr>
<tr>
<td>Oct-14</td>
<td>711,160</td>
<td>2,412</td>
<td>2,469</td>
</tr>
<tr>
<td>Nov-14</td>
<td>782,520</td>
<td>2,411</td>
<td>2,946</td>
</tr>
<tr>
<td>Dec-14</td>
<td>687,400</td>
<td>2,413</td>
<td>3,529</td>
</tr>
<tr>
<td>Jan-15</td>
<td>613,640</td>
<td>2,412</td>
<td>3,410</td>
</tr>
<tr>
<td>Feb-15</td>
<td>568,360</td>
<td>2,414</td>
<td>861</td>
</tr>
<tr>
<td>Mar-15</td>
<td>528,720</td>
<td>2,415</td>
<td>1,741</td>
</tr>
<tr>
<td>Apr-15</td>
<td>497,480</td>
<td>2,423</td>
<td>2,606</td>
</tr>
<tr>
<td>Totals</td>
<td>7,526,800</td>
<td>29,856</td>
<td>26,040</td>
</tr>
</tbody>
</table>

The bolded values are the values used in the customizable rate schedule cost calculations and may be combinations of other rates or charges that are shown in the tables. The Small Account Average in the Table 5.2 is the monthly average of a smaller utility meter that will not be affected by the CHP system. It is included in the calculations for thoroughness.

The sizes of the CHP system used are 50 kW_e, 100 kW_e, 150 kW_e, 200 kW_e, 250 kW_e, and 300 kW_e. Both MicroTurbines and ICE are considered. The efficiencies used are the averages of the ranges of efficiencies suggested in the tool. These values are 34.5%, 50.5%, 29.5%, and 60.5%. The first two values are ICE electric and thermal efficiencies, respectively, and the last two values are MicroTurbine electric and thermal efficiencies, respectively. The efficiencies are used to calculate the thermal input [kW_t & MMBtu/hr] and thermal output [MMBtu/hr]. The plant operates all 8,760 hours of the year and can be modeled as one 24-hour shift, two 12-hour shifts, three eight-hour shifts, or anything that adds up to 24 hours per day. It operates all seven days of the week. The first shift’s starting time does not affect any calculations, only the graphs that show 15-minute interval thermal plant demand and CHP...
thermal output. The average thermal load factor (LF) is estimated to be 0.5 and the average thermal slope factor (SF) to be 0.5 as well. The LF calculates an average daily thermal peak demand and the SF determines the nature of the plant’s build up to that daily peak demand. The last input value on the CHP System Information tab is $0.03/kWh for any credited kWh (though no extra monthly electricity was credited to the CHP plant).

Finally, the investment costs used are $2,750/kW for ICE and $3,000/kW for MicroTurbines. These numbers also account for the additional parts and labor costs. Maintenance estimates are $0.02/kWh for MicroTurbines and ICE greater than 100 kW and $0.0225/kWh for ICE of 100 kW or less. A federal MicroTurbine incentive is applied to all MicroTurbines. This incentive is a one-time grant of 10% of any costs associated with implementing the CHP system up to $200/kW.

Results from the simulation are shown below, divided by MicroTurbine and ICE CHP systems. The best case scenario for Sweet Potato Plant is to implement a 50 kW ICE or a 200 kW MicroTurbine. However, the SPP is at best just below 11 years. ICE typically only have a lifetime of about 15 years so this would not be economical. Likewise, MicroTurbines typically last about 20 – 25 years. Still, such a long payback period is undesirable and the 250 kW MicroTurbine would not be considered economical either.
Table 5.3: Sweet Potato Plant MicroTurbine NAS, electric power, and SPP

<table>
<thead>
<tr>
<th>Net Annual Savings</th>
<th>$12,830</th>
<th>$25,371</th>
<th>$36,645</th>
<th>$46,440</th>
<th>$54,877</th>
<th>$61,744</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power_e</td>
<td>50</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>250</td>
<td>300</td>
</tr>
<tr>
<td>Simple Payback</td>
<td>10.91</td>
<td>11.04</td>
<td>11.46</td>
<td>12.06</td>
<td>12.76</td>
<td>13.60</td>
</tr>
</tbody>
</table>

Figure 5.1: Plot of NAS vs. SPP for range of MicroTurbine electric power at Sweet Potato Plant
Table 5.4: Sweet Potato Plant IC Engine NAS, electric power, and SPP

<table>
<thead>
<tr>
<th>Net Annual Savings</th>
<th>Power_e</th>
<th>Simple Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10,844</td>
<td>50</td>
<td>12.68</td>
</tr>
<tr>
<td>$21,659</td>
<td>100</td>
<td>12.70</td>
</tr>
<tr>
<td>$35,401</td>
<td>150</td>
<td>11.65</td>
</tr>
<tr>
<td>$46,232</td>
<td>200</td>
<td>11.90</td>
</tr>
<tr>
<td>$56,278</td>
<td>250</td>
<td>12.22</td>
</tr>
<tr>
<td>$65,669</td>
<td>300</td>
<td>12.56</td>
</tr>
</tbody>
</table>

Figure 5.2: Plot of NAS vs. SPP for range of IC engine electric power at Sweet Potato Plant

As the plots show, the SPP seems to hit a limit as the electric output of the CHP system increases, and in the case of the MicroTurbine, eventually becomes less economic. In the case of the ICE, the estimated maintenance rate is reduced to $0.02/kWh_e from $0.0225/kWh_e, which is reflected with a slight dip in the plot. Due to the highly seasonal nature of Sweet Potato Plant’s thermal demand, as the CHP system increases in size, less of its thermal output is able to be recovered for useful plant promises. Even though electric utility cost savings increase, so does
the cost to run the CHP system. The increasing price and decreasing overall thermal efficiency create a limit for CHP systems most feasible payback scenario.

This limit is based on a plant’s baseload thermal demand and the peak thermal demand to some extent. In reality, as CHP systems get much bigger, outside of the range of micro-CHP systems considered here (50 kW\textsubscript{e} to 300 kW\textsubscript{e}) the $/kW\textsubscript{e}$ investment rate and the $/kWh\textsubscript{e}$ maintenance rates decrease. These two rates are essentially constant in the micro-CHP range.

5.2 Statewide Scenario Analysis

5.2.1 Sweet Potato Plant Scenario. Sweet Potato Plant is evaluated at the three locations across the state under the same circumstances as the evaluation at its actual location. The only differences are the utility rates determining its annual utility costs and annual utility cost savings.

5.2.2 Frozen Yogurt Plant Scenario. Frozen Yogurt Plant has a smaller but non-seasonal thermal demand and operates 2,900 hours per year, 5 days a week, with a 0.9 LF. A 0.9 SF is also used. The rest of the inputs are the same as the first simulation. The usage profile is shown below in Table 3.5.
Table 2.5: Frozen Yogurt Plant electric and natural gas usage profile

<table>
<thead>
<tr>
<th>Month</th>
<th>Electricity kWh</th>
<th>kW-mo</th>
<th>Natural Gas MMBtu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep-12</td>
<td>226,560</td>
<td>882.0</td>
<td>987</td>
</tr>
<tr>
<td>Oct-12</td>
<td>161,120</td>
<td>849.0</td>
<td>907</td>
</tr>
<tr>
<td>Nov-12</td>
<td>147,840</td>
<td>812.0</td>
<td>946</td>
</tr>
<tr>
<td>Dec-12</td>
<td>141,760</td>
<td>813.0</td>
<td>747</td>
</tr>
<tr>
<td>Jan-13</td>
<td>153,520</td>
<td>824.0</td>
<td>999</td>
</tr>
<tr>
<td>Feb-13</td>
<td>167,440</td>
<td>861.0</td>
<td>1,003</td>
</tr>
<tr>
<td>Mar-13</td>
<td>182,240</td>
<td>846.0</td>
<td>1,090</td>
</tr>
<tr>
<td>Apr-13</td>
<td>227,520</td>
<td>1,062.0</td>
<td>1,141</td>
</tr>
<tr>
<td>May-13</td>
<td>249,160</td>
<td>1,043.0</td>
<td>1,112</td>
</tr>
<tr>
<td>Jun-13</td>
<td>269,560</td>
<td>1,092.0</td>
<td>1,155</td>
</tr>
<tr>
<td>Jul-13</td>
<td>262,200</td>
<td>1,139.0</td>
<td>1,023</td>
</tr>
<tr>
<td>Aug-13</td>
<td>238,040</td>
<td>1,096.0</td>
<td>897</td>
</tr>
<tr>
<td>Totals:</td>
<td>2,426,960</td>
<td>11,319</td>
<td>12,007</td>
</tr>
</tbody>
</table>

5.2.3 Poultry Plant Scenario. Poultry Plant has a slightly higher thermal demand than the sweet potato plant with some seasonality, but not as much. It operates for 4,960 hours per year, 6 days per week with a LF and SF of 0.6.
Table 5.6: Poultry Plant electric and natural gas usage profile

<table>
<thead>
<tr>
<th>Month</th>
<th>Electricity kWh</th>
<th>kW-mo</th>
<th>Natural Gas MMBtu</th>
</tr>
</thead>
<tbody>
<tr>
<td>May-11</td>
<td>1,090,750</td>
<td>2,348.3</td>
<td>1,735</td>
</tr>
<tr>
<td>Jun-11</td>
<td>1,172,750</td>
<td>2,456.8</td>
<td>1,756</td>
</tr>
<tr>
<td>Jul-11</td>
<td>1,337,750</td>
<td>2,463.2</td>
<td>1,707</td>
</tr>
<tr>
<td>Aug-11</td>
<td>1,206,750</td>
<td>2,561.7</td>
<td>1,742</td>
</tr>
<tr>
<td>Sep-11</td>
<td>1,245,000</td>
<td>2,537.2</td>
<td>2,134</td>
</tr>
<tr>
<td>Oct-11</td>
<td>1,219,250</td>
<td>2,315.8</td>
<td>2,196</td>
</tr>
<tr>
<td>Nov-11</td>
<td>1,086,000</td>
<td>2,361.3</td>
<td>2,354</td>
</tr>
<tr>
<td>Dec-11</td>
<td>1,110,250</td>
<td>2,295.1</td>
<td>2,831</td>
</tr>
<tr>
<td>Jan-12</td>
<td>1,151,000</td>
<td>2,379.3</td>
<td>4,245</td>
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<tr>
<td>Feb-12</td>
<td>936,750</td>
<td>2,157.2</td>
<td>2,520</td>
</tr>
<tr>
<td>Mar-12</td>
<td>933,250</td>
<td>2,156.2</td>
<td>2,545</td>
</tr>
<tr>
<td>Apr-12</td>
<td>1,079,000</td>
<td>2,232.2</td>
<td>2,083</td>
</tr>
<tr>
<td>Totals:</td>
<td>13,568,500</td>
<td>28,264</td>
<td>27,848</td>
</tr>
</tbody>
</table>

5.3 Discussion

The table below shows all of the most lucrative sizes of CHP systems for both MicroTurbines and ICE for all three plants (sweet potato, frozen yogurt, and poultry products) considering all three combinations of utility rates based on locations. The least economical place to implement a CHP system would be in Fort Smith due to the already low electric utility costs. The MicroTurbine is almost always more economical or approximately even with the ICE, though only due to the incentive. The SPP from the utility rates corresponding to Little Rock are lowest for Frozen Yogurt Plant, but the SPP is lower in NWA for the other two plants.

Frozen Yogurt Plant and Poultry Plant are more economical with larger CHP systems, and Sweet Potato Plant has varying results. This shows for each individual energy usage profile there is an optimum size of micro-CHP system that is not only based on the monthly average thermal demand, but also the monthly peak thermal demand, the monthly baseload thermal demand, and seasonal variance in thermal demand.
### Table 5.7: Comparison of NAS, SPP, and electric power for most lucrative MicroTurbine and ICE sizes in multiple locations for Sweet Potato Plant, Frozen Yogurt Plant, and Poultry Plant

<table>
<thead>
<tr>
<th>Facility Products</th>
<th>Locations</th>
<th>Utility Company</th>
<th>CHP Type</th>
<th>kW&lt;sub&gt;e&lt;/sub&gt;</th>
<th>Net Annual Savings</th>
<th>Simple Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet Potato</td>
<td>Original Location</td>
<td>Custom</td>
<td>MicroTurbine</td>
<td>50</td>
<td>$12,830</td>
<td>10.91</td>
</tr>
<tr>
<td></td>
<td>Custom Black Hills</td>
<td>Custom MicroTurbine</td>
<td>150</td>
<td>$26,519</td>
<td>26.95</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICE Black Hills</td>
<td>MicroTurbine</td>
<td>150</td>
<td>$25,985</td>
<td>26.46</td>
<td></td>
</tr>
<tr>
<td>Frozen Yogurt</td>
<td>NWA Black Hills</td>
<td>MicroTurbine</td>
<td>150</td>
<td>($12,575)</td>
<td>-33.40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICE Black Hills</td>
<td>MicroTurbine</td>
<td>150</td>
<td>($20,950)</td>
<td>-32.82</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Entergy MicroTurbine Center</td>
<td>MicroTurbine</td>
<td>150</td>
<td>($1,601)</td>
<td>-262.34</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICE MicroTurbine Center</td>
<td>ICE MicroTurbine</td>
<td>150</td>
<td>($1,825)</td>
<td>-376.66</td>
<td></td>
</tr>
<tr>
<td>Poultry</td>
<td>NWA Black Hills</td>
<td>MicroTurbine</td>
<td>300</td>
<td>$16,109</td>
<td>52.14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICE Black Hills</td>
<td>MicroTurbine</td>
<td>300</td>
<td>$14,043</td>
<td>58.75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Entergy MicroTurbine Center</td>
<td>MicroTurbine</td>
<td>300</td>
<td>$35,279</td>
<td>23.81</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICE MicroTurbine Center</td>
<td>ICE MicroTurbine</td>
<td>300</td>
<td>$32,740</td>
<td>25.20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NWA Black Hills</td>
<td>MicroTurbine</td>
<td>300</td>
<td>$31,711</td>
<td>26.49</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICE Black Hills</td>
<td>MicroTurbine</td>
<td>300</td>
<td>$28,528</td>
<td>28.92</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Entergy MicroTurbine Center</td>
<td>MicroTurbine</td>
<td>300</td>
<td>$3,456</td>
<td>243.06</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICE MicroTurbine Center</td>
<td>ICE MicroTurbine</td>
<td>300</td>
<td>$14,043</td>
<td>58.75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NWA Black Hills</td>
<td>MicroTurbine</td>
<td>300</td>
<td>$26,638</td>
<td>31.53</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICE Black Hills</td>
<td>MicroTurbine</td>
<td>300</td>
<td>$22,403</td>
<td>36.82</td>
<td></td>
</tr>
</tbody>
</table>

Considering all optimally sized micro-CHP systems, implementation is not economically feasible in any of the three major regions considered. The utility rates in these non-rural areas of Arkansas are still low enough compared to the price of micro-CHP implementation for manufacturing companies to not need to implement micro-CHP technology. However, as rates and technology change, or if a manufacturing plant is located in a less populous area where electric rates are more expensive, a plant could use the algorithm spreadsheet tool to make an accurate first assessment.

The following plot compares what combination of rates would be favorable for CHP implementation for a plant that operates 8,760 hours a year with a one to one ratio of baseload thermal demand to electric energy consumption. The vertical axis shows the spark spread, which is the difference between the rate at which electricity is purchased from the grid, and the rate at
which electricity can be created using purchased natural gas ($7.00/MMBtu), taking into account the electric efficiency of the CHP system. To represent these spark spread values the natural gas rates were held constant – natural gas rates are not expected to rise for the foreseeable future. An average MicroTurbine electric efficiency value was selected (29.5%) and the electric kWh rate was changed to produce the spark spread values in the plot below. The spark spread is plotted against the IRR on the y-axis for four different demand charge values from $5/kW-mo to $20/kW-mo.

![Figure 5.3: Plot of IRR vs. spark spread for four different demand charge values](image)

The spark spreads for the three manufacturing locations are marked by the red Xs based demand charges. As the plot shows, the relationship between the spark spread and the internal rate of return are almost linear. The three manufacturing locations examined in this study all offer negative spark spread values that yield extremely low IRR values. In order to achieve the
maximum 7-year simple payback as mentioned to be desirable earlier in the report, the price per unit of electricity would need to be above $0.08/kWh\text{e} for a $10/kW\text{e}-\text{mo}$ electric demand rate.
Chapter 6: Conclusions

An algorithm tool was developed using Excel’s Visual Basic for Applications (VBA) program for manufacturing plants to explore the possibilities of implementing CHP systems. The CHP algorithm tool was proven to be accurate when it was used to recalculate CHP savings from 3 different scenarios and simulations as performed by Rodriguez (2014) in, “A Technical and Economic Assessment of a Cogeneration System in an Urban Academic Building.”

The tool was then used to calculate the Net Annual Savings (NAS), Internal Rate of Return (IRR), Simple Payback Period (SPP), and Return on Investment (ROI) for 6 different sizes of micro-CHP systems (ranging from 50 kW_{e} to 300 kW_{e}) for both MicroTurbines and ICE in 3 different locations throughout the state of Arkansas, all with different applicable utility rates.

As predicted, the most important factor for achieving economic feasibility was the utility rates, and not the size or type of CHP system. Little Rock, AR and the Northwest Arkansas (NWA) metropolitan area both had higher utility rates than in Fort Smith, AR. Higher utility rate costs resulted in higher utility rate cost savings. For example, saving one kWh_{e}, one kW_{e}, or one MMBtu to a manufacturing plant in Little Rock or NWA is more valuable than it is to a manufacturing plant in Fort Smith. Therefore, these two locations would be more interested in implementing a CHP system.

However, while all three locations could reduce the cost of their utility bills (by reducing electric utility costs and increasing natural gas utility costs to run the CHP system) the cost to maintain the CHP system created lower NAS, and sometimes even negative NAS.

Only a couple of the 120 scenarios that were simulated achieved a SPP between ten and 15 years. Generally, a manufacturing plant of this size would not want to invest in a project with a SPP of much greater than 7 or 8 years. In conclusion, manufacturing plants in the state of
Arkansas are not likely to consider purchasing and implementing CHP systems due to poor economic feasibility. This could change in the future if technology develops enough to reduce the prices of CHP systems or the spark spread in Arkansas increases to at least above $0.00 or an average price per kWh of $0.08.

The spreadsheet algorithm tool did show that it can sufficiently analyze a scenario for micro-CHP implementation. And though micro-CHP implementation is unfavorable now, the tool is flexible for future use. The custom rate schedules feature allows for the user to examine scenarios in any location of the state on many imaginable structures of rate schedules. In addition, users can update the rates for the major companies included in the tool.


Appendix A: Validation
### Table A.1: Electric and natural gas usage profiles used in the verification simulations

<table>
<thead>
<tr>
<th></th>
<th>Electrical Demand kWh_e</th>
<th>Electrical Peak Demand kW_e-mo</th>
<th>Heat Demand MMBtu_t</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>384,452</td>
<td>675</td>
<td>2,529</td>
</tr>
<tr>
<td>February</td>
<td>422,169</td>
<td>705</td>
<td>2,437</td>
</tr>
<tr>
<td>March</td>
<td>437,416</td>
<td>805</td>
<td>3,179</td>
</tr>
<tr>
<td>April</td>
<td>387,138</td>
<td>975</td>
<td>740</td>
</tr>
<tr>
<td>May</td>
<td>453,520</td>
<td>1,110</td>
<td>799</td>
</tr>
<tr>
<td>June</td>
<td>505,222</td>
<td>930</td>
<td>471</td>
</tr>
<tr>
<td>July</td>
<td>492,611</td>
<td>915</td>
<td>332</td>
</tr>
<tr>
<td>August</td>
<td>455,701</td>
<td>910</td>
<td>243</td>
</tr>
<tr>
<td>September</td>
<td>448,767</td>
<td>745</td>
<td>466</td>
</tr>
<tr>
<td>October</td>
<td>453,442</td>
<td>965</td>
<td>965</td>
</tr>
<tr>
<td>November</td>
<td>424,739</td>
<td>980</td>
<td>1,919</td>
</tr>
<tr>
<td>December</td>
<td>397,042</td>
<td>690</td>
<td>1,364</td>
</tr>
<tr>
<td><strong>Totals:</strong></td>
<td><strong>5,262,219</strong></td>
<td><strong>10,405</strong></td>
<td><strong>15,444</strong></td>
</tr>
</tbody>
</table>

### Table A.2: CHP System Scenario Inputs for 41 Cooper Square

<table>
<thead>
<tr>
<th>Simulation 2 Inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy cost</td>
<td>$0.176 per kWh_e</td>
</tr>
<tr>
<td>Peak Demand cost</td>
<td>$8.739 per kW_e-mo</td>
</tr>
<tr>
<td>Natural Gas cost</td>
<td>$10.290 per MMBtu_t</td>
</tr>
<tr>
<td>CHP Power</td>
<td>223.083 kW_e</td>
</tr>
<tr>
<td>CHP Input</td>
<td>734.775 kW_t</td>
</tr>
<tr>
<td>CHP Input</td>
<td>2.507 MMBtu/hr</td>
</tr>
<tr>
<td>CHP Output</td>
<td>0.920 MMBtu/hr</td>
</tr>
<tr>
<td>Maintenance cost</td>
<td>$0.0446 per kWh_e</td>
</tr>
<tr>
<td>Length of Shift</td>
<td>19.98 hr/day</td>
</tr>
<tr>
<td>Thermal L.F.</td>
<td>0.5791</td>
</tr>
</tbody>
</table>
Table A.3: Retrofit CHP System Scenario Inputs for 41 Cooper Square

<table>
<thead>
<tr>
<th>Simulation 3 Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy cost</td>
</tr>
<tr>
<td>Peak Demand cost</td>
</tr>
<tr>
<td>Natural Gas cost</td>
</tr>
<tr>
<td>CHP Power</td>
</tr>
<tr>
<td>CHP Input</td>
</tr>
<tr>
<td>CHP Output</td>
</tr>
<tr>
<td>Maintenance cost</td>
</tr>
<tr>
<td>Length of Shift</td>
</tr>
<tr>
<td>Thermal L.F.</td>
</tr>
</tbody>
</table>

Table A.4: RFP CHP System Scenario Inputs for 41 Cooper Square

<table>
<thead>
<tr>
<th>Simulation 4 Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy cost</td>
</tr>
<tr>
<td>Demand cost</td>
</tr>
<tr>
<td>Natural Gas cost</td>
</tr>
<tr>
<td>CHP Power</td>
</tr>
<tr>
<td>CHP Input</td>
</tr>
<tr>
<td>CHP Output</td>
</tr>
<tr>
<td>Maintenance cost</td>
</tr>
<tr>
<td>Length of Shift</td>
</tr>
<tr>
<td>Thermal L.F.</td>
</tr>
</tbody>
</table>
Table A.5: Economic performance of Simulation 2

<table>
<thead>
<tr>
<th>Current CHP System</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHP Unit Cost</td>
</tr>
<tr>
<td>Parts &amp; Labor Costs</td>
</tr>
<tr>
<td>Maintenance Cost</td>
</tr>
<tr>
<td>Annual CHP kWh</td>
</tr>
<tr>
<td>Annual NG Offset</td>
</tr>
<tr>
<td>Electric Cost Savings</td>
</tr>
<tr>
<td>NG Cost Offset</td>
</tr>
<tr>
<td>Utility Cost Savings</td>
</tr>
<tr>
<td>Maintenance Cost</td>
</tr>
<tr>
<td>Net Annual Savings</td>
</tr>
<tr>
<td>Simple Payback Period</td>
</tr>
<tr>
<td>ROI</td>
</tr>
</tbody>
</table>

Actual Values from Rodriguez’s Thesis

Report Ann Sav. | $101,000 |
Rep. SPP        | 11.88 year(s) |
Rep ROI         | 8.42% |

Table A.6: Economic performance of Simulation 3

<table>
<thead>
<tr>
<th>Retrofitted CHP System</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHP Unit Cost</td>
</tr>
<tr>
<td>Parts &amp; Labor Costs</td>
</tr>
<tr>
<td>Maintenance Cost</td>
</tr>
<tr>
<td>Annual CHP kWh</td>
</tr>
<tr>
<td>Annual NG Offset</td>
</tr>
<tr>
<td>Electric Cost Savings</td>
</tr>
<tr>
<td>NG Cost Offset</td>
</tr>
<tr>
<td>Utility Cost Savings</td>
</tr>
<tr>
<td>Maintenance Cost</td>
</tr>
<tr>
<td>Net Annual Savings</td>
</tr>
<tr>
<td>Simple Payback Period</td>
</tr>
<tr>
<td>ROI</td>
</tr>
</tbody>
</table>

Actual Values from Rodriguez’s Thesis

Report Ann Sav. | $206,000 |
Rep. SPP        | 5.83 year(s) |
Rep ROI         | 17.17% |
Table A.7: Economic performance of Simulation 4

<table>
<thead>
<tr>
<th>RFP CHP System</th>
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</thead>
<tbody>
<tr>
<td>CHP Unit Cost</td>
</tr>
<tr>
<td>Parts &amp; Labor Costs</td>
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<td>Maintenance Cost</td>
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<tr>
<td>Annual CHP kWh</td>
</tr>
<tr>
<td>Annual NG Offset</td>
</tr>
<tr>
<td>Electric Cost Savings</td>
</tr>
<tr>
<td>NG Cost Offset</td>
</tr>
<tr>
<td>Utility Cost Savings</td>
</tr>
<tr>
<td>Maintenance Cost</td>
</tr>
<tr>
<td>Net Annual Savings</td>
</tr>
<tr>
<td>Simple Payback Period</td>
</tr>
<tr>
<td>ROI</td>
</tr>
</tbody>
</table>

**Actual Values from Rodríguez’s Thesis**

| Report Ann Sav. | $286,000 |
| Rep. SPP       | 6.57 year(s) |
| Rep ROI        | 15.21% |
Table A.8: Simulation results from algorithm tool showing Simulation 1 and Simulation 2

<table>
<thead>
<tr>
<th>Month</th>
<th>Without CHP</th>
<th>Current CHP</th>
<th>Utility Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electric Utility Cost</td>
<td>Natural Gas Utility Cost</td>
<td>Total Cost</td>
</tr>
<tr>
<td>January</td>
<td>$73,562.38</td>
<td>$26,022.18</td>
<td>$99,584.56</td>
</tr>
<tr>
<td>February</td>
<td>$80,462.74</td>
<td>$25,075.60</td>
<td>$105,538.34</td>
</tr>
<tr>
<td>March</td>
<td>$84,020.11</td>
<td>$32,710.26</td>
<td>$116,730.37</td>
</tr>
<tr>
<td>April</td>
<td>$76,656.81</td>
<td>$7,616.35</td>
<td>$84,273.16</td>
</tr>
<tr>
<td>May</td>
<td>$89,519.81</td>
<td>$32,710.26</td>
<td>$122,230.07</td>
</tr>
<tr>
<td>June</td>
<td>$97,046.34</td>
<td>$4,850.91</td>
<td>$101,897.25</td>
</tr>
<tr>
<td>July</td>
<td>$94,695.72</td>
<td>$3,419.16</td>
<td>$98,114.88</td>
</tr>
<tr>
<td>August</td>
<td>$88,155.87</td>
<td>$2,502.84</td>
<td>$90,658.71</td>
</tr>
<tr>
<td>September</td>
<td>$85,493.55</td>
<td>$4,793.80</td>
<td>$90,287.35</td>
</tr>
<tr>
<td>October</td>
<td>$88,238.93</td>
<td>$9,926.45</td>
<td>$98,165.38</td>
</tr>
<tr>
<td>November</td>
<td>$83,318.28</td>
<td>$19,749.70</td>
<td>$103,067.98</td>
</tr>
<tr>
<td>December</td>
<td>$75,909.30</td>
<td>$14,030.93</td>
<td>$89,940.23</td>
</tr>
<tr>
<td>Totals:</td>
<td>$1,017,079.84</td>
<td>$158,916.39</td>
<td>$1,175,996.23</td>
</tr>
</tbody>
</table>

Note: Utility Cost Savings do not reflect maintenance costs
Table A.8: Simulation results from algorithm tool showing Simulation 1 and Simulation 3

<table>
<thead>
<tr>
<th>Month</th>
<th>Without CHP</th>
<th>Retrofitted CHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>$73,562.38</td>
<td>$26,022.18</td>
</tr>
<tr>
<td>February</td>
<td>$80,462.74</td>
<td>$25,075.60</td>
</tr>
<tr>
<td>March</td>
<td>$84,020.11</td>
<td>$32,710.26</td>
</tr>
<tr>
<td>April</td>
<td>$76,656.81</td>
<td>$7,616.35</td>
</tr>
<tr>
<td>May</td>
<td>$89,519.81</td>
<td>$8,218.21</td>
</tr>
<tr>
<td>June</td>
<td>$97,046.34</td>
<td>$4,850.91</td>
</tr>
<tr>
<td>July</td>
<td>$94,695.72</td>
<td>$3,419.16</td>
</tr>
<tr>
<td>August</td>
<td>$88,155.87</td>
<td>$2,502.84</td>
</tr>
<tr>
<td>September</td>
<td>$85,493.55</td>
<td>$4,793.80</td>
</tr>
<tr>
<td>October</td>
<td>$88,238.93</td>
<td>$9,926.45</td>
</tr>
<tr>
<td>November</td>
<td>$83,318.28</td>
<td>$19,749.70</td>
</tr>
<tr>
<td>December</td>
<td>$75,909.30</td>
<td>$14,030.93</td>
</tr>
<tr>
<td>Totals:</td>
<td>$1,017,079.84</td>
<td>$158,916.39</td>
</tr>
</tbody>
</table>

Note: Utility Cost Savings do not reflect maintenance costs
Table A.9: Simulation results from algorithm tool showing Simulation 1 and Simulation 4.

<table>
<thead>
<tr>
<th>Month</th>
<th>Without CHP</th>
<th>RFP CHP</th>
<th>Utility Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electric Utility Cost</td>
<td>Natural Gas Utility Cost</td>
<td>Total Cost</td>
</tr>
<tr>
<td>January</td>
<td>$73,562.38</td>
<td>$26,022.18</td>
<td>$99,584.56</td>
</tr>
<tr>
<td>February</td>
<td>$80,462.74</td>
<td>$25,075.60</td>
<td>$105,538.34</td>
</tr>
<tr>
<td>March</td>
<td>$84,020.11</td>
<td>$32,710.26</td>
<td>$116,730.37</td>
</tr>
<tr>
<td>April</td>
<td>$76,656.81</td>
<td>$7,616.35</td>
<td>$84,273.16</td>
</tr>
<tr>
<td>May</td>
<td>$89,519.81</td>
<td>$8,218.21</td>
<td>$97,738.02</td>
</tr>
<tr>
<td>June</td>
<td>$97,046.34</td>
<td>$4,850.91</td>
<td>$101,897.25</td>
</tr>
<tr>
<td>July</td>
<td>$94,695.72</td>
<td>$3,419.16</td>
<td>$98,114.88</td>
</tr>
<tr>
<td>August</td>
<td>$88,155.87</td>
<td>$2,502.84</td>
<td>$90,658.71</td>
</tr>
<tr>
<td>September</td>
<td>$85,493.55</td>
<td>$4,793.80</td>
<td>$90,287.35</td>
</tr>
<tr>
<td>October</td>
<td>$88,238.93</td>
<td>$9,926.45</td>
<td>$98,165.38</td>
</tr>
<tr>
<td>November</td>
<td>$83,318.28</td>
<td>$19,749.70</td>
<td>$103,067.98</td>
</tr>
<tr>
<td>December</td>
<td>$75,909.30</td>
<td>$14,030.93</td>
<td>$89,940.23</td>
</tr>
<tr>
<td>Totals:</td>
<td>$1,017,079.84</td>
<td>$158,916.39</td>
<td>$1,175,996.23</td>
</tr>
</tbody>
</table>

Note: Utility Cost Savings do not reflect maintenance costs.
Figure A.1: Weekly Electrical Demand for January

Figure A.2: Weekly Electrical Demand for February
Figure A.3: Weekly Electrical Demand for March

Figure A.4: Weekly Electrical Demand for April
Figure A.5: Weekly Electrical Demand for May

Figure A.6: Weekly Electrical Demand for June
Figure A.7: Weekly Electrical Demand for July

Figure A.8: Weekly Electrical Demand for August
Figure A.9: Weekly Electrical Demand for September

Figure A.10: Weekly Electrical Demand for October
Figure A.11: Weekly Electrical Demand for November

Figure A.12: Weekly Electrical Demand for December
Figure A.13: Weekly Heat Demand for January

Figure A.14: Weekly Heat Demand for February
Figure A.15: Weekly Heat Demand for March

Figure A.16: Weekly Heat Demand for April
Figure A.17: Weekly Heat Demand for May

Figure A.18: Weekly Heat Demand for June
Figure A.19: Weekly Heat Demand for July

Figure A.20: Weekly Heat Demand for August
Figure A.21: Weekly Heat Demand for September

Figure A.22: Weekly Heat Demand for October
Figure A.23: Weekly Heat Demand for November

Figure A.24: Weekly Heat Demand for December
Appendix B:

Detailed Algorithm Flowcharts
Electric Utility Bill Costs

Input Electric Rate Schedule

Built-in or Custom Rate Schedule?

- Built-in
- Custom

Energy Seasonal Information, Demand Seasonal Information, Energy Peak Information, Demand Peak Information, Block Expander Information, Number of Energy Riders, Number of Demand Riders, Minimum Billed Demand Information, Ratchet Clause Information, First Month of Bills, Taxes and Fees Information

Generate Cells for Energy Rates, Demand Rates, Fuel Rates, Taxes and Fees, Minimum Billed Demand, Ratchet Clause Percentage and number of applicable months, Usage Information Table

A

B
Input Energy Rates, Demand Rates, Fuel Rates, Taxes and Fees, Minimum Billed Demand, Ratchet Clause Percentage and number of applicable months, Usage Information

Calculate Energy Cost, Demand Cost, Cost of Fuel, Energy Riders Cost, Demand Riders Cost, Subtotal, Taxes and Fees Cost, Total Cost
Natural Gas Utility Bill Costs

Input Natural Gas Rate Schedule

Built-in or Custom Rate Schedule?

- Energy Seasonal Information, Demand Seasonal Information, Energy Peak Information, Block Expander Information, Number of Energy Riders, Number of Demand Riders, Minimum Billed Demand Information, Ratchet Clause Information, First Month of Bills, Taxes and Fees Information

Generate Cells for Energy Rates, Demand Rates, Fuel Rates, Taxes and Fees, Minimum Billed Demand, Ratchet Clause Percentage and number of applicable months, Usage Information Table

A

B

113
Input Energy Rates, Demand Rates, Fuel Rates, Taxes and Fees, Minimum Billed Demand, Ratchet Clause Percentage and number of applicable months, Usage Information

Calculate Energy Cost, Demand Cost, Cost of Fuel, Energy Riders Cost, Demand Riders Cost, Subtotal, Taxes and Fees Cost, Total Cost
Input Taxes, Fees

CenterPoint, AOGC, or Black Hills?

Input Transmission Service Option, LCFC Incentive

Input Natural Gas Consumption, Peak-Demand Day information

Calculate Current Annual Natural Gas Utility Costs using templates

End of Natural Gas Utility Bill Costs Algorithm
Proposed Electric Utility Data

Input CHP Electric Power Output, Shifts/day, Length of Shifts, Operating Days/wk, First Shift Start Time, Daily Average Plant Thermal Load Factor, Daily Thermal Demand Usage Slope Factor, kWh Credits Value

Calculate Monthly Operating Hours

Calculate Monthly CHP kWh Output

Is Monthly CHP kWh Output > Monthly Billed kWh?

- No
  - Proposed Monthly Billed kWh = Monthly Billed kWh - Monthly CHP kWh Output

- YES
  - Proposed Monthly Billed kWh = 0 Monthly Credited kWh = Monthly CHP kWh Output - Monthly Billed kWh
Monthly Operating Days = \[\frac{\text{(Weekly Operating Days)}}{(7 \text{ days/wk})} \times \frac{[365 \text{ days/yr}]}{(12 \text{ mo/yr})}\]  
Daily Operating Hours = (Length of Shift) \times (Shifts/day)

Monthly Operating Hours = (Daily Operating Hours) \times (Monthly Operating Days)

Monthly CHP Thermal Input [MMBtu] = (Monthly Operating Hours) \times \frac{(CHP Thermal Input [MMBtu/hr])}{(CHP Thermal Output [MMBtu/hr])}

Daily NG Plant Consumption = (Monthly NG Plant Consumption) \div (Monthly Operating Days)

Daily Peak-hour NG Plant Consumption = (Daily NG Plant Consumption) \div (Daily Operating Hours \times \text{Average Thermal Daily Load Factor})

\[n = \text{Daily Operating Hours} \times 4\]
\[M = \frac{n}{2}\]
\[P = M - 4\]
\[
\text{15-minute Non-Peak Average NG Consumption} = \\
\frac{(\text{Daily NG Consumption} - \text{Daily Peak-Hour Consumption})}{(M + P)}
\]

\[
\begin{align*}
\text{TRUE} & \quad \frac{\text{Daily Peak-Hour Consumption}}{4} - \text{15-minute Non-Peak Average NG Consumption} > \\
& \quad \text{15-minute Non-Peak Average NG Consumption} \\
\text{FALSE} & \quad \text{Max Non-Peak-Hour Consumption Variance} = \\
& \quad \frac{\text{Daily Peak-Hour Consumption}}{4} - \text{15-minute Non-Peak Average NG Consumption}
\end{align*}
\]

\[
\text{Max Non-Peak-Hour Consumption Variance} = 15\text{-minute Non-Peak Average NG Consumption}
\]

(15-minute Consumption)\(i\) = Daily Peak-Hour Consumption

M < i ≤ M + 4

TRUE

FALSE

D

E

F

H
\[(15\text{-minute Consumption})_i = [15\text{-minute Non-Peak Average NG Consumption} + (1 - \text{Daily Thermal Demand Usage Slope Factor}) \times \text{Max Non-Peak-Hour Consumption Variance} - \left[\left(2 \times \left(\frac{M - 4}{2}\right)\right) \times \left(1 - \text{Daily Thermal Demand Usage Slope Factor}\right) \times \text{Max Non-Peak-Hour Consumption Variance}\right] \times 2} / (P)\]
$i > (\text{Daily Operating Hours}) \times 4$

**TRUE**

Daily Recoverable Heat = $\sum_{i=1}^{DOH\times4} (15\text{-minute Recoverable Heat})$

Monthly Recoverable Heat = Monthly Operating Days * Daily Recoverable Heat

End of Proposed Natural Gas Utility Data Algorithm
Electric Utility Cost Savings

Input Original Electric Utility Data

Calculate Current ‘Electric Utility Bill Costs’

Calculate ‘Proposed Electric Utility Data’

Calculate Proposed ‘Electric Utility Bill Costs’


End of Electric Utility Cost Savings Algorithm
1. Natural Gas Utility Cost Offset
2. Input Original Natural Gas Utility Data
3. Calculate Current ‘Natural Gas Utility Bill Costs’
4. Calculate ‘Proposed Natural Gas Utility Data’
5. Calculate Proposed ‘Natural Gas Utility Bill Costs’
7. End of Natural Gas Utility Cost Savings Algorithm
Calculate Economic Performance

Input CHP investment, Labor & Additional Costs, Maintenance Rate [$/kWh], MicroTurbine Incentive

Annual Utility Savings = Electric Utility Savings - Natural Gas Utility Offset

CHP Annual kWh_e Production = (CHP Electric Power) * (Monthly Operating Hours * 12 mo/yr)

Maintenance Cost = (CHP Annual kWh_e Production) * (Maintenance Rate)

i = 0

i > 0

MicroTurbine Incentive?

NO

A

YES

B

D

E
Investment Rebate = $0

Investment Rebate = 10% * CHP Investment

Maximum Rebate = $200*CHP Electric Power [kW]

Investment Rebate > Maximum Rebate

MicroTurbine Rebate = Maximum Rebate

(Cash Flow) = (Investment Incentive) - (CHP Investment + Labor & Additional Costs)
(Cash Flow) = (Annual Utility Savings) - (Maintenance Cost)

i = i + 1

i > 25

Net Annual Savings = Utility Cost Savings – Maintenance Cost

F
Calculate Internal Rate of Return using Cash Flow values, 
“=IRR(Cash Flow)”

Simple Payback Period = (CHP Investment + Labor & Additional Costs – Investment Rebate) / 
(Net Annual Savings)

Return on Investment = 1 / 
(Simple Payback Period) * 100

End of Economic Performance Algorithm
Appendix C:

VBA Algorithm Code
Select Electric Rate Schedule

Public Sub ElSelectNextButton_Click()

CurrentPage = 0

If OptButtonCustomizeEl.Value = True Then

    NextPage = CurrentPage + 1

    Worksheets("Ground Zero").Range("Z1").Value = NextPage

    MultiPage1.Value = NextPage

Else:

    If (CityTaxTB = Empty Or CityTaxTB = "N/A") Then

        CityTaxTB = 0

    End If

    If (CountyTaxTB = Empty Or CountyTaxTB = "N/A") Then

        CountyTaxTB = 0

    End If

    If (StateTaxTB = Empty Or StateTaxTB = "N/A") Then

        StateTaxTB = 0

    End If

    If (MFATB = Empty Or MFATaxTB = "N/A") Then

        MFATB = 0

    End If

    If (IBRATB = Empty Or IBRATB = "N/A") Then

        IBRATB = 0

End If
End If

With Sheet1

'Assign Tax values etc. from userform to Entergy Rate Schedule Sheet'

.Range("M4").Value = CityTaxTB / 100
.Range("M5").Value = CountyTaxTB / 100
.Range("M6").Value = StateTaxTB / 100
.Range("M9").Value = MFATB / 100

If IBRATB <> "N/A" Then

.Range("M7").Value = IBRATB / 100

End If

End With

With Sheet3

'Assign Tax values etc. from userform to OG&E Rate Schedule Sheet'

.Range("N11").Value = CityTaxTB / 100
.Range("N12").Value = CountyTaxTB / 100
.Range("N13").Value = StateTaxTB / 100
.Range("N16").Value = MFATB / 100

.Range("E3").Value = ServiceLevelCB
.Range("I20").Value = MinBillTB
If (MinBillTB <> 0 And MinBillTB <> "N/A") Then
    .Range("E4").Value = "YES"
Else:
    .Range("E4").Value = "NO"
End If

End With

With Sheet2

'Assign Tax values etc. from userform to SWEPCO Rate Schedule Sheet'

    .Range("I7").Value = CityTaxTB / 100
    .Range("I8").Value = CountyTaxTB / 100
    .Range("I9").Value = StateTaxTB / 100
    .Range("I12").Value = MFATB / 100

    .Range("C5").Value = ServiceTypeCB
    .Range("E5").Value = TOUCB

End With
'FORMATTING TIMEEEE'

'If statement counts the number of usage columns'

'Usage columns will have commas & no decimal place'

'Cost columns will be currency format with 2 decimal places'

If (OptButtonLGS.Value = True Or OptButtonLPS.Value = True Or _
    OptButtonPL1.Value = True Or OptButtonLP.Value = True Or _
    OptButtonLLP.Value = True) Then

    UsageCol = 2

End If

If (OptButtonGST.Value = True Or OptButtonPST.Value = True Or _
    OptButtonPLTOUD.Value = True Or OptButtonPLTOUE.Value = True Or _
    OptButtonLPT.Value = True) Then

    UsageCol = 4

End If

With Worksheets("Ground Zero")

For j = 0 To 12

    For i = 0 To UsageCol - 1

        .Cells(4 + j, 4 + i).NumberFormat = ",,##0"

        If j <> 12 Then
            .Cells(4 + j, 4 + i).Interior.Color = 15986394
        End If

    End For

End For
Next i

For i = UsageCol To UsageCol + 4
    .Cells(4 + j, 4 + i).NumberFormat = "$#,###.00"
    Next i

Next j
End With

'Go To Next Page'

NextPage = CurrentPage + 2
Worksheets("Ground Zero").Range("Z1").Value = NextPage
MultiPage1.Value = NextPage
End If

End Sub
Calculate Electric Utility Cost

Private Sub ElCost_Click()

Dim UsageCol As Integer
Dim Sum As Single

If Worksheets("Ground Zero").Range("B1").Value = "Large General Service (LGS)" Then
    Worksheets("Ground Zero").Range("F2:L16").Value =
    Worksheets("Enerty").Range("F36:L50").Value
    UsageCol = 2
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Large General Service - Time-Of-Use (GST)" Then
    Worksheets("Ground Zero").Range("H2:L16").Value =
    Worksheets("Enerty").Range("H54:L68").Value
    UsageCol = 4
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Large Power Service (LPS)" Then
    Worksheets("Ground Zero").Range("F2:L16").Value =
    Worksheets("Enerty").Range("F72:L86").Value
    UsageCol = 2
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Large Power Service - Time-Of-Use (PST)" Then
    Worksheets("Ground Zero").Range("H2:L16").Value =
    Worksheets("Enerty").Range("H90:L104").Value
    UsageCol = 4

ElseIf Worksheets("Ground Zero").Range("B1").Value = "Lighting & Power (PL-1)" Then
    Worksheets("Ground Zero").Range("F2:L16").Value =
    Worksheets("OG&E").Range("F31:L45").Value
    UsageCol = 2
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Lighting & Power Time-of-Use Demand (PL-TOU-D)" Then
    Worksheets("Ground Zero").Range("H2:L16").Value =
    Worksheets("OG&E").Range("H51:L65").Value
    UsageCol = 4
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Lighting & Power Time-of-Use Energy (PL-TOU-E)" Then
    Worksheets("Ground Zero").Range("H2:L16").Value =
    Worksheets("OG&E").Range("H71:L85").Value
    UsageCol = 4
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Lighting & Power" Then
    Worksheets("Ground Zero").Range("F2:L16").Value =
    Worksheets("SWEPCO").Range("F35:L49").Value
    UsageCol = 2
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Large Lighting & Power" Then
    Worksheets("Ground Zero").Range("F2:L16").Value =
    Worksheets("SWEPCO").Range("F54:L68").Value
    UsageCol = 2
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Lighting & Power - Time-of-Use" Then
    Worksheets("Ground Zero").Range("H2:L16").Value = Worksheets("SWEPCO").Range("H73:L87").Value
    UsageCol = 4
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Customizable Electric" Then
    Worksheets("DIY El. Rates").Activate
    'UCount on DIY El. Rates page cell A172 is one less than the actual count'
    'I subtracted one to make it more usable for i = 0 to UCount, but it is less clear'
    UsageCol = Worksheets("DIY El. Rates").Range("A172").Value + 1
End If

For i = 0 To UsageCol - 1
    Sum = 0
    For j = 0 To 11
        Sum = Sum + Cells(4 + j, 4 + i).Value
        If Cells(3, 4 + i).Value = "kWh" Then
            Cells(3 + j, 4 + i).NumberFormat = "#,###"
        ElseIf Cells(3, 4 + i).Value = "kW-mo" Then
            Cells(3 + j, 4 + i).NumberFormat = "#,###.0"
        End If
    Next j
    Cells(4 + 12, 4 + i).Value = Sum
'FORMATTING TIMEEEE'

With Worksheets("Ground Zero")

    For i = UsageCol To UsageCol + 4 - 1
        For j = 0 To 11
            .Cells(4 + j, 4 + i).Interior.Color = 15523812
        Next j
    Next i

End With

Range("B2:P17").HorizontalAlignment = xlCenter
Range("B2:P17").VerticalAlignment = xlCenter
Range("B1:C16").Font.FontStyle = "Bold"
Range("D2:P3").Font.FontStyle = "Bold"
Range("D16:L16").Font.FontStyle = "Bold"
Range("B1").Font.Underline = xlUnderlineStyleSingle
Worksheets("Ground Zero").Columns("C:Y").AutoFit
Range("B2:P17").Rows.AutoFit
End Sub
Create Customizable Electric Rate Schedule Table and Inputs Cells

Public Sub CreateTable_Click()

Worksheets("DIY El. Rates").Activate

Dim C As Integer
Dim R As Integer
Dim TC As Integer
Dim TR As Integer
Dim TTC As Integer
Dim TTR As Integer
Dim ExR As Integer
Dim UCount As Integer
Dim CCount As Integer
Dim Subcount As Integer
Dim Subcount1 As Integer
Dim Subcount2 As Integer
Dim Subcount3 As Integer
Dim Subcount4 As Integer
Dim Subcount5 As Integer
Dim Subcount6 As Integer
Dim Subcount7 As Integer
Dim Subcount8 As Integer
Dim Energy As Single
C = 5                   ' Reference Cell Column
Cells(116, 1).Value = C
Worksheets("Ground Zero").Range("Z43").Value = C
R = 4                   ' Reference Cell Row
Cells(118, 1).Value = R
Worksheets("Ground Zero").Range("Z45").Value = R
TC = 0                  ' Column offset for the Usage Information Table.
Cells(120, 1).Value = TC
Worksheets("Ground Zero").Range("Z47").Value = TC
TR = 23                 ' Row offset for the Usage Information Table.
Cells(122, 1).Value = TR
Worksheets("Ground Zero").Range("Z49").Value = TR
TTC = TC + 0            ' Column offset for the Costs Table
Cells(124, 1).Value = TTC
Worksheets("Ground Zero").Range("Z51").Value = TTC
TTR = TR + 18           ' Row offset for the Costs Table
Cells(126, 1).Value = TTR
Worksheets("Ground Zero").Range("Z53").Value = TTR
RS = 0                  ' (Row Space) This is the spacing between rows for the table where the
                       ' customers enter their their information regarding their rate schedule
                       ' charges.'
ExR = 0                 ' (Extra Row) This is the number of extra rows for the table where
                       ' the customers enter their information regarding their rate schedule charges.'
UCount = 0 ' Ongoing tally for number of rows for the Usage Information Table.

' This ensures columns are created one cell over from the previous column.'
CCount = 1 ' Ongoing tally for number of rows for the Costs Table.
Subcount = 1

'BEGINNING OF PAGE FORMATTING' (CLEAR TRACES OF PAST USE')

With Range("B1:Z100")
    .ClearContents
    .ClearFormats
End With

Range("A68").Value = Months
Range("A94").Value = SummerStart ' First Summer Month
Range("A103").Value = SummerLength ' Number of Summer Months

'Create Months Columns, Bold Summer Months (for double-checking),
MoNo = MonthNo(Months)
SumMo = MonthNo(SummerStart)

For j = 0 To 11
    M = MoNo + j
    If M > 12 Then
        M = M - 12
    End If
End For
Cells(R + TR + 1 + j, C + TC - 1).Value = MonthName(M)
Cells(R + TTR + 1 + j, C + TTC - 1).Value = MonthName(M)
If (M >= SumMo And M < SumMo + SummerLength) Then
    Cells(R + TR + 1 + j, C + TC - 1).Font.Bold = True
    Cells(R + TTR + 1 + j, C + TTC - 1).Font.Bold = True
Else: Cells(R + TR + 1 + j, C + TC - 1).Font.Bold = False
    Cells(R + TTR + 1 + j, C + TTC - 1).Font.Bold = False
End If
Next j

Range("A5").Value = EnergySeasons.Value    ' Seasons YES or NO
Range("A165").Value = SimplePeak            ' If there are no seasons, is there a peak? YES or NO'
Range("A33").Value = Block                   ' Block Expander YES or NO
Range("A38").Value = NumBlock                ' Number of Blocks in Expander
Range("A145").Value = BlockBase             ' Block Size: Fixed kWh amount or specific kWh per kW-mo of demand
Range("A10").Value = SumPeak.Value          ' Summer peak YES or NO for Energy
Range("A15").Value = WintPeak.Value         ' Winter peak YES or NO for Energy

' Months represents the first month of the 12 month billing year'
' SummerStart represents the first month of the summer months'
'SummerLength represents the number of summer months'
'M is the number of the month'
'S is the number of the summer month (first summer month is 1)'

Cells(R + ExR, C).Value = "Fuel Charge ($)"
Cells(R + ExR + 1, C).NumberFormat = "$0.00#####"
ExR = ExR + 2

'ENERGY CHARGES; ON-PEAK/OFF-PEAK, SUMMER/WINTER, AND BLOCKS'

If EnergySeasons.Value = "No" Then ' There is either a simple $/kWh charge or the
first row is the block expander charges'
    If Block = "No" Then ' NO Seasons NO Block: The 1st line is just $/kWh
since there is NO block expander (or seasons)'
        If SimplePeak = "No" Then

            Cells(R + ExR, C).Value = "Cost per kWh ($)"
            Cells(R + ExR + 1, C).NumberFormat = "$0.00#####"
            Cells(R + TR - 1, C + TC).Value = "Total"
            Cells(R + TR, C + TC).Value = "kWh"

            For j = 1 To 12
Cells(R + TR + j, C + TC).Interior.Color = 15986394
Cells(R + TR + j, C + TC).NumberFormat = "#,###"

Next j

UCount = UCount + 1
Cells(132, 1).Value = 1

ElseIf SimplePeak = "Yes" Then

Cells(R + ExR, C).Value = "On-peak Cost per kWh ($)"
Cells(R + ExR + 1, C).NumberFormat = "$0.00######"
Cells(R + TR - 1, C + TC).Value = "On-peak"
Cells(R + TR, C + TC).Value = "kWh"
UCount = UCount + 1
Cells(R + ExR, C + 1).Value = "Off-peak Cost per kWh ($)"
Cells(R + ExR + 1, C + 1).NumberFormat = "$0.00######"
Cells(R + TR - 1, C + TC + 1).Value = "Off-peak"
Cells(R + TR, C + TC + 1).Value = "kWh"

For j = 1 To 12

For i = 0 To 1

Cells(R + TR + j, C + TC + i).Interior.Color = 15986394
Cells(R + TR + j, C + TC + i).NumberFormat = "#,###"

Next i

Next j

UCount = UCount + 1
Cells(132, 1).Value = 2
End If

ExR = ExR + 2 ' The first row is complete, so new input info. labels will be two rows down'

Cells(133, 1).Value = 0
Cells(134, 1).Value = 0

ElseIf Block = "Yes" Then ' NO Seasons YES Block: The 1st line will be Block Expander, 2nd line is Block Sizes'

For i = 1 To NumBlock - 1 ' For Loop to create correct amount of blocks'

Cells(R + ExR, C + i - 1).Value = "Block #" & i & " Cost per kWh ($)"
Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00#####"

Next i

Cells(R + ExR, C + NumBlock - 1).Value = "Remaining kWh Cost per kWh ($)" ' Last cell is "Remaining" Block'

Cells(R + ExR + 1, C + NumBlock - 1).NumberFormat = "$0.00#####"

Cells(R + TR - 1, C + TC).Value = "Total"

Cells(R + TR, C + TC).Value = "kWh"

For j = 1 To 12

Cells(R + TR + j, C + TC).Interior.Color = 15986394
Cells(R + TR + j, C + TC).NumberFormat = "#,###"

Next j
UCount = UCount + 1                                                                  ' UCount used for Usage table column count'

ExR = ExR + 2

Cells(132, 1).Value = 0

Cells(133, 1).Value = NumBlock

Cells(134, 1).Value = NumBlock - 1

If SimplePeak.Value = "Yes" Then
    MsgBox "Peaks are not allowed with" & vbNewLine & "Block Expanders. Thank You."
End If

' 1st row complete. New input info will be 2 rows down.'

If BlockBase.Value = "Fixed (kWh)" Then                                              ' Next (2nd) line is Block Sizes'
    For i = 1 To NumBlock.Value - 1                                                ' For Loop to create correct amount of block size cells'
        Cells(R + ExR, C + i - 1).Value = "Block " & i & " Size (kWh)"
        Cells(R + ExR + 1, C + i - 1).NumberFormat = ",###" 
    Next i
ElseIf BlockBase.Value = "Demand Based (kWh/kW-mo)" Then
    If/ElseIf statement decides whether blocks sizes are based on strictly kWh or kWh/kW-mo'
    For i = 1 To NumBlock.Value - 1
        Cells(R + ExR, C + i - 1).Value = "Block " & i & " Size (kWh/kW-mo)"
    Next i
Cells(R + ExR + 1, C + i - 1).NumberFormat = ",,###"

Next i

End If

Cells(R + ExR, C + NumBlock - 1).Value = "Remaining kWh"

Cells(R + ExR + 1, C + NumBlock - 1).Value = "(Different Each Month)"

ExR = ExR + 2

End If

' Both options for NO Seasons has been completed'

ElseIf EnergySeasons.Value = "Yes" Then

If Block = "Yes" Then

UCount = 0

If (SumPeak.Value = "Peak" Or WintPeak.Value = "Peak") Then

MsgBox "Peaks are not allowed with" & vbNewLine & "Block Expanders. Thank You."

End If

Cells(R + ExR, C - 1).Value = "Summer: 

For i = 1 To NumBlock - 1

' For Loop to create correct amount of blocks'

Cells(R + ExR, C + i - 1).Value = "Block #" & i & " Cost per kWh ($)"

Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00#####"

Next i

Cells(R + ExR, C + NumBlock - 1).Value = "Remaining kWh Cost per kWh ($)"

' Last cell is "Remaining" Block'
Cells(R + ExR + 1, C + NumBlock - 1).NumberFormat = "$0.00########"

ExR = ExR + 2

Cells(R + ExR, C - 1).Value = "Winter: "
For i = 1 To NumBlock - 1                                             ' For Loop to create correct amount of blocks'
    Cells(R + ExR, C + i - 1).Value = "Block #" & i & " Cost per kWh ($)"
    Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00########"
    Next i
Cells(R + ExR, C + NumBlock - 1).Value = "Remaining kWh Cost per kWh ($)"
Cells(R + ExR + 1, C + NumBlock - 1).NumberFormat = "$0.00########"
Cells(R + TR, C + TC).Value = "Total kWh"
For j = 1 To 12
    Cells(R + TR + j, C + TC).Interior.Color = 15986394
    Cells(R + TR + j, C + TC).NumberFormat = "#,###"
    Next j
ExR = ExR + 2

If BlockBase.Value = "Fixed (kWh)" Then                                    ' Next (2nd) line is Block Sizes'
    For i = 1 To NumBlock.Value - 1                                     ' For Loop to create correct amount of block size cells'
        Cells(R + ExR, C + i - 1).Value = "Block " & i & " Size (kWh)"
    Next i
Cells(R + ExR + 1, C + i - 1).NumberFormat = ",###"

Next i

ElseIf BlockBase.Value = "Demand Based (kWh/kW-mo)" Then

' If/ElseIf statement decides whether blocks sizes are based on strictly kWh or kWh/kW-mo'

For i = 1 To NumBlock.Value - 1

Cells(R + ExR, C + i - 1).Value = "Block " & i & " Size (kWh/kW-mo)"

Cells(R + ExR + 1, C + i - 1).NumberFormat = ",###"

Next i

End If

Cells(R + ExR, C + NumBlock - 1).Value = "Remaining kWh"

Cells(R + ExR + 1, C + NumBlock - 1).Value = "(Different Each Month)"

ExR = ExR + 2

UCount = UCount + 1

' UCount used for Usage table column count'

Cells(132, 1).Value = 0

Cells(133, 1).Value = NumBlock

Cells(134, 1).Value = NumBlock - 1

ElseIf Block = "No" Then

If SumPeak.Value = "No Peak" Then

Cells(R + ExR, C).Value = "Summer Cost per kWh ($)"

Cells(R + ExR + 1, C).NumberFormat = "$0.00######"

End If
Cells(R + TR - 1, C + TC) = "Summer"

Cells(R + TR, C + TC) = "kWh"

For j = 1 To 12

'Summer/Winter Determination'

M = MoNo + j - 1

If M > 12 Then

    M = M - 12

End If

If (M >= SumMo And M < SumMo + SummerLength) Then

    Cells(R + TR + j, C + TC).Interior.Color = 15986394

    Cells(R + TR + j, C + TC).NumberFormat = ",###"

End If

Next j

UCount = UCount + 1

If WintPeak.Value = "No Peak" Then

    Cells(R + ExR, C + UCount).Value = "Winter Cost per kWh ($)"

    Cells(R + ExR + 1, C + UCount).NumberFormat = "$0.00######"

    Cells(R + TR - 1, C + UCount - 1 + TC).Value = "Total"

    Cells(R + TR, C + UCount - 1 + TC).Value = "kWh"

For j = 1 To 12

    Cells(R + TR + j, C + TC).Interior.Color = 15986394

    Cells(R + TR + j, C + TC).NumberFormat = ",###"

End If
Next j
Subcount = Subcount + 0

ElseIf WintPeak.Value = "Peak" Then

Cells(R + ExR, C + UCount).Value = "Winter On-peak Cost per kWh ($)"
Cells(R + ExR + 1, C + UCount).NumberFormat = "$0.00######"
Cells(R + TR - 1, C + UCount + TC).Value = "Winter On-peak"
Cells(R + TR, C + UCount + TC).Value = "kWh"

For j = 1 To 12

'Summer/WInter Determination'
M = MoNo + j - 1
If M > 12 Then

M = M - 12

End If
If (M < SumMo Or M >= SumMo + SummerLength) Then

Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"

End If

Next j
Subcount = Subcount + 1
UCount = UCount + 1

Cells(R + ExR, C + UCount).Value = "Winter Off-peak Cost per kWh ($)"
Cells(R + ExR + 1, C + UCount).NumberFormat = "$0.00######"
Cells(R + TR - 1, C + UCount + TC).Value = "Winter Off-peak"

Cells(R + TR, C + UCount + TC).Value = "kWh"

For j = 1 To 12

'Summer/Winter Determination'

M = MoNo + j - 1

If M > 12 Then

    M = M - 12

End If

If (M < SumMo Or M >= SumMo + SummerLength) Then

    Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394

    Cells(R + TR + j, C + TC + UCount).NumberFormat = ",###"

End If

Next j

Subcount = Subcount + 1

UCount = UCount + 1

End If

End If

If SumPeak.Value = "Peak" Then

    Cells(R + ExR, C).Value = "Summer On-peak Cost per kWh ($)"

    Cells(R + ExR + 1, C).NumberFormat = "$0.00######"

    Cells(R + TR - 1, C + TC).Value = "Summer On-peak"
Cells(R + TR, C + TC).Value = "kWh"

For j = 1 To 12
    'Summer/WInter Determination'
    M = MoNo + j - 1
    If M > 12 Then
        M = M - 12
    End If
    If (M >= SumMo And M < SumMo + SummerLength) Then
        Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
        Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"
    End If
Next j

UCount = UCount + 1

Cells(R + ExR, C + UCount).Value = "Summer Off-peak Cost per kWh ($)"
Cells(R + ExR + 1, C + UCount).NumberFormat = "$0.00#####"
Cells(R + TR - 1, C + UCount + TC).Value = "Summer Off-peak"
Cells(R + TR, C + UCount + TC).Value = "kWh"

For j = 1 To 12
    'Summer/WInter Determination'
    M = MoNo + j - 1
    If M > 12 Then
        M = M - 12
    End If
If (M >= SumMo And M < SumMo + SummerLength) Then

    Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394

    Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"

End If

Next j

Subcount = Subcount + 1

UCount = UCount + 1

If WintPeak.Value = "No Peak" Then

    Cells(R + ExR, C + UCount).Value = "Winter Cost per kWh ($)"

    Cells(R + ExR + 1, C + UCount).NumberFormat = "$0.00####"

    Cells(R + TR - 1, C + UCount + TC).Value = "Winter"

    Cells(R + TR, C + UCount + TC).Value = "kWh"

For j = 1 To 12

    'Summer/WInter Determination'

    M = MoNo + j - 1

    If M > 12 Then

        M = M - 12

    End If

    If (M < SumMo Or M >= SumMo + SummerLength) Then

        Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394

        Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"

    End If

End If
Next j

Subcount = Subcount + 1

UCount = UCount + 1

ElseIf WintPeak.Value = "Peak" Then

Cells(R + ExR, C + UCount).Value = "Winter On-peak Cost per kWh ($)"

Cells(R + ExR + 1, C + UCount).NumberFormat = "$0.00#####"

Cells(R + TR - 1, C + UCount + TC).Value = "Winter On-peak"

Cells(R + TR, C + UCount + TC).Value = "kWh"

For j = 1 To 12

'Summer/WInter Determination'

M = MoNo + j - 1

If M > 12 Then

M = M - 12

End If

If (M < SumMo Or M >= SumMo + SummerLength) Then

Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394

Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"

End If

Next j

Subcount = Subcount + 1

UCount = UCount + 1

Cells(R + ExR, C + UCount).Value = "Winter Off-peak Cost per kWh ($)"
Cells(R + ExR + 1, C + UCount).NumberFormat = "$0.00######"

Cells(R + TR - 1, C + UCount + TC).Value = "Winter Off-peak"

Cells(R + TR, C + UCount + TC).Value = "kWh"

For j = 1 To 12
    'Summer/Winter Determination'
    M = MoNo + j - 1
    If M > 12 Then
        M = M - 12
    End If
    If (M < SumMo Or M >= SumMo + SummerLength) Then
        Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
        Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"
    End If
    Next j

Subcount = Subcount + 1
UCount = UCount + 1

End If
End If
ExR = ExR + 2
Cells(132, 1).Value = Subcount
Cells(133, 1).Value = 0
Cells(134, 1).Value = 0
End If
End If

'KWH RIDERS'

Subcount = 0
Range("A80").Value = RiderskWh
If RiderskWh <> 0 Then
  If RiderskWh < 5 Then
    For i = 1 To RiderskWh
      Cells(R + ExR, C + i - 1).Value = "Rider " & i & " ($/kWh)"
      Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00#####"
      Subcount = Subcount + 1
    Next i
    Cells(135, 1).Value = Subcount
    Cells(136, 1).Value = 0
    ExR = ExR + 2
  ElseIf RiderskWh > 4 Then
    For i = 1 To 4
      Cells(R + ExR, C + i - 1).Value = "Rider " & i & " ($/kWh)"
    Next i
  End If
ElseIf RiderskWh > 4 Then
  For i = 1 To 4
    Cells(R + ExR, C + i - 1).Value = "Rider " & i & " ($/kWh)"
  Next i
End If
Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00#####"

Subcount = Subcount + 1

Next i

Cells(135, 1).Value = Subcount

ExR = ExR + 2

Subcount = 0

For i = 5 To RiderskWh

    Cells(R + ExR, C + Subcount).Value = "Rider " & i & " ($/kWh)"

    Cells(R + ExR + 1, C + Subcount).NumberFormat = "$0.00#####"

    Subcount = Subcount + 1

Next i

Cells(136, 1).Value = Subcount

ExR = ExR + 2

End If

ElseIf RiderskWh = 0 Then

Cells(135, 1).Value = 0

Cells(136, 1).Value = 0

End If

'DEMAND CHARGES; ON-PEAK/OFF-PEAK, SUMMER/WINTER'

Range("A19").Value = DemandSeasons
Range("A170").Value = SimplePeakDem
Range("A24").Value = SumPeakDem
Range("A29").Value = WintPeakDem
Subcount = 0
If DemandSeasons.Value = "No" Then
    If SimplePeakDem = "No" Then
        Cells(R + ExR, C + Subcount).Value = "Cost per kW-mo ($)"
        Cells(R + TR - 1, C + UCount + TC).Value = "Total Actual Demand"
        Cells(R + TR, C + UCount + TC).Value = "kW-mo"
        For j = 1 To 12
            Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
            Cells(R + TR + j, C + TC + UCount).NumberFormat = "#.##0.0"
        Next j
        UCount = UCount + 1
        Subcount = Subcount + 1
    ElseIf SimplePeakDem = "Yes" Then
        Cells(R + ExR, C + Subcount).Value = "On-Peak Cost per kW-mo ($)"
        Cells(R + TR - 1, C + UCount + TC).Value = "On-Peak Actual Demand"
        Cells(R + TR, C + UCount + TC).Value = "kW-mo"
        For j = 1 To 12
            Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
            Cells(R + TR + j, C + TC + UCount).NumberFormat = "#.##0.0"
        Next j
    End If
ElseIf SimplePeakDem = "Yes" Then
    Cells(R + ExR, C + Subcount).Value = "On-Peak Cost per kW-mo ($)"
    Cells(R + TR - 1, C + UCount + TC).Value = "On-Peak Actual Demand"
    Cells(R + TR, C + UCount + TC).Value = "kW-mo"
    For j = 1 To 12
        Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
        Cells(R + TR + j, C + TC + UCount).NumberFormat = "#.##0.0"
    Next j
UCount = UCount + 1
Subcount = Subcount + 1

Cells(R + ExR, C + Subcount).Value = "Off-Peak Cost per kW-mo ($)"
Cells(R + TR - 1, C + UCount + TC).Value = "Off-Peak Actual Demand"
Cells(R + TR, C + UCount + TC).Value = "kW-mo"

For j = 1 To 12
    Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
    Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,##0.0"
    Next j

UCount = UCount + 1
Subcount = Subcount + 1

End If

ElseIf DemandSeasons.Value = "Yes" Then
    If SumPeakDem.Value = "No Peak" Then
        Cells(R + ExR, C + Subcount).Value = "Summer Cost per kW-mo ($)"
        Cells(R + TR - 1, C + UCount + TC) = "Summer Actual Demand"
        Cells(R + TR, C + UCount + TC) = "kW-mo"
        For j = 1 To 12
            'Summer/Winter Determination'
            M = MoNo + j - 1
            If M > 12 Then
                M = M - 12
End If

If (M >= SumMo And M < SumMo + SummerLength) Then
    Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
    Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,##0.0"
End If

Next j

UCount = UCount + 1

Subcount = Subcount + 1

If WintPeakDem.Value = "No Peak" Then
    Cells(R + ExR, C + Subcount).Value = "Winter Cost per kW-mo ($)"
    Cells(R + TR - 1, C + UCount - 1 + TC).Value = "Total Actual Demand"
    Cells(R + TR, C + UCount - 1 + TC).Value = "kW-mo"
    For j = 1 To 12
        'Summer/WInter Determination'
        Cells(R + TR + j, C + TC + UCount - 1).Interior.Color = 15986394
        Cells(R + TR + j, C + TC + UCount - 1).NumberFormat = "#,##0.0"
    Next j
    UCount = UCount + 1
    Subcount = Subcount + 1
ElseIf WintPeakDem.Value = "Peak" Then
Cells(R + ExR, C + Subcount).Value = "Winter On-peak Cost per kW-mo ($)"

Cells(R + TR - 1, C + UCount + TC).Value = "Winter On-peak Actual Demand"

Cells(R + TR, C + UCount + TC).Value = "kW-mo"

For j = 1 To 12

'Summer/WInter Determination'

M = MoNo + j - 1

If M > 12 Then

    M = M - 12

End If

If (M < SumMo Or M >= SumMo + SummerLength) Then

    Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394

    Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,##0.0"

End If

Next j

UCount = UCount + 1

Subcount = Subcount + 1

Cells(R + ExR, C + Subcount).Value = "Winter Off-peak Cost per kW-mo ($)"

Cells(R + TR - 1, C + UCount + TC).Value = "Winter Off-peak Actual Demand"

Cells(R + TR, C + UCount + TC).Value = "kW-mo"

For j = 1 To 12

'Summer/WInter Determination'

    M = MoNo + j - 1
If M > 12 Then
  M = M - 12
End If

If (M < SumMo Or M >= SumMo + SummerLength) Then
  Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
  Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,##0.0"
End If

Next j

UCount = UCount + 1
Subcount = Subcount + 1

End If
End If

If SumPeakDem.Value = "Peak" Then
  Cells(R + ExR, C + Subcount).Value = "Summer On-peak Cost per kW-mo ($)"
  Cells(R + TR - 1, C + UCount + TC).Value = "Summer On-peak Actual Demand"
  Cells(R + TR, C + UCount + TC).Value = "kW-mo"
For j = 1 To 12
  'Summer/WInter Determination'
  M = MoNo + j - 1
  If M > 12 Then
    M = M - 12
End If

If (M >= SumMo And M < SumMo + SummerLength) Then
    Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
    Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,##0.0"
End If

Next j

UCount = UCount + 1
Subcount = Subcount + 1

Cells(R + ExR, C + Subcount).Value = "Summer Off-peak Cost per kW-mo ($)"
Cells(R + TR - 1, C + UCount + TC).Value = "Summer Off-peak Actual Demand"
Cells(R + TR, C + UCount + TC).Value = "kW-mo"
For j = 1 To 12
    'Summer/WInter Determination'
    M = MoNo + j - 1
    If M > 12 Then
        M = M - 12
    End If
    If (M >= SumMo And M < SumMo + SummerLength) Then
        Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
        Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,##0.0"
    End If
Next j
UCount = UCount + 1
Subcount = Subcount + 1

If WintPeakDem.Value = "No Peak" Then
    Cells(R + ExR, C + Subcount).Value = "Winter Cost per kW-mo ($)"
    Cells(R + TR - 1, C + UCount + TC).Value = "Winter Actual Demand"
    Cells(R + TR, C + UCount + TC).Value = "kW-mo"
    For j = 1 To 12
        'Summer/Winter Determination'
        M = MoNo + j - 1
        If M > 12 Then
            M = M - 12
        End If
        If (M < SumMo Or M >= SumMo + SummerLength) Then
            Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
            Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,##0.0"
        End If
    Next j
    UCount = UCount + 1
    Subcount = Subcount + 1
ElseIf WintPeakDem.Value = "Peak" Then
    Cells(R + ExR, C + Subcount).Value = "Winter On-peak Cost per kW-mo ($)"
Cells(R + TR - 1, C + UCount + TC).Value = "Winter On-peak Actual Demand"
Cells(R + TR, C + UCount + TC).Value = "kW-mo"

For j = 1 To 12

'Summer/ Winter Determination'
M = MoNo + j - 1
If M > 12 Then
    M = M - 12
End If
If (M < SumMo Or M >= SumMo + SummerLength) Then
    Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
    Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,##0.0"
End If
Next j
UCount = UCount + 1
Subcount = Subcount + 1

Cells(R + ExR, C + Subcount).Value = "Winter Off-peak Cost per kW-mo ($)"
Cells(R + TR - 1, C + UCount + TC).Value = "Winter Off-peak Actual Demand"
Cells(R + TR, C + UCount + TC).Value = "kW-mo"

For j = 1 To 12

'Summer/ Winter Determination'
M = MoNo + j - 1
If M > 12 Then
M = M - 12

End If

If (M < SumMo Or M >= SumMo + SummerLength) Then

Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,##0.0"

End If

Next j

UCount = UCount + 1
Subcount = Subcount + 1

End If
End If
End If

'Demand Charge Formatting'
iC = 0

Do While Cells(R + ExR, C + iC).Value <> Empty

iC = iC + 1

Loop

For i = 0 To iC - 1

Cells(R + ExR + 1, C + i).NumberFormat = "$#.00#########

Next i

ExR = ExR + 2
Cells(137, 1).Value = Subcount

'Assign Userform entries to fixed cells (demand section)'
Range("A42").Value = Ratchet
Range("A160").Value = RatchMos
Range("A46").Value = MinDem
Range("A50").Value = Franchise
Range("A54").Value = Taxes

'RATCHET CLAUSE AND MINIMUM BILLED DEMAND'

'RATCHET CLAUSE'
Subcount = 0
Cells(R + ExR, C + Subcount).Value = "Ratchet Percentage (%)"
Cells(R + ExR + 1, C + Subcount).NumberFormat = "0.00%"
If Ratchet = "No" Then
    Cells(R + ExR + 1, C + Subcount).Value = "N/A"
End If
Subcount = Subcount + 1

'MINIMUM BILLED DEMAND'
Cells(R + ExR, C + Subcount).Value = "Minimum Billed Demand (kW-mo)"
Cells(R + ExR + 1, C + Subcount).NumberFormat = "#,###"
If MinDem = "No" Then

    Cells(R + ExR + 1, C + Subcount).Value = "N/A"

End If

Subcount = Subcount + 1

ExR = ExR + 2

'DEMAND RIDERS'

'DEMAND RIDERS UP TO 4'

Subcount = 0

Range("A114").Value = RiderskWmo

If RiderskWmo <> 0 Then

    If RiderskWmo < 5 Then

        For i = 1 To RiderskWmo

            Cells(R + ExR, C + Subcount).Value = "Rider " & i & " ($/kW-mo)"

            Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00########"

            Subcount = Subcount + 1

        Next i

        Cells(138, 1).Value = Subcount

        Cells(139, 1).Value = 0

        ExR = ExR + 2

    ElseIf RiderskWmo > 4 Then

ElseIf RiderskWmo > 4 Then
For i = 1 To 4
    Cells(R + ExR, C + Subcount).Value = "Rider " & i & "   ($/kW-mo)"
    Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00######"
    Subcount = Subcount + 1
    Next i

Cells(138, 1).Value = Subcount
ExR = ExR + 2

Subcount = 0
For i = 5 To RiderskWmo
    Cells(R + ExR, C + Subcount).Value = "Rider " & i & "   ($/kW-mo)"
    Cells(R + ExR + 1, C + Subcount).NumberFormat = "$0.00######"
    Subcount = Subcount + 1
    Next i

Cells(139, 1).Value = Subcount
ExR = ExR + 2

End If
Else:
    Cells(138, 1).Value = 0
    Cells(139, 1).Value = 0
End If
'FRANCHISE FEE'

Subcount = 0

Cells(R + ExR, C + Subcount).Value = "Franchise Fee Percentage(%)"
Cells(R + ExR + 1, C + Subcount).NumberFormat = "0.000%"

If Franchise = "No" Then
    Cells(R + ExR + 1, C + Subcount).Value = "N/A"
End If

Subcount = Subcount + 1

'TAXES'

Cells(R + ExR, C + Subcount).Value = "Total Tax Percentage(%)"
Cells(R + ExR + 1, C + Subcount).NumberFormat = "0.000%"

If Taxes = "No" Then
    Cells(R + ExR + 1, C + Subcount).Value = "N/A"
End If

Subcount = Subcount + 1

ExR = ExR + 2

Cells(140, 1).Value = Subcount

'CUSTOMER CHARGE'

Cells(R + ExR, C).Value = "Customer Charge ($)"
Cells(R + ExR + 1, C).NumberFormat = "#,##0.00"
'OFFICIAL Usage Count

UCC = 0

Do While Cells(R + TR, C + TC + UCC).Value <> Empty
    UCC = UCC + 1
Loop

UCount = UCC

Worksheets("Ground Zero").Range("Z39").Value = UCount - 1

Worksheets("DIY El. Rates").Range("A172").Value = UCount - 1

'END OF PAGE FORMATTING (PREPARE FOR FUTURE USE)'

'END OF PAGE FORMATTING (PREPARE FOR FUTURE USE)'

'CCC = Costs Columns Count"

'UCC = Usage Columns Count"

UCC = 0

Do While Cells(R + TR, C + TC + UCC).Value <> Empty
    UCC = UCC + 1
Loop

For i = 0 To UCC - 1
    Cells(R + TR - 1, C + TC + i).Font.FontStyle = "Bold"
    Cells(R + TR, C + TC + i).Font.FontStyle = "Bold"
Next i
CCC = 0

Do While Cells(R + TTR, C + TTC + CCC).Value <> Empty

    CCC = CCC + 1

Loop

If CCC > 0 Then

    For j = 0 To 13

        For i = 0 To CCC

            Cells(R + TTR + j - 1, C + TTC + i).ClearContents

            Next i

        Next j

    End If

For j = 0 To 10

    For i = 0 To 3

        If Cells(R + j * 2, C + i).Value <> Empty Then

            Cells(R + j * 2, C + i).Font.FontStyle = "Bold"

            'Cells(R + j * 2, C + i).Font.Underline = xlUnderlineStyleSingle

            Cells(R + j * 2 + 1, C + i).Borders.LineStyle = xlContinuous

        End If

        Next i

    Next j

With Worksheets("DIY El. Rates").Range("B1:Y100")
.HorizontalAlignment = xlCenter
.VertAlignment = xlCenter
.Columns("B:Y").AutoFit
.Rows("1:100").AutoFit

For i = C + 0 - 1 To C + 10 - 1
    With .Columns(i)
        If .ColumnWidth > 20 Then
            .ColumnWidth = 20
            .WrapText = True
        ElseIf .ColumnWidth < 15 Then
            .ColumnWidth = 15
        End If
    End With
Next i
.Columns("B:Y").AutoFit
End With
End
End Sub
Sub Calculate_Costs_Click()

Dim C As Integer
Dim R As Integer
Dim TC As Integer
Dim TR As Integer
Dim TTC As Integer
Dim TTR As Integer
Dim ExR As Integer
Dim UCount As Integer
Dim CCount As Integer
Dim Subcount As Integer
Dim SCSznEn As Integer
Dim SCNumBlock As Integer
Dim SCBlockSize As Integer
Dim SCkWhRider14 As Integer
Dim SCkWhRider58 As Integer
Dim SCSznDem As Integer
Dim SCkWRider14 As Integer
Dim SCkWRider58 As Integer
Dim SCMisc As Integer
Dim SummerLength As Integer
C = Cells(116, 1).Value
R = Cells(118, 1).Value
TC = Cells(120, 1).Value
TR = Cells(122, 1).Value
TTC = Cells(124, 1).Value
TTR = Cells(126, 1).Value

'BEGINNING OF PAGE FORMATTING' (CLEAR TRACES OF PAST USE)'

'CCC = Costs Columns Count"
CCC = 0
Do While Cells(R + TTR, C + TTC + CCC).Value <> Empty
    CCC = CCC + 1
Loop
For j = 0 To 12
    For i = 0 To CCC
        Cells(R + TTR + j, C + TTC + i).ClearContents
        Cells(R + TTR + j, C + TTC + i).ClearFormats
    Next i
Next j

'SC Stands for Subcount, running tallies from the userform algorithm, max 4'
SCSznEn = Cells(132, 1).Value                                        ' Number of Energy peaks and/or
season combinations
SCNumBlock = Cells(133, 1).Value  ' Number of blocks in block expander; !IF SEASONS YES AND BLOCKS YES THEN SUMMER/WINTER BLOCK# SHARE SAME SUBCOUNT!'

SCBlockSize = Cells(134, 1).Value + 1  ' Number of blocks, Used for the size of each block

SCkWhRider14 = Cells(135, 1).Value  ' Number of kWh riders between from 1 - 4

SCkWhRider58 = Cells(136, 1).Value  ' Number of kWh rider from 5 - 8

SCSznDem = Cells(137, 1).Value  ' Number of Demand peaks and/or season combinations

SCkWRider14 = Cells(138, 1).Value  ' Number of kW riders between from 1 - 4

SCkWRider58 = Cells(139, 1).Value  ' Number of kW rider from 5 - 8

SCMisc = Cells(140, 1).Value  ' Number of Miscellaneous columns

ExR = 0

Subcount = 1

'Cost Table column count -1; Counts columns that have been finished in the Costs Table so CCount can be added to the Cells() column reference for the current calculations column'

CCount = 0
'Usage Table column count -1; Counts columns that have been finished in the Usage Table so UCount can be added to the Cells() column reference for the current calculations reference column'

UCount = 0

EnergySeasons = Range("A5").Value
SumPeak = Range("A10").Value
WintPeak = Range("A15").Value
Block = Range("A33").Value
BlockBase = Range("A145").Value
Months = Range("A68").Value  ' First month of Utility data
SummerStart = Range("A94").Value
SummerLength = Range("A103").Value
MoNo = MonthNo(Range("A68").Value)  ' Number for of Months'
SumMo = MonthNo(Range("A94").Value)  ' Number for SummerStart'

If SCzSznEn = 0 Then
    SCFuel = 1
Else: SCFuel = SCSznEn
End If

Cells(R + TTR - 1, C + CCount).Value = "Fuel Cost"
Cells(R + TTR, C + CCount).Value = "$(S)"
FuelCharge = Cells(R + ExR + 1, C).Value
For j = 1 To 12

    TotalkWh = 0

    For i = 1 To SCFuel

        TotalkWh = TotalkWh + Cells(R + TR + j, C + i - 1).Value

    Next i

    FuelCost = TotalkWh * FuelCharge

    Cells(R + TTR + j, C + CCount).Value = FuelCost

Next j

CCount = CCount + 1

ExR = ExR + 2

Cells(R + TTR - 1, C + TTC + CCount).Value = "Energy Cost"

Cells(R + TTR, C + TTC + CCount).Value = "($)"

If EnergySeasons = "No" Then ' There is either a simple $/kWh charge or the first row
    is the block expander charges'

        If Block = "No" Then ' NO Seasons NO Block: The 1st line is just $/kWh
    since there is NO block expander (or seasons)'

            For j = 1 To 12

                Energy = 0

                For i = 1 To SCSznEn

                    Energy = Energy + Cells(R + ExR + 1, C + i - 1).Value * Cells(R + TR + j, C + TC + i
                    - 1).Value

                Next i

        Next j

    Next ExR
Cells(R + TTR + j, C + TTC + CCount).Value = Energy

Next j

UCount = UCount + SCSznEn

ExR = ExR + 2  ' The first row is complete, so new input info. labels will be two rows down'

ElseIf Block = "Yes" Then  ' NO Seasons YES Block: The 1st line will be Block Expander, 2nd line is Block Sizes'

If BlockBase = "Fixed (kWh)" Then

For j = 1 To 12

Energy = 0

TotalkWh = Cells(R + TR + j, C + TC + UCount).Value

Remaining = TotalkWh

For i = 1 To SCNumBlock  ' For Loop to create correct amount of blocks'

If Remaining > 0 Then

If i <> SCNumBlock Then

BlockCharge = Cells(R + ExR + 1, C + i - 1).Value

BlockSize = Cells(R + ExR + 1 + 2, C + i - 1).Value

If Remaining < BlockSize Then

BlockSize = Remaining

End If

Energy = Energy + BlockCharge * BlockSize

End If

ElseIf Block = "Yes" Then  ' NO Seasons YES Block: The 1st line will be Block Expander, 2nd line is Block Sizes'

If BlockBase = "Fixed (kWh)" Then

For j = 1 To 12

Energy = 0

TotalkWh = Cells(R + TR + j, C + TC + UCount).Value

Remaining = TotalkWh

For i = 1 To SCNumBlock  ' For Loop to create correct amount of blocks'

If Remaining > 0 Then

If i <> SCNumBlock Then

BlockCharge = Cells(R + ExR + 1, C + i - 1).Value

BlockSize = Cells(R + ExR + 1 + 2, C + i - 1).Value

If Remaining < BlockSize Then

BlockSize = Remaining

End If

Energy = Energy + BlockCharge * BlockSize

End If

End If

End If
Remaining = Remaining - BlockSize

ElseIf i = SCNumBlock Then

    BlockCharge = Cells(R + ExR + 1, C + i - 1).Value
    Energy = Energy + BlockCharge * Remaining

End If

End If

Next i

Cells(R + TTR + j, C + TTC + CCount).Value = Energy

Next j

ExR = ExR + 4

ElseIf BlockBase = "Demand Based (kWh/kW-mo)" Then

    For j = 1 To 12

        Energy = 0
        TotalkWh = Cells(R + TR + j, C + TC + UCount).Value
        Remaining = TotalkWh
        MonthDemand = Cells(R + TR + j, C + TC + 1 + DC + UCount).Value
        For i = 1 To SCNumBlock                                                    ' For Loop to create correct
        amount of blocks'

            If Remaining > 0 Then

                If i <> SCNumBlock Then

                    BlockCharge = Cells(R + ExR + 1, C + i - 1).Value
                    BlockSize = Cells(R + ExR + 1 + 2, C + i - 1).Value * MonthDemand

                End If

            End If

        Next i

    Next j

End If
If Remaining < BlockSize Then
    BlockSize = Remaining
End If

Energy = Energy + BlockCharge * BlockSize
Remaining = Remaining - BlockSize

ElseIf i = SCNumBlock Then
    BlockCharge = Cells(R + ExR + 1, C + i - 1).Value
    Energy = Energy + BlockCharge * Remaining
End If

End If

Next i

Cells(R + TTR + j, C + TTC + CCount).Value = Energy

Next j

UCount = UCount + 0

Riders calculation comes next, which is still based on Total kWh'

ExR = ExR + 4

' Current focus is on Block# Charges, which deals with the Block Sizes in the cells below, to continue, must jump down 4 cells (skipping Block Sizes).'

End If

' END Block Base IF'

End If

' END of Block YES/NO'

CCount = CCount + 1

' Both options for NO Seasons has been completed'
ElseIf EnergySeasons = "Yes" Then

    If Block = "Yes" Then

        If BlockBase = "Fixed (kWh)" Then

            For j = 1 To 12

                ' The following line determines if the current month's single digit value is outside the range of single digit values of 'Summer Months'

                If (MonthNo(Cells(R + TR + j, C + TC - 1).Value) < MonthNo(Range("A94").Value) Or MonthNo(Cells(R + TR + j, C + TC - 1).Value) >= (MonthNo(Range("A94").Value) + SummerLength)) Then

                    SznR = 2  ' The season additional rows is defined; Winter block charges are [SznR=] 2 rows down from the summer block charges'

                Else: SznR = 0

            End If

            Energy = 0

            TotalkWh = Cells(R + TR + j, C + TC + UCount).Value

            Remaining = TotalkWh

            For i = 1 To SCNumBlock

                ' For Loop to create correct amount of blocks'

                If Remaining > 0 Then

                    If i <> SCNumBlock Then

                        BlockCharge = Cells(R + ExR + 1 + SznR, C + i - 1).Value

                        BlockSize = Cells(R + ExR + 1 + 4, C + i - 1).Value

                        If Remaining < BlockSize Then

                        End If

                    End If

                End If

            Next i

        End If

    End If

End If
BlockSize = Remaining

End If

Energy = Energy + BlockCharge * BlockSize

Remaining = Remaining - BlockSize

ElseIf i = SCNumBlock Then

BlockCharge = Cells(R + ExR + 1 + SznR, C + i - 1).Value

Energy = Energy + BlockCharge * Remaining

End If

End If

Next i

Cells(R + TTR + j, C + TTC + CCount).Value = Energy

Next j

CCount = CCount + 1

ExR = ExR + 6

ElseIf BlockBase = "Demand Based (kWh/kW-mo)" Then

For j = 1 To 12

' The following line determines if the current month's single digit value is outside the
range of single digit values of 'Summer Months'

If (MonthNo(Cells(R + TR + j, C + TC - 1).Value) < MonthNo(Range("A94").Value)
Or MonthNo(Cells(R + TR + j, C + TC - 1).Value) >= (MonthNo(Range("A94").Value) +
SummerLength)) Then
SznR = 2 ' The season additional rows is defined; Winter block charges are [SznR=] 2 rows down from the summer block charges'

Else: SznR = 0

End If

Energy = 0

TotalkWh = Cells(R + TR + j, C + TC + UCount).Value

Remaining = TotalkWh

MonthDemand = Cells(R + TR + j, C + TC + 1 + DC + UCount).Value

For i = 1 To SCNumBlock ' For Loop to create correct amount of blocks'

If Remaining > 0 Then

If i <> SCNumBlock Then

BlockCharge = Cells(R + ExR + 1 + SznR, C + i - 1).Value

BlockSize = Cells(R + ExR + 1 + 4, C + i - 1).Value * MonthDemand

If Remaining < BlockSize Then

BlockSize = Remaining

End If

Energy = Energy + BlockCharge * BlockSize

Remaining = Remaining - BlockSize

ElseIf i = SCNumBlock Then

BlockCharge = Cells(R + ExR + 1 + SznR, C + i - 1).Value

Energy = Energy + BlockCharge * Remaining

187
End If
End If
Next i
Cells(R + TTR + j, C + TTC + CCount).Value = Energy
Next j
UCount = UCount + 0 ' UCount remains at 0, kWh
Riders calculation comes next, which is still based on Total kWh'
CCount = CCount + 1
ExR = ExR + 6 ' Current focus is on Block#
Charges, which deals with the Block Sizes in the cells below, to continue, must jump down 4 cells (skipping Block Sizes).
End If ' END Block Base IF

ElseIf Block = "No" Then
If (WintPeak = "No Peak" And SumPeak = "No Peak") Then
SummEnCharge = Cells(R + ExR + 1, C).Value
WintEnCharge = Cells(R + ExR + 1, C + 1).Value
For j = 1 To 12
Energy = 0
'Summer/WInter Determination'
M = MoNo + j - 1
If M > 12 Then
M = M - 12
End If

If (M >= SumMo And M < SumMo + SummerLength) Then

    EnergyCharge = SummEnCharge

Else: EnergyCharge = WintEnCharge

End If

Energy = Cells(R + TR + j, C + TC).Value * EnergyCharge

Cells(R + TTR + j, C + TTC + CCount).Value = Energy

Next j

UCount = UCount + 0  'still have to do riders'

Else:

    For j = 1 To 12

        Energy = 0

        For i = 1 To SCSznEn

            Energy = Energy + Cells(R + ExR + 1, C + i - 1).Value * Cells(R + TR + j, C + TC + i - 1).Value

        Next i

        Cells(R + TTR + j, C + TCC + CCount).Value = Energy

    Next j

End If

If SumPeak = "No Peak" Then

    If WintPeak = "Peak" Then

        UCount = UCount + 2

    End If

End If
End If

If SumPeak = "Peak" Then
    If WintPeak = "No Peak" Then
        UCount = UCount + 2
    ElseIf WintPeak = "Peak" Then
        UCount = UCount + 3
    End If
End If

ExR = ExR + 2

CCount = CCount + 1

End If

End If

End If

If SCkWhRider14 > 0 Then
    Cells(R + TTR - 1, C + TTC + CCount).Value = "Riders Cost"
    Cells(R + TTR, C + TTC + CCount).Value = "\$(")"
    For j = 1 To 12
        TotalkWh = 0
        If SCSznEn > 1 Then
            For i = 1 To SCSznEn
                TotalkWh = TotalkWh + Cells(R + TR + j, C + TC + i - 1).Value
            Next i
        End If
    Next j
End If
Next i

Else: TotalWh = Cells(R + TR + j, C + TC).Value

End If

If SCkWhRider14 > 0 Then
  RiderSum = 0
  For i = 1 To SCkWhRider14
    RiderSum = RiderSum + TotalWh * Cells(R + ExR + 1, C + i - 1).Value
  Next i
  If SCkWhRider58 > 0 Then
    For i = 1 To SCkWhRider58
      RiderSum = RiderSum + TotalWh * Cells(R + ExR + 1 + 2, C + i - 1).Value
    Next i
    End If
    Cells(R + TTR + j, C + TTC + CCount).Value = RiderSum
  End If
  Next j
End If

If SCkWhRider14 > 0 Then
  CCount = CCount + 1
  ExR = ExR + 2
  If SCkWhRider58 > 0 Then
ExR = ExR + 2
End If
End If

If ((EnergySeasons = "Yes" And WintPeak = "No Peak" And SumPeak = "No Peak") Or SCSznEn > 2 Or Block = "Yes") Then
  UCount = UCount + 1
End If

'DEMAND CALCULATIONS'
DemandSeasons = Range("A19").Value
SumPeakDem = Range("A24").Value
WintPeakDem = Range("A29").Value
RatchMos = Range("A160").Value
SimplePeakDem = Range("A170").Value

Cells(R + TTR - 1, C + CCount).Value = "Demand Cost"
Cells(R + TTR, C + CCount).Value = "($)"

MinDem = Cells(R + ExR + 1 + 2, C + 1).Value
If (MinDem = "N/A" Or MinDem = 0) Then
  Cells(R + ExR + 1 + 2, C + 1).Value = 0

192
MinDem = Empty

End If

If (Cells(R + ExR + 1 + 2, C).Value = "N/A" Or Cells(R + ExR + 1 + 2, C).Value = 0) Then

Cells(R + ExR + 1 + 2, C).Value = 0

RatchMos = Empty

End If

Subcount = 0

If DemandSeasons = "No" Then

If SimplePeakDem = "No" Then

For j = 1 To 12

Billed = 0

DemCost = 0

Billed = Cells(R + TR + j, C + TC + UCount).Value

If Billed < MinDem Then

Billed = MinDem

End If

For i = 1 To RatchMos

RM = i

If j - RM <= 0 Then

RM = RM - 12

End If

End If

End If
End If

RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value

If Billed < RatchDem Then
    Billed = RatchDem
End If

Next i

DemCost = Cells(R + ExR + 1, C).Value * Billed

Cells(R + TTR + j, C + TTC + CCount).Value = DemCost

Next j

UCount = UCount + 1

ElseIf SimplePeakDem = "Yes" Then

    For j = 1 To 12
        Billed = 0
        DemCost = 0
        Billed = Cells(R + TR + j, C + TC + UCount).Value
        If Billed < MinDem Then
            Billed = MinDem
        End If
        For i = 1 To RatchMos
            RM = i
            If j - RM <= 0 Then
RM = RM - 12

End If

RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value

If Billed < RatchDem Then
    Billed = RatchDem
End If

Next i

OnCost = Cells(R + ExR + 1, C).Value * Billed

OffCost = Cells(R + ExR + 1, C + 1).Value * Cells(R + TR + j, C + TC + UCount + 1).Value

DemCost = OnCost + OffCost

Cells(R + TTR + j, C + TTC + CCount).Value = DemCost

Next j

UCount = UCount + 2

End If

ElseIf DemandSeasons = "Yes" Then

'TWO SEASONS...

If SumPeakDem = "No Peak" Then

'TWO SEASONS, NO SUMMER PEAK...

If WintPeakDem = "No Peak" Then

'TWO SEASONS, NO PEAKS'
For j = 1 To 12
    Billed = 0
    DemCost = 0
    Billed = Cells(R + TR + j, C + TC + UCount).Value
    If Billed < MinDem Then
        Billed = MinDem
    End If
    For i = 1 To RatchMos
        RM = i
        If j - RM <= 0 Then
            RM = RM - 12
        End If
        RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value
        If Billed < RatchDem Then
            Billed = RatchDem
        End If
    Next i
'Summer/WInter Determination'
M = MoNo + j - 1
If M > 12 Then
    M = M - 12
End If
If (M >= SumMo And M < SumMo + SummerLength) Then

    DemCharge = Cells(R + ExR + 1, C).Value

Else: DemCharge = Cells(R + ExR + 1, C + 1).Value

End If

DemCost = DemCharge * Billed

Cells(R + TTR + j, C + TTC + CCount).Value = DemCost

Next j

UCount = UCount + 0

ElseIf WintPeakDem = "Peak" Then

'TWO SEASONS, ONLY WINTER PEAK'

'Summer Demand Cost (No Peak)'

For j = 1 To 12

'Summer/Winter Determination'

M = MoNo + j - 1

If M > 12 Then

    M = M - 12

End If

If (M >= SumMo And M < SumMo + SummerLength) Then

    SummBilled = 0

    SummDemCost = 0

    SummBilled = Cells(R + TR + j, C + TC + UCount).Value

'Minimum Billed Demand'
If SummBilled < MinDem Then
    SummBilled = MinDem
End If

'Ratchet Clause'
For i = 1 To RatchMos
    RM = i
    If j - RM <= 0 Then
        RM = RM - 12
    End If

'Ratchet Clause recognizes Summer/Winter'
If (M >= SumMo And M < SumMo + SummerLength) Then
    RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value
    Else: RatchDem = Cells(R + TR + j - RM, C + TC + UCount + 1).Value * Cells(R + ExR + 1 + 2, C).Value
End If
If SummBilled < RatchDem Then
    SummBilled = RatchDem
End If
Next i

'Summer Cost is Billed Demand * Summer Charge'
SummDemCharge = Cells(R + ExR + 1, C).Value
SummDemCost = SummDemCharge * SummBilled
'If Winter month, Summer Costs equal 0'
Else: SummDemCost = 0
End If

'Winter Demand Cost (w/Peak)'

'Winter/Summer Determination
If (M < SumMo Or M >= SumMo + SummerLength) Then
   WintBilled = 0
   WintDemCost = 0
   WintBilled = Cells(R + TR + j, C + TC + UCount + 1).Value
   'Minimum Billed Demand applied'
   If WintBilled < MinDem Then
      WintBilled = MinDem
   End If
   'Ratchet Clause applied'
   For i = 1 To RatchMos
      RM = i
      If j - RM <= 0 Then
         RM = RM - 12
      End If
   End For
   'Ratchet Clause recognizes Summer/Winter'
   If (M >= SumMo And M < SumMo + SummerLength) Then
RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value

Else: RatchDem = Cells(R + TR + j - RM, C + TC + UCount + 1).Value * Cells(R + ExR + 1 + 2, C).Value

End If

If WintBilled < RatchDem Then

    WintBilled = RatchDem

End If

Next i

'(Possibly Change) On-peak Cost checks minimum demand and ratchet clause,

' Off-peak does not'

WintOnCost = Cells(R + ExR + 1, C + 1).Value * WintBilled

WintOffCost = Cells(R + ExR + 1, C + 2).Value * Cells(R + TR + j, C + TC + UCount + 2).Value

' If Summer month, Winter Costs equal 0'

'Ratchet Clause recognizes Summer/Winter'

Else:

    WintOnCost = 0

    WintOffCost = 0

End If

WintDemCost = WintOnCost + WintOffCost

' Combine Summer and Winter Costs'
DemCost = SummDemCost + WintDemCost

Cells(R + TTR + j, C + TTC + CCount).Value = DemCost

Next j

UCount = UCount + 3

End If
End If

If SumPeakDem = "Peak" Then
'TWO SEASONS, SUMMER PEAK...'

If WintPeakDem = "No Peak" Then
'TWO SEASONS, ONLY SUMMER PEAK'
'Summer Demand Cost (w/Peak)'
For j = 1 To 12
'Summer/WInter Determination'
M = MoNo + j - 1
If M > 12 Then
M = M - 12
End If
If (M >= SumMo And M < SumMo + SummerLength) Then
SummBilled = 0
SummDemCost = 0
SummBilled = Cells(R + TR + j, C + TC + UCount).Value

'Minimum Billed Demand applied'
If SummBilled < MinDem Then
    SummBilled = MinDem
End If

'Ratchet Clause applied'
For i = 1 To RatchMos
    RM = i
    If j - RM <= 0 Then
        RM = RM - 12
    End If
    'Ratchet Clause recognizes Summer/Winter'
    If (M >= SumMo And M < SumMo + SummerLength) Then
        RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value
    Else: RatchDem = Cells(R + TR + j - RM, C + TC + UCount + 2).Value * Cells(R + ExR + 1 + 2, C).Value
    End If
    If SummBilled < RatchDem Then
        SummBilled = RatchDem
    End If
Next i
'(Possibly Change) On-peak Cost checks minimum demand and ratchet clause,

'Off-peak does not'

SummOnCost = Cells(R + ExR + 1, C).Value * SummBilled

SummOffCost = Cells(R + ExR + 1, C + 1).Value * Cells(R + TR + j, C + TC + UCount + 1).Value

'If Winter month, Summer Costs equal 0'

ElseIf (M < SumMo Or M >= SumMo + SummerLength) Then
    SummOnCost = 0
    SummOffCost = 0
End If

SummDemCost = SummOnCost + SummOffCost

'Winter Demand Cost (No Peak)'

If (M < SumMo Or M >= SumMo + SummerLength) Then
    WintBilled = 0
    WintDemCost = 0
    WintBilled = Cells(R + TR + j, C + TC + UCount + 2).Value

'Minimum Billed Demand'

If WintBilled < MinDem Then
    WintBilled = MinDem
End If

'Ratchet Clause'

For i = 1 To RatchMos
RM = i

If j - RM <= 0 Then
    RM = RM - 12
End If

'Ratchet Clause recognizes Summer/Winter'

If (M >= SumMo And M < SumMo + SummerLength) Then
    RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value
Else: RatchDem = Cells(R + TR + j - RM, C + TC + UCount + 2).Value * Cells(R + ExR + 1 + 2, C).Value
End If

If WintBilled < RatchDem Then
    WintBilled = RatchDem
End If

Next i

'Winter Cost is Billed Demand * Winter Charge'

WintDemCharge = Cells(R + ExR + 1, C + 2).Value

WintDemCost = WintDemCharge * WintBilled

'If Summer month, Winter Costs equal 0'

Else: WintDemCost = 0
End If

'Combine Summer and Winter Costs'
DemCost = SummDemCost + WintDemCost

Cells(R + TTR + j, C + TTC + CCount).Value = DemCost

Next j

UCount = UCount + 3

ElseIf WintPeakDem = "Peak" Then

'TWO SEASONS, PEAKS IN BOTH SEASONS'

For j = 1 To 12

'Summer Demand Cost (w/Peak)'
'Summer/WInter Determination'

M = MoNo + j - 1

If M > 12 Then

M = M - 12

End If

If (M >= SumMo And M < SumMo + SummerLength) Then

SummBilled = 0
SummDemCost = 0

SummBilled = Cells(R + TR + j, C + TC + UCount).Value

'Minimum Billed Demand applied'

If SummBilled < MinDem Then

SummBilled = MinDem
'Ratchet Clause applied'

For i = 1 To RatchMos

    RM = i

    If j - RM <= 0 Then
        RM = RM - 12
    End If

'Veratch Clause recognizes Summer/Winter'

If (M >= SumMo And M < SumMo + SummerLength) Then

    RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value

Else: RatchDem = Cells(R + TR + j - RM, C + TC + UCount + 2).Value * Cells(R + ExR + 1 + 2, C).Value

End If

If SummBilled < RatchDem Then

    SummBilled = RatchDem

End If

Next i

'(Possibly Change)On-peak Cost checks minimum demand and ratchet clause,

'Off-peak does not'

SummOnCost = Cells(R + ExR + 1, C).Value * SummBilled

SummOffCost = Cells(R + ExR + 1, C + 1).Value * Cells(R + TR + j, C + TC + UCount + 1).Value
'If Winter month, Summer Costs equal 0'
ElseIf (M < SumMo Or M >= SumMo + SummerLength) Then
    SummOnCost = 0
    SummOffCost = 0
End If
SummDemCost = SummOnCost + SummOffCost

'Winter Demand Cost (w/Peak)'
If (M < SumMo Or M >= SumMo + SummerLength) Then
    WintBilled = 0
    WintDemCost = 0
    WintBilled = Cells(R + TR + j, C + TC + UCount + 2).Value
'Minimum Billed Demand applied'
If WintBilled < MinDem Then
    WintBilled = MinDem
End If
'Ratchet Clause applied'
For i = 1 To RatchMos
    RM = i
    If j - RM <= 0 Then
        RM = RM - 12
    End If
'Ratchet Clause recognizes Summer/Winter'

If (M >= SumMo And M < SumMo + SummerLength) Then

    RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value

Else: RatchDem = Cells(R + TR + j - RM, C + TC + UCount + 2).Value * Cells(R + ExR + 1 + 2, C).Value

End If

If WintBilled < RatchDem Then

    WintBilled = RatchDem

End If

Next i

'(Possibly Change)On-peak Cost checks minimum demand and ratchet clause,

'Off-peak does not'

WintOnCost = Cells(R + ExR + 1, C + 2).Value * WintBilled

WintOffCost = Cells(R + ExR + 1, C + 3).Value * Cells(R + TR + j, C + TC + UCount + 3).Value

'If Summer month, Winter Costs equal 0'

ElseIf (M >= SumMo And M < SumMo + SummerLength) Then

    WintOnCost = 0

    WintOffCost = 0

End If

WintDemCost = WintOnCost + WintOffCost

'Combine Summer and Winter Costs'
DemCost = SummDemCost + WintDemCost

Cells(R + TTR + j, C + TTC + CCount).Value = DemCost

Next j

UCount = UCount + 4

End If

End If

End If

CCount = CCount + 1

'Skip Costs per kW-mo ($) and skip Ratchet/Minimum Billed Demand Rows'

ExR = ExR + 4

'Arrives at either kW-mo Riders Row (if SCkWRider14 > 0)
'
'  or Franchise Fee (if SCkWRider14 < 0)'

Do While Cells(R + TR, C + TC + kWhC).Value = "kWh"

  kWhC = kWhC + 1

Loop

Do While Cells(R + TR, C + TC + kWhC + kWmoC).Value = "kW-mo"
\[ \text{kWmoC} = \text{kWmoC} + 1 \]

Loop

\[ \text{SCSznDem} = \text{kWmoC} \]

If \( \text{SCkWRider14} > 0 \) Then

\[
\text{Cells}(R + \text{TTR} - 1, C + \text{TTC} + \text{CCount}).\text{Value} = "\text{Demand Riders Cost}" \\
\text{Cells}(R + \text{TTR}, C + \text{TTC} + \text{CCount}).\text{Value} = "\$(\)"
\]

\[ \text{TotalkW} = 0 \]

For \( j = 1 \) To 12

\[ \text{TotalkW} = 0 \]

For \( i = 0 \) To \( \text{SCSznDem} - 1 \)

\[ \text{TotalkW} = \text{TotalkW} + \text{Cells}(R + \text{TR} + j, C + \text{TC} + \text{UCount} - \text{SCSznDem} + i).\text{Value} \]

Next \( i \)

If \( \text{SCkWRider14} > 0 \) Then

\[ \text{RiderSum} = 0 \]

For \( i = 1 \) To \( \text{SCkWRider14} \)

\[ \text{RiderSum} = \text{RiderSum} + \text{TotalkW} \times \text{Cells}(R + \text{ExR} + 1, C + i - 1).\text{Value} \]

Next \( i \)

If \( \text{SCkWRider58} > 0 \) Then

For \( i = 1 \) To \( \text{SCkWRider58} \)

\[ \text{RiderSum} = \text{RiderSum} + \text{TotalkW} \times \text{Cells}(R + \text{ExR} + 1 + 2, C + i - 1).\text{Value} \]

Next \( i \)

End If
Cells(R + TTR + j, C + TTC + CCount).Value = RiderSum

End If

Next j

End If

If SCkWRider14 > 0 Then
    CCount = CCount + 1
    ExR = ExR + 2
    If SCkWRider58 > 0 Then
        ExR = ExR + 2
    End If
End If

' Subtotal is the sum of everything from the first column (i=0) to the previous column (i =
CCount - 1) (CCount is the current column).'

' Each months Subtotal (for j = 1 to 12) is entered into the cell in the current column (CCount).'

Cells(R + TTR, C + TTC + CCount).Value = "Subtotal"

Cells(R + TTR + 1, C + TTC + CCount).Value = "($)"

CustomerCharge = Cells(R + ExR + 2 + 1, C).Value

For j = 1 To 12
    Subtotal = 0
    For i = 0 To CCount - 1
Subtotal = Subtotal + Cells(R + TTR + j, C + TTC + i).Value

Next i

Subtotal = Subtotal + CustomerCharge

Cells(R + TTR + j, C + TTC + CCount).Value = Subtotal

Next j

CCount = CCount + 1

' Franchise Fee  = (Municipal Tax Rate) * (Subtotal)'
' FranchiseRate = Municipal Tax Rate'
' Franchise = Franchise Fee'
' SubFranch = Franchise + Subtotal
' Taxes = (Total Tax Rate) * (Subtotal + Franchise Fee)'
' TotalTaxRate = Total Tax Rate'
' Taxes = Total Taxes'
' Taxes and Franchise Fee will be combined in one column (CCount) and as one combined value'
' TaxesFees = Franchise Fee + Total Taxes'

Cells(R + TTR - 1, C + TTC + CCount).Value = "Taxes & Fees"

Cells(R + TTR, C + TTC + CCount).Value = "($)"

FranchiseRate = Cells(R + ExR + 1, C).Value

If FranchiseRate = "N/A" Then

    FranchiseRate = Empty

End If

TotalTaxRate = Cells(R + ExR + 1, C + 1).Value
If TotalTaxRate = "N/A" Then
    TotalTaxRate = Empty
End If

For j = 1 To 12
    Subtotal = Cells(R + TTR + j, C + TTC + CCount - 1).Value
    Franchise = FranchiseRate * Subtotal
    SubFranch = Franchise + Subtotal
    Taxes = SubFranch * TotalTaxRate
    TaxesFees = Franchise + Taxes
    Cells(R + TTR + j, C + TTC + CCount).Value = TaxesFees
    Next j

CCount = CCount + 1

Cells(R + TTR - 1, C + TTC + CCount).Value = "Total"
Cells(R + TTR, C + TTC + CCount).Value = "($)"

For j = 1 To 12
    Total = Cells(R + TTR + j, C + TTC + CCount - 2) + Cells(R + TTR + j, C + TTC + CCount - 1)
    Cells(R + TTR + j, C + TTC + CCount).Value = Total
    Next j

Worksheets("Ground Zero").Range("Z41").Value = CCount
Worksheets("DIY El. Rates").Range("A174").Value = CCount
CCC = 0

Do While Cells(R + TTR, C + TTC + CCC).Value <> Empty
    CCC = CCC + 1
Loop

UCC = 0

Do While Cells(R + TR, C + TC + UCC).Value <> Empty
    UCC = UCC + 1
Loop

For i = 0 To CCC - 1
    Cells(R + TTR - 1, C + TTC + i).Font.FontStyle = "Bold"
    Cells(R + TTR, C + TTC + i).Font.FontStyle = "Bold"
    For j = 1 To 12
        Cells(R + TTR + j, C + TTC + i).NumberFormat = "$#,##0.00"
    Next j
Next i

With Worksheets("DIY El. Rates")
    .Range("B1:Y100").HorizontalAlignment = xlCenter
    .Range("B1:Y100").VerticalAlignment = xlCenter
For i = CCC - UCC To CCC - 1
Columns(C + TTC + i).AutoFit

If .Columns(C + TTC + i).ColumnWidth < 15 Then

.Columns(C + TTC + i).ColumnWidth = 15

End If

Next i

End With

End Sub
Select Natural Gas Rate Schedule

Private Sub NGSelectNextButton_Click()

    CurrentPage = 2

    If OptButtonCustomizeNG.Value = True Then
        NextPage = CurrentPage + 1
    Worksheets("Ground Zero").Range("Z1").Value = NextPage
    MultiPage1.Value = NextPage
    Else:
        If (NGCityTaxTB = Empty Or NGCityTaxTB = "N/A") Then
            NGCityTaxTB = 0
        End If
        If (NGCountyTaxTB = Empty Or NGCountyTaxTB = "N/A") Then
            NGCountyTaxTB = 0
        End If
        If (NGStateTaxTB = Empty Or NGStateTaxTB = "N/A") Then
            NGStateTaxTB = 0
        End If
        If (NGMFATB = Empty Or NGMFATB = "N/A") Then
            NGMFATB = 0
        End If
    With Sheet5
'Assign Tax values etc. from userform to AOGC Rate Schedule Sheet'

.Range("J5").Value = NGCityTaxTB / 100
.Range("J6").Value = NGCountyTaxTB / 100
.Range("J7").Value = NGStateTaxTB / 100
.Range("J9").Value = NGMFATB / 100

End With

With Sheet9

'Assign Tax values etc. from userform to Black Hills Rate Schedule Sheet'

.Range("J12").Value = NGCityTaxTB / 100
.Range("J13").Value = NGCountyTaxTB / 100
.Range("J14").Value = NGStateTaxTB / 100
.Range("J15").Value = NGMFATB / 100

End With

With Sheet10

'Assign Tax values etc. from userform to CenterPoint Rate Schedule Sheet'

.Range("L9").Value = NGCityTaxTB / 100
.Range("L10").Value = NGCountyTaxTB / 100
.Range("L11").Value = NGStateTaxTB / 100
.Range("L12").Value = NGMFATB / 100

.Range("C4").Value = NGTSOCB
.Range("C20").Value = NGLCFCCB

End With

NextPage = CurrentPage + 2

Worksheets("Ground Zero").Range("Z1").Value = NextPage

MultiPage1.Value = NextPage

End If

'FORMATTING TIMEEEE'

'If statement counts the number of usage columns'

'Usage columns will have commas & no decimal place'

'Cost columns will be currency format with 2 decimal places'

With Worksheets("Ground Zero")

If (OptButtonMediumSales.Value = True Or OptButtonBusiness3.Value = True Or _
    OptButtonSCS2.Value = True) Then

For j = 0 To 11


.Cells(25 + j, 6).Value = "N/A"

Next j
End If


For j = 0 To 11


Next j

End If

If OptButtonCustomizeNG.Value = False Then

UsageCol = 3

For j = 0 To 12

For i = 0 To UsageCol - 1

.Cells(25 + j, 4 + i).NumberFormat = "#,##0.0"

If j = 12 Then

.Cells(25 + j, 4 + i).Font.FontStyle = "Bold"

End If

Next i

Next j

For i = UsageCol To UsageCol + 5

.Cells(4 + j, 4 + i).NumberFormat = "$#,###.00"

End If
If j = 12 Then

    Cells(25 + j, 4 + i).Font.FontStyle = "Bold"

End If

Next i

Next j

End If

.Range("D22:P24").Font.FontStyle = "Bold"

.Range("B22:C37").Font.FontStyle = "Bold"

End With

End Sub
Calculate Natural Gas Utility Cost

Private Sub NGCost_Click()

With Worksheets("Ground Zero")
    With .Range("G22:P37")
        .ClearContents
        .ClearFormats
    End With
If .Cells(24, 4).Value = "MCF" Then
    For j = 0 To 11
    Next j
ElseIf .Cells(24, 4).Value = "CCF" Then
    For j = 0 To 11
        .Cells(25 + j, 4 + 1).Value = .Cells(25 + j, 4 + 0).Value * 0.1023
    Next j
End If

If (.Range("B21").Value = "Medium Business Sales" Or _
    .Range("B21").Value = "Large Business Sales") Then

CostCol = 8
ElseIf .Range("B21").Value = "Business 3 Sales" Or _
 .Range("B21").Value = "Business 4 Sales" Or _
 .Range("B21").Value = "Business 5 Sales") Then
 CostCol = 8
ElseIf (.Range("B21").Value = "Small Commercial Firm Sales Service (SCS-1)" Or _
 .Range("B21").Value = "Large Commercial Firm Service (LCS-1)" Or _
 .Range("B21").Value = "Small Commercial Firm Sales Service - Off-Peak (SCS-2") Then
 .Range("G22:N36").Value = Worksheets("CenterPoint").Range("F32:M47").Value
 CostCol = 7
End If

UsageCol = 3
For i = 0 To UsageCol - 1
 Sum = 0
 For j = 0 To 11
   If .Cells(25 + j, 4 + i).Value <> "N/A" Then
     Sum = Sum + .Cells(25 + j, 4 + i).Value
   End If
 Next j


.Cells(25 + 12, 4 + i).Value = Sum
.Cells(25 + 12, 4 + i).Font.FontStyle = "Bold"
.Cells(25 + 12, 4 + i).Interior.Pattern = xlNone
.Cells(25 + 12, 4 + i).NumberFormat = ",##0.0"

Next i

For i = UsageCol To UsageCol + CostCol - 1

    Sum = 0
    For j = 0 To 12
        With .Cells(25 + j, 4 + i)
            If .Value <> "N/A" Then
                .NumberFormat = "$#,##0.00"
                If j <> 12 Then
                    Sum = Sum + .Value
                    If i <> UsageCol + CostCol - 1 Then
                        .Interior.Color = 15523812
                    Else: .Interior.ColorIndex = 0
                    End If
                ElseIf j = 12 Then
                    If Sum <> 0 Then
                        .Value = Sum
                        .Interior.ColorIndex = 0
                        .Font.FontStyle = "Bold"
                    End If
                End If
            End If
        End With
    Next j
Next i
End If

End If

End If

End With

Next j

Next i

.Range("B22:P37").HorizontalAlignment = xlCenter

.Range("B22:P37").VerticalAlignment = xlCenter

.Range("B21:C37").Font.FontStyle = "Bold"

.Range("D22:P24").Font.FontStyle = "Bold"

.Columns("C:Y").AutoFit

.Range("B22:P37").Rows.AutoFit

End With

End Sub
Create Customizable Natural Gas Rate Schedule Table and Inputs Cells

Private Sub CreateNGTable_Click()

Worksheets("DIY NG Rates").Activate

Dim C As Integer
Dim R As Integer
Dim TC As Integer
Dim TR As Integer
Dim TTC As Integer
Dim TTR As Integer
Dim ExR As Integer
Dim UCount As Integer
Dim CCount As Integer
Dim Subcount As Integer
Dim Subcount1 As Integer
Dim Subcount2 As Integer
Dim Subcount3 As Integer
Dim Subcount4 As Integer
Dim Subcount5 As Integer
Dim Subcount6 As Integer
Dim Subcount7 As Integer
Dim Subcount8 As Integer
Dim Consumption As Single
C = 5                   ' Reference Cell Column
Cells(116, 1).Value = C
R = 6                   ' Reference Cell Row
Cells(118, 1).Value = R
TC = 0                  ' Column offset for the Usage Information Table.'
Cells(120, 1).Value = TC
TR = 21                 ' Row offset for the Usage Information Table.’
Cells(122, 1).Value = TR
TTC = TC + 0            ' Column offset for the Costs Table
Cells(124, 1).Value = TTC
TTR = TR + 18           ' Row offset for the Costs Table
Cells(126, 1).Value = TTR
RS = 0                  ' (Row Space) This is the spacing between rows for the table where the
' customers enter their their information regarding their rate schedule
' charges.'
ExR = 0                 ' (Extra Row) This is the number of extra rows for the table where
' the customers enter their information regarding their rate schedule charges.'
UCount = 0              ' Ongoing tally for number of rows for the Usage Information Table.
' This ensures columns are created one cell over from the previous column.'
CCount = 1              ' Ongoing tally for number of rows for the Costs Table.
Subcount = 1
'BEGINNING OF PAGE FORMATTING' (CLEAR TRACES OF PAST USE)

With Range("B1:Z100")

.ClearContents

.ClearFormats

End With


'MONTHS BASED ON FIRST MONTH'

' Assigning the Months value to Cell A68 displays the selection from the above list's
drop down box.

'MoNo is the single digit representation of the month selected in the Months drop down box.

'MonthNo is a function I wrote to assign a single digit representation to the name of
a month.

'The For Loop generates the 11 months subsequent to the Months Value. Given the single
digit representation for the Months Value, the next 11 numbers are calculated, starting
back at 1 after 12.

'Example: If the selected month is October, its single digit representation is 10.

'     When j = 4, M = 14, but since M is > 12, 12 is subtracted from M.

'     So the new M value is 2 which corresponds to February.

'     February is 4 months after October.

'NGMonths represents the first month of the 12 month billing year'
'NGSummerStart represents the first month of the summer months'

'NGSummerLength represents the number of summer months'

'M is the number of the month'

'S is the number of the summer month (first summer month is 1)'

Range("A68").Value = NGMonths

Range("A94").Value = NGSummerStart                    ' First Summer Month

If NGSummerLength = "N/A" Then
    NGSummerLength = Empty
End If

Range("A103").Value = NGSummerLength                  ' Number of Summer Months

'Create Months Columns, Bold Summer Months (for double-checking),

MoNo = MonthNo(NGMonths)

SumMo = MonthNo(NGSummerStart)

For j = 0 To 11
    M = MoNo + j

    If M > 12 Then
        M = M - 12
    End If

    Cells(R + TR + 1 + j, C + TC - 1).Value = MonthName(M)
    Cells(R + TTR + 1 + j, C + TTC - 1).Value = MonthName(M)

    If (M >= SumMo And M < SumMo + NGSummerLength) Then
        Cells(R + TR + 1 + j, C + TC - 1).Font.Bold = True
        Cells(R + TTR + 1 + j, C + TTC - 1).Font.Bold = True

    End If
Else: Cells(R + TR + 1 + j, C + TC - 1).Font.Bold = False

Cells(R + TTR + 1 + j, C + TTC - 1).Font.Bold = False

End If

Next j

'STORE MORE VALUES'

Range("A5").Value = NGConsumptionSeasons ' Seasons YES or NO
Range("A165").Value = NGSimplePeakCons ' If there are no seasons, is there a peak? YES or NO'
Range("A33").Value = NGBlock ' Block Expander YES or NO
Range("A38").Value = NGNumBlock ' Number of Blocks in Expander
Range("A145").Value = NGBlockBase ' Block Size: Fixed MMBtu amount or specific MMBtu per MMBtu Demand of demand
Range("A10").Value = NGSumPeakCons ' Summer peak YES or NO for Energy
Range("A15").Value = NGWintPeakCons ' Winter peak YES or NO for Energy

Cells(R - 2, C).Value = "Transportation Charge ($/MMBtu)"
Cells(R - 2 + 1, C).NumberFormat = "$0.00#####"

'ENERGY CHARGES; ON-PEAK/OFF-PEAK, SUMMER/WINTER, AND BLOCKS'

If NGConsumptionSeasons.Value = "No" Then ' There is either a simple $/MMBtu charge or the first row is the block expander charges'

229
If NGBlock = "No" Then  
'' NO Seasons NO Block: The 1st line is just
$/MMBtu since there is NO block expander (or seasons)'
If NGSimplePeakCons = "No" Then

Cells(R, C).Value = "Cost per MMBtu ($)"
Cells(R + TR - 1, C + TC).Value = "Total"
Cells(R + TR, C + TC).Value = "MMBtu"
For j = 1 To 12

Cells(R + TR + j, C + TC).Interior.Color = 15986394
Cells(R + TR + j, C + TC).NumberFormat = "#,###"
Next j
UCount = UCount + 1
Cells(132, 1).Value = 1
ElseIf NGSimplePeakCons = "Yes" Then

Cells(R, C).Value = "On-peak Cost per MMBtu ($)"
Cells(R + TR - 1, C + TC).Value = "On-peak"
Cells(R + TR, C + TC).Value = "MMBtu"
UCount = UCount + 1
Cells(R, C + 1).Value = "Off-peak Cost per MMBtu ($)"
Cells(R + TR - 1, C + TC + 1).Value = "Off-peak"
Cells(R + TR, C + TC + 1).Value = "MMBtu"
For j = 1 To 12

For i = 0 To 1

Cells(R + TR + j, C + TC + i).Interior.Color = 15986394

230
Cells(R + TR + j, C + TC + i).NumberFormat = "#,###"

Next i

Next j

UCount = UCount + 1

Cells(132, 1).Value = 2

End If

ExR = ExR + 2 ' The first row is complete, so new input info. labels will be two rows down'

Cells(133, 1).Value = 0

Cells(134, 1).Value = 0

ElseIf NGBlock = "Yes" Then ' NO Seasons YES Block: The 1st line will be Block Expander, 2nd line is Block Sizes'

For i = 1 To NGNumBlock - 1 ' For Loop to create correct amount of blocks'

Cells(R + ExR, C + i - 1).Value = "Block #" & i & " Cost per MMBtu ($)"

Next i

Cells(R + ExR, C + NGNumBlock - 1).Value = "Remaining MMBtu Cost per MMBtu ($)"

' Last cell is "Remaining" Block'

Cells(R + TR, C + TC).Value = "Total MMBtu"

For j = 1 To 12

Cells(R + TR + j, C + TC).Interior.Color = 15986394

Cells(R + TR + j, C + TC).NumberFormat = "#,###"
Next j

    UCount = UCount + 1 ' UCount used for Usage table

column count'

    ExR = ExR + 2

    Cells(132, 1).Value = 0

    Cells(133, 1).Value = NGNumBlock

    Cells(134, 1).Value = NGNumBlock - 1

    If NGSimplePeakCons.Value = "Yes" Then
        MsgBox "Peaks are not allowed with" & vbCrLf & "Block Expanders. Thank You."
    End If

    ' 1st row complete. New input info will be 2 rows down.'

    If NGBlockBase.Value = "Fixed (MMBtu)" Then ' Next (2nd) line is Block Sizes'
        For i = 1 To NGNumBlock.Value - 1 ' For Loop to create correct amount of block size cells'
            Cells(R + ExR, C + i - 1).Value = "Block " & i & " Size (MMBtu)"
        Next i
    ElseIf NGBlockBase.Value = "Demand Based (MMBtu/MMBtu Demand)" Then
        ' If/ElseIf statement decides whether blocks sizes are based on strictly MMBtu or MMBtu/MMBtu Demand'
        For i = 1 To NGNumBlock.Value - 1

232
Cells(R + ExR, C + i - 1).Value = "Block " & i & " Size (MMBtu/MMBtu Demand)"

Next i

End If

Cells(R + ExR, C + NGNumBlock - 1).Value = "Remaining MMBtu"
Cells(R + ExR + 1, C + NGNumBlock - 1).Value = "(Different Each Month)"
ExR = ExR + 2

End If

' Both options for NO Seasons has been completed'

ElseIf NGConsumptionSeasons.Value = "Yes" Then

If NGBlock = "Yes" Then

UCount = 0

If (NGSumPeakCons.Value = "Peak" Or NGWintPeakCons.Value = "Peak") Then

MsgBox "Peaks are not allowed with" & vbNewLine & "Block Expanders. Thank You."

End If

Cells(R + ExR, C - 1).Value = "Summer: "

For i = 1 To NGNumBlock - 1

' For Loop to create correct amount of blocks'

Cells(R + ExR, C + i - 1).Value = "Block #" & i & " Cost per MMBtu ($)"

Next i

Cells(R + ExR, C + NGNumBlock - 1).Value = "Remaining MMBtu Cost per MMBtu ($)"

' Last cell is "Remaining" Block'

ExR = ExR + 2
Cells(R + ExR, C - 1).Value = "Winter: "

For i = 1 To NGNumBlock - 1

    Cells(R + ExR, C + i - 1).Value = "Block #" & i & " Cost per MMBtu ($)"

    Next i

Cells(R + ExR, C + NGNumBlock - 1).Value = "Remaining MMBtu Cost per MMBtu ($)"

Cells(R + TR, C + TC).Value = "Total MMBtu"

For j = 1 To 12

    Cells(R + TR + j, C + TC).Interior.Color = 15986394

    Cells(R + TR + j, C + TC).NumberFormat = "#,###"

    Next j

ExR = ExR + 2

If NGBlockBase.Value = "Fixed (MMBtu)" Then

    For i = 1 To NGNumBlock.Value - 1

        Cells(R + ExR, C + i - 1).Value = "Block " & i & " Size (MMBtu)"

        Next i

ElseIf NGBlockBase.Value = "Demand Based (MMBtu/MMBtu Demand)" Then

    ' If/ElseIf statement decides whether blocks sizes are based on strictly MMBtu or

    MMBtu/MMBtu Demand'

    For i = 1 To NGNumBlock.Value - 1

    Next i

    ' For Loop to create correct amount of block size cells'

    Cells(R + ExR, C + i - 1).Value = "Block " & i & " Size (MMBtu)"

    Next i

ElseIf NGBlockBase.Value = "Demand Based (MMBtu/MMBtu Demand)" Then

    ' If/ElseIf statement decides whether blocks sizes are based on strictly MMBtu or

    MMBtu/MMBtu Demand'

    For i = 1 To NGNumBlock.Value - 1


Cells(R + ExR, C + i - 1).Value = "Block " & i & " Size (MMBtu/MMBtu Demand)"

Next i

End If

Cells(R + ExR, C + NGNumBlock - 1).Value = "Remaining MMBtu"

Cells(R + ExR + 1, C + NGNumBlock - 1).Value = "(Different Each Month)"

ExR = ExR + 2

UCount = UCount + 1

' UCount used for Usage table column count'

Cells(132, 1).Value = 0

Cells(133, 1).Value = NGNumBlock

Cells(134, 1).Value = NGNumBlock - 1

ElseIf NGBlock = "No" Then

If NGSumPeakCons.Value = "No Peak" Then

    Cells(R, C).Value = "Summer Cost per MMBtu ($)"

    Cells(R + TR - 1, C + TC) = "Summer"

    Cells(R + TR, C + TC) = "MMBtu"

For j = 1 To 12

    'Summer/WInter Determination'

    M = MoNo + j - 1

    If M > 12 Then

        M = M - 12

235
End If

If (M >= SumMo And M < SumMo + NGSummerLength) Then
    Cells(R + TR + j, C + TC).Interior.Color = 15986394
    Cells(R + TR + j, C + TC).NumberFormat = "#,###"
End If

Next j

UCount = UCount + 1

If NGWintPeakCons.Value = "No Peak" Then
    Cells(R, C + UCount).Value = "Winter Cost per MMBtu ($)"
    Cells(R + TR - 1, C + UCount - 1 + TC).Value = "Total"
    Cells(R + TR, C + UCount - 1 + TC).Value = "MMBtu"
    For j = 1 To 12
        Cells(R + TR + j, C + TC).Interior.Color = 15986394
        Cells(R + TR + j, C + TC).NumberFormat = "#,###"
    Next j
    Subcount = Subcount + 0

ElseIf NGWintPeakCons.Value = "Peak" Then
    Cells(R, C + UCount).Value = "Winter On-peak Cost per MMBtu ($)"
    Cells(R + TR - 1, C + UCount + TC).Value = "Winter On-peak"
    Cells(R + TR, C + UCount + TC).Value = "MMBtu"
    For j = 1 To 12
'Summer/Winter Determination'

M = MoNo + j - 1

If M > 12 Then
    M = M - 12
End If

If (M < SumMo Or M >= SumMo + NGSummerLength) Then
    Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
    Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"
End If

Next j

Subcount = Subcount + 1

UCount = UCount + 1

Cells(R, C + UCount).Value = "Winter Off-peak Cost per MMBtu ($)"

Cells(R + TR - 1, C + UCount + TC).Value = "Winter Off-peak"

Cells(R + TR, C + UCount + TC).Value = "MMBtu"

For j = 1 To 12
    'Summer/Winter Determination'
    M = MoNo + j - 1
    If M > 12 Then
        M = M - 12
    End If
    If (M < SumMo Or M >= SumMo + NGSummerLength) Then
        Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
    End If
End For
Cells(R + TR + j, C + TC + UCount).NumberFormat = ",###"
End If
Next j
Subcount = Subcount + 1
UCount = UCount + 1
End If
End If

If NGSumPeakCons.Value = "Peak" Then
    Cells(R, C).Value = "Summer On-peak Cost per MMBtu ($)"
    Cells(R + TR - 1, C + TC).Value = "Summer On-peak"
    Cells(R + TR, C + TC).Value = "MMBtu"
    For j = 1 To 12
        'Summer/WinTer Determination'
        M = MoNo + j - 1
        If M > 12 Then
            M = M - 12
        End If
        If (M >= SumMo And M < SumMo + NGSummerLength) Then
            Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
            Cells(R + TR + j, C + TC + UCount).NumberFormat = ",###"
        End If
    Next j
End If
Next j
UCount = UCount + 1

Cells(R, C + UCount).Value = "Summer Off-peak Cost per MMBtu ($)"

Cells(R + TR - 1, C + UCount + TC).Value = "Summer Off-peak"

Cells(R + TR, C + UCount + TC).Value = "MMBtu"

For j = 1 To 12
   'Summer/WInter Determination'
   M = MoNo + j - 1
   If M > 12 Then
      M = M - 12
   End If
   If (M >= SumMo And M < SumMo + NGSummerLength) Then
      Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
      Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"
   End If
Next j

Subcount = Subcount + 1
UCount = UCount + 1

If NGWintPeakCons.Value = "No Peak" Then
   Cells(R, C + UCount).Value = "Winter Cost per MMBtu ($)"
   Cells(R + TR - 1, C + UCount + TC).Value = "Winter"
   Cells(R + TR, C + UCount + TC).Value = "MMBtu"
239
For j = 1 To 12
    'Summer/Winter Determination'
    M = MoNo + j - 1
    If M > 12 Then
        M = M - 12
    End If
    If (M < SumMo Or M >= SumMo + NGSummerLength) Then
        Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
        Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"
    End If
Next j
Subcount = Subcount + 1
UCount = UCount + 1

ElseIf NGWintPeakCons.Value = "Peak" Then
    Cells(R, C + UCount).Value = "Winter On-peak Cost per MMBtu ($)"
    Cells(R + TR - 1, C + UCount + TC).Value = "Winter On-peak"
    Cells(R + TR, C + UCount + TC).Value = "MMBtu"
    For j = 1 To 12
        'Summer/Winter Determination'
        M = MoNo + j - 1
        If M > 12 Then
            M = M - 12
    End If
Next j

240
End If

If (M < SumMo Or M >= SumMo + NGSummerLength) Then

    Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
    Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"

End If

Next j

Subcount = Subcount + 1

UCount = UCount + 1

Cells(R, C + UCount).Value = "Winter Off-peak Cost per MMBtu ($)"

Cells(R + TR - 1, C + UCount + TC).Value = "Winter Off-peak"

Cells(R + TR, C + UCount + TC).Value = "MMBtu"

For j = 1 To 12

    'Summer/Inter Determination'

    M = MoNo + j - 1

    If M > 12 Then

        M = M - 12

    End If

    If (M < SumMo Or M >= SumMo + NGSummerLength) Then

        Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
        Cells(R + TR + j, C + TC + UCount).NumberFormat = "#,###"

    End If

Next j

Subcount = Subcount + 1
UCount = UCount + 1

End If

End If

ExR = ExR + 2

Cells(132, 1).Value = Subcount

Cells(133, 1).Value = 0

Cells(134, 1).Value = 0

End If

End If

iC = 0

Do While Cells(R + ExR - 2, C + iC).Value <> Empty

    iC = iC + 1

Loop

For i = 0 To iC - 1

    Cells(R + ExR - 1, C + i).NumberFormat = "$0.00######"

Next i

'Consumption RIDERS'

Subcount = 0

Range("A80").Value = NGRidersCons
If NGRidersCons <> 0 Then

    If NGRidersCons < 5 Then
        For i = 1 To NGRidersCons
            Cells(R + ExR, C + Subcount).Value = "Rider " & i & " ($/MMBtu)"
            Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00####" "
            Subcount = Subcount + 1
        Next i
    Cells(135, 1).Value = Subcount
    Cells(136, 1).Value = 0
    ExR = ExR + 2

    ElseIf NGRidersCons > 4 Then
        For i = 1 To 4
            Cells(R + ExR, C + Subcount).Value = "Rider " & i & " ($/MMBtu)"
            Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00####" "
            Subcount = Subcount + 1
        Next i
    Cells(135, 1).Value = Subcount
    ExR = ExR + 2

    Subcount = 0
    For i = 5 To NGRidersCons
        Cells(R + ExR, C + Subcount).Value = "Rider " & i & " ($/MMBtu)"
    Next i

243
Cells(R + ExR + 1, C + Subcount).NumberFormat = "$0.00######"

Subcount = Subcount + 1

Next i

Cells(136, 1).Value = Subcount

ExR = ExR + 2

End If

ElseIf NGRidersCons = 0 Then

Cells(135, 1).Value = 0

Cells(136, 1).Value = 0

End If

'DEMAND CHARGES; ON-PEAK/OFF-PEAK, SUMMER/WINTER'

Range("A19").Value = NGDemandSeasons

Subcount = 0

If NGDemandSeasons.Value = "No" Then

Cells(R + ExR, C + Subcount).Value = "Cost per MMBtu Demand ($)"

Cells(R + TR - 1, C + UCount + TC).Value = "Total"

Cells(R + TR, C + UCount + TC).Value = "MMBtu Demand"

For j = 1 To 12

Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394
Cells(R + TR + j, C + TC + UCount).NumberFormat = ",##0.0"

Next j

UCount = UCount + 1

Subcount = Subcount + 1

ElseIf NGDemandSeasons.Value = "Yes" Then

Cells(R + ExR, C + Subcount).Value = "Summer Cost per MMBtu ($)"

Cells(R + TR - 1, C + UCount + TC) = "Summer"

Cells(R + TR, C + UCount + TC) = "MMBtu Demand"

For j = 1 To 12

'Summer/Winter Determination'

M = MoNo + j - 1

If M > 12 Then

M = M - 12

End If

If (M >= SumMo And M < SumMo + NGSummerLength) Then

Cells(R + TR + j, C + TC + UCount).Interior.Color = 15986394

Cells(R + TR + j, C + TC + UCount).NumberFormat = ",##0.0"

End If

Next j

UCount = UCount + 1

Subcount = Subcount + 1
Cells(R + ExR, C + Subcount).Value = "Winter Cost per MMBtu ($)"

Cells(R + TR - 1, C + UCount + TC - 1).Value = "Total"

Cells(R + TR, C + UCount + TC - 1).Value = "MMBtu Demand"

For j = 1 To 12
    'Summer/Winter Determination'
    M = MoNo + j - 1
    If M > 12 Then
        M = M - 12
    End If
    If (M < SumMo Or M >= SumMo + NGSummerLength) Then
        Cells(R + TR + j, C + TC + UCount - 1).Interior.Color = 15986394
        Cells(R + TR + j, C + TC + UCount - 1).NumberFormat = "#,##0"
    End If
Next j

Subcount = Subcount + 1

End If

ExR = ExR + 2

Do While Cells(R + ExR - 2, C + iC).Value <> Empty
    iC = iC + 1
Loop
For $i = 0$ To $iC - 1$

    Cells(R + ExR - 1, C + $i$).NumberFormat = "$0.00######$

Next $i$

Cells(137, 1).Value = Subcount

'Assign Userform entries to fixed cells (demand section)'

Range("A42").Value = NGRatchet
Range("A160").Value = NGRatchMos
Range("A46").Value = NGMinDem
Range("A50").Value = NGFranchise
Range("A54").Value = NGTaxes

'RATCHET CLAUSE AND MINIMUM BILLED DEMAND'

'RATCHET CLAUSE'

Subcount = 0

Cells(R + ExR, C + Subcount).Value = "Ratchet Percentage (%)"
Cells(R + ExR + 1, C + Subcount).NumberFormat = "0.00%"

If NGRatchet = "No" Then

    Cells(R + ExR + 1, C + Subcount).Value = "N/A"

End If

Subcount = Subcount + 1
'MINIMUM BILLED DEMAND'

Cells(R + ExR, C + Subcount).Value = "Minimum Billed Demand (MMBtu Demand)"

Cells(R + ExR + 1, C + Subcount).NumberFormat = "#,###"

If NGMinDem = "No" Then
    Cells(R + ExR + 1, C + Subcount).Value = "N/A"
End If

Subcount = Subcount + 1

ExR = ExR + 2

'DEMAND RIDERS'

'DEMAND RIDERS UP TO 4'

Subcount = 0

Range("A114").Value = NGRidersDem

If NGRidersDem <> 0 Then
    If NGRidersDem < 5 Then
        For i = 1 To NGRidersDem
            Cells(R + ExR, C + Subcount).Value = "Rider " & i & " ($/MMBtu Demand)"
            Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00#######"
            Subcount = Subcount + 1
        Next i
        Cells(138, 1).Value = Subcount
    End If
    Cells(139, 1).Value = 0
    ExR = ExR + 2
'DEMAND RIDERS UP TO 8'

ElseIf NGRidersDem > 4 Then

    For i = 1 To 4
        Cells(R + ExR, C + Subcount).Value = "Rider " & i & "  ($/MMBtu Demand)"
        Cells(R + ExR + 1, C + i - 1).NumberFormat = "$0.00######"
        Subcount = Subcount + 1
    Next i

    Cells(138, 1).Value = Subcount

    ExR = ExR + 2

    Subcount = 0

    For i = 5 To NGRidersDem
        Cells(R + ExR, C + Subcount).Value = "Rider " & i & "  ($/MMBtu Demand)"
        Cells(R + ExR + 1, C + i - 4 - 1).NumberFormat = "$0.00######"
        Subcount = Subcount + 1
    Next i

    Cells(139, 1).Value = Subcount

    ExR = ExR + 2

End If

ElseIf NGRidersDem = 0 Then

    Cells(138, 1).Value = 0
Cells(139, 1).Value = 0

End If

'TAXES AND FRANCHISE FEE'

'FRANCHISE FEE'

Subcount = 0

Cells(R + ExR, C + Subcount).Value = "Franchise Fee Percentage(%)"

Cells(R + ExR + 1, C + Subcount).NumberFormat = "0.000%"

If NGFranchise = "No" Then

   Cells(R + ExR + 1, C + Subcount).Value = "N/A"

End If

Subcount = Subcount + 1

'TAXES'

Cells(R + ExR, C + Subcount).Value = "Total Tax Percentage(%)"

Cells(R + ExR + 1, C + Subcount).NumberFormat = "0.000%"

If NGTaxes = "No" Then

   Cells(R + ExR + 1, C + Subcount).Value = "N/A"

End If

Subcount = Subcount + 1

ExR = ExR + 2

Cells(140, 1).Value = Subcount
Cells(R + ExR, C).Value = "Customer Charge ($)"
Cells(R + ExR, C).NumberFormat = "$#,##0.00"

' All cells are formatted to center alignment and the column widths are autofitted.
' The final Count number is displayed for as a double checking method for code writing purposes.

Range("B1:Z100").HorizontalAlignment = xlCenter
Range("B1:Z100").Columns.AutoFit

'END OF PAGE FORMATTING (PREPARE FOR FUTURE USE)'
'END OF PAGE FORMATTING (PREPARE FOR FUTURE USE)'
'CCC = Costs Columns Count"
'UCC = Usage Columns Count"
UCC = 0
Do While Cells(R + TR, C + TC + UCC).Value <> Empty
UCC = UCC + 1

Loop

For i = 0 To UCC - 1
    Cells(R + TR - 1, C + TC + i).Font.FontStyle = "Bold"
    Cells(R + TR, C + TC + i).Font.FontStyle = "Bold"
    Cells(R + TR + j, C + TTC + i).ClearContents
    Next i

CCC = 0

Do While Cells(R + TTR, C + TTC + CCC).Value <> Empty
    CCC = CCC + 1
    Loop
If CCC > 0 Then
    For j = 0 To 12
        For i = 0 To CCC
            Cells(R + TTR + j, C + TTC + i).ClearContents
            Next i
        Next j
    End If

For j = 0 To 10
    For i = 0 To 3
        If Cells(R + j * 2 - 2, C + i).Value <> Empty Then
            Cells(R + j * 2 - 2, C + i).Font.FontStyle = "Bold"
    Next i
Next j
'Cells(R + j * 2 - 2, C + i).Font.Underline = xlUnderlineStyleSingle
Cells(R + j * 2 + 1 - 2, C + i).Borders.LineStyle = xlContinuous

End If

Next i

Next j

With Range("B1:Y100")
   .HorizontalAlignment = xlCenter
   .VerticalAlignment = xlCenter
   .Columns("B:Y").AutoFit
   .Rows("1:100").AutoFit

For i = C + 0 - 1 To C + 10 - 1
   With .Columns(i)
      If .ColumnWidth > 15 Then
         .ColumnWidth = 15
         .WrapText = True
      ElseIf .ColumnWidth < 10 Then
         .ColumnWidth = 10
      End If
   End With
Next i
Columns("B:Y").AutoFit

End With

End

End Sub
Calculate Customizable Rate Schedule Natural Gas Utility Cost

Sub NGCalculateButton_Click()

    Dim C As Integer
    Dim R As Integer
    Dim TC As Integer
    Dim TR As Integer
    Dim TTC As Integer
    Dim TTR As Integer
    Dim ExR As Integer
    Dim UCount As Integer
    Dim CCount As Integer
    Dim Subcount As Integer
    Dim SCSznCons As Integer
    Dim SCNumBlockNG As Integer
    Dim SCBlockSizeNG As Integer
    Dim SCCConsRider14 As Integer
    Dim SCCConsRider58 As Integer
    Dim SCSznDemNG As Integer
    Dim SCDemRider14 As Integer
    Dim SCDemRider58 As Integer
    Dim SCMiscNG As Integer
    Dim NGSummerLength As Integer
C = Cells(116, 1).Value
R = Cells(118, 1).Value
TC = Cells(120, 1).Value
TR = Cells(122, 1).Value
TTC = Cells(124, 1).Value
TTR = Cells(126, 1).Value

'CCC = Costs Columns Count"
CCC = 0
Do While Cells(R + TTR, C + TTC + CCC).Value <> Empty
    CCC = CCC + 1
Loop
For j = 0 To 13
    For i = 0 To CCC
        Cells(R + TTR + j - 1, C + TTC + i).ClearContents
    Next i
Next j

'SC Stands for Subcount, running tallies from the userform algorithm, max 4'
SCSznCons = Cells(132, 1).Value
                          ' Number of Energy peaks and/or season combinations
SCNumBlockNG = Cells(133, 1).Value ' Number of blocks in block expander; !IF SEASONS YES AND BLOCKS YES THEN SUMMER/WINTER BLOCK# SHARE SAME SUBCOUNT!

SCBlockSizeNG = Cells(134, 1).Value + 1 ' Number of blocks, Used for the size of each block

SCConsRider14 = Cells(135, 1).Value ' Number of kWh riders between from 1 - 4

SCConsRider58 = Cells(136, 1).Value ' Number of kWh rider from 5 - 8

SCSznDemNG = Cells(137, 1).Value ' Number of Demand peaks and/or season combinations

SCDemRider14 = Cells(138, 1).Value ' Number of kW riders between from 1 - 4

SCDemRider58 = Cells(139, 1).Value ' Number of kW rider from 5 - 8

SCMiscNG = Cells(140, 1).Value ' Number of Miscellaneous columns

ExR = 0

Subcount = 1

'Cost Table column count -1; Counts columns that have been finished in the Costs Table so CCount can be added to the Cells() column reference for the current calculations column'

CCount = 0
'Usage Table column count -1; Counts columns that have been finished in the Usage Table so UCount can be added to the Cells() column reference for the current calculations reference column'

UCount = 0

NGConsumptionSeasons = Range("A5").Value
NGSumPeakCons = Range("A10").Value
NGWintPeakCons = Range("A15").Value
NGBlock = Range("A33").Value
NGBlockBase = Range("A145").Value
NGSummerStart = Range("A94").Value
NGSummerLength = Range("A103").Value
MoNo = MonthNo(Range("A68").Value) ' Number for of Months'
SumMo = MonthNo(Range("A94").Value) ' Number for SummerStart'

Cells(R + TTR - 1, C + TTC + CCount).Value = "Transportation Cost"
Cells(R + TTR, C + TTC + CCount).Value = "$(")
TransportCharge = Cells(R - 1, C).Value
For j = 1 To 12
    Consumption = 0
    For i = 1 To SCSznCons
        Consumption = Consumption + Cells(R + TR + 1, C + i - 1).Value
    Next
Next

258
TransportCost = Consumption * TransportCharge

Cells(R + TTR + j, C + TTC + CCount).Value = TransportCost

Next j

CCount = CCount + 1

Cells(R + TTR - 1, C + TTC + CCount).Value = "Energy Cost"

Cells(R + TTR, C + TTC + CCount).Value = "($)"

If NGConsumptionSeasons = "No" Then ' There is either a simple $/kWh charge or
the first row is the block expander charges'

    If NGBlock = "No" Then ' NO Seasons NO Block: The 1st line is just $/kWh
since there is NO block expander (or seasons)'

        For j = 1 To 12

            Energy = 0

            For i = 1 To SCSznCons

                Energy = Energy + Cells(R + ExR + 1, C + i - 1).Value * Cells(R + TR + j, C + TC + i - 1).Value

            Next i

            Cells(R + TTR + j, C + TTC + CCount).Value = Energy

        Next j

        UCount = UCount + SCSznCons

        ExR = ExR + 2 ' The first row is complete, so new input info. labels will
be two rows down'
ElseIf NGBlock = "Yes" Then

   ' NO Seasons YES Block: The 1st line will be
   Block Expander, 2nd line is Block Sizes'

   If NGBlockBase = "Fixed (kWh)" Then

      For j = 1 To 12

      Energy = 0

      TotalkWh = Cells(R + TR + j, C + TC + UCount).Value

      Remaining = TotalkWh

      For i = 1 To SCNumBlockNG

      ' For Loop to create
      correct amount of blocks'

      If Remaining > 0 Then

         If i <> SCNumBlockNG Then

            BlockCharge = Cells(R + ExR + 1, C + i - 1).Value

            BlockSize = Cells(R + ExR + 1 + 2, C + i - 1).Value

            If Remaining < BlockSize Then

              BlockSize = Remaining

            End If

            Energy = Energy + BlockCharge * BlockSize

            Remaining = Remaining - BlockSize

         End If

      End If

   End If

ElseIf i = SCNumBlockNG Then

   BlockCharge = Cells(R + ExR + 1, C + i - 1).Value

   Energy = Energy + BlockCharge * Remaining

End If
End If

Next i

Cells(R + TTR + j, C + TTC + CCount).Value = Energy

Next j

ExR = ExR + 4

ElseIf NGBlockBase = "Demand Based (kWh/kW-mo)" Then

For j = 1 To 12

Energy = 0

TotalkWh = Cells(R + TR + j, C + TC + UCount).Value

Remaining = TotalkWh

MonthDemand = Cells(R + TR + j, C + TC + 1 + DC + UCount).Value

For i = 1 To SCNumBlockNG

' For Loop to create correct amount of blocks'

If Remaining > 0 Then

If i <> SCNumBlockNG Then

BlockCharge = Cells(R + ExR + 1, C + i - 1).Value

BlockSize = Cells(R + ExR + 1 + 2, C + i - 1).Value * MonthDemand

If Remaining < BlockSize Then

BlockSize = Remaining

End If

Energy = Energy + BlockCharge * BlockSize

Remaining = Remaining - BlockSize

End If

End If
ElseIf i = SCNumBlockNG Then

    BlockCharge = Cells(R + ExR + 1, C + i - 1).Value

    Energy = Energy + BlockCharge * Remaining

End If

End If

Next i

Cells(R + TTR + j, C + TTC + CCount).Value = Energy

Next j

UCount = UCount + 0

' UCount remains at 0, kWh

Riders calculation comes next, which is still based on Total kWh'

    ExR = ExR + 4

' Current focus is on Block#

Charges, which deals with the Block Sizes in the cells below, to continue, must jump down 4

   cells (skipping Block Sizes).

    End If  ' END Block Base IF'

End If  ' END of Block YES/NO'

CCount = CCount + 1

' Both options for NO Seasons has been completed'

ElseIf NGConsumptionSeasons = "Yes" Then

    If NGBlock = "Yes" Then

        If NGBlockBase = "Fixed (kWh)" Then

            For j = 1 To 12

                ' The following line determines if the current month's single digit value is outside the

                range of single digit values of 'Summer Months'

                .

262
If (MonthNo(Cells(R + TR + j, C + TC - 1).Value) < MonthNo(Range("A94").Value) 
Or MonthNo(Cells(R + TR + j, C + TC - 1).Value) >= (MonthNo(Range("A94").Value) + 
NGSummerLength)) Then

    SznR = 2     ' The season additional rows is defined; Winter block charges are
[SznR=] 2 rows down from the summer block charges'
Else: SznR = 0
End If

Energy = 0

TotalkWh = Cells(R + TR + j, C + TC + UCount).Value

Remaining = TotalkWh

For i = 1 To SCNumBlockNG                                                    ' For Loop to create
correct amount of blocks'

    If Remaining > 0 Then

        If i <> SCNumBlockNG Then

            BlockCharge = Cells(R + ExR + 1 + SznR, C + i - 1).Value

            BlockSize = Cells(R + ExR + 1 + 4, C + i - 1).Value

            If Remaining < BlockSize Then

                BlockSize = Remaining

            End If

            Energy = Energy + BlockCharge * BlockSize

            Remaining = Remaining - BlockSize

        ElseIf i = SCNumBlockNG Then
BlockCharge = Cells(R + ExR + 1 + SznR, C + i - 1).Value
Energy = Energy + BlockCharge * Remaining
End If
End If
Next i
Cells(R + TTR + j, C + TTC + CCount).Value = Energy
Next j
CCount = CCount + 1
ExR = ExR + 6
ElseIf NGBlockBase = "Demand Based (kWh/kW-mo)" Then
For j = 1 To 12
' The following line determines if the current month's single digit value is outside the range of single digit values of 'Summer Months'
If (MonthNo(Cells(R + TR + j, C + TC - 1).Value) < MonthNo(Range("A94").Value)
Or MonthNo(Cells(R + TR + j, C + TC - 1).Value) >= (MonthNo(Range("A94").Value) + NGSummerLength)) Then
SznR = 2 ' The season additional rows is defined; Winter block charges are [SznR=] 2 rows down from the summer block charges'
Else: SznR = 0
End If
Energy = 0
TotalkWh = Cells(R + TR + j, C + TC + UCount).Value
Remaining = TotalkWh
MonthDemand = Cells(R + TR + j, C + TC + 1 + DC + UCount).Value

For i = 1 To SCNumBlockNG ' For Loop to create correct amount of blocks'

If Remaining > 0 Then

If i <> SCNumBlockNG Then

BlockCharge = Cells(R + ExR + 1 + SznR, C + i - 1).Value

BlockSize = Cells(R + ExR + 1 + 4, C + i - 1).Value * MonthDemand

If Remaining < BlockSize Then

BlockSize = Remaining

End If

Energy = Energy + BlockCharge * BlockSize

Remaining = Remaining - BlockSize

ElseIf i = SCNumBlockNG Then

BlockCharge = Cells(R + ExR + 1 + SznR, C + i - 1).Value

Energy = Energy + BlockCharge * Remaining

End If

End If

Next i

Cells(R + TTR + j, C + TTC + CCount).Value = Energy

Next j

UCount = UCount + 0 ' UCount remains at 0, kWh

Riders calculation comes next, which is still based on Total kWh'
CCount = CCount + 1

ExR = ExR + 6

' Current focus is on Block# Charges, which deals with the Block Sizes in the cells below, to continue, must jump down 4 cells (skipping Block Sizes).'

End If  ' END Block Base IF'

ElseIf NGBlock = "No" Then

If (NGWintPeakCons = "No Peak" And NGSumPeakCons = "No Peak") Then

SummEnCharge = Cells(R + 1, C).Value

WintEnCharge = Cells(R + 1, C + 1).Value

For j = 1 To 12

Energy = 0

'Summer/WInter Determination'

M = MoNo + j - 1

If M > 12 Then

M = M - 12

End If

If (M >= SumMo And M < SumMo + NGSummerLength) Then

EnergyCharge = SummEnCharge

Else: EnergyCharge = WintEnCharge

End If

Energy = Cells(R + TR + j, C + TC).Value * EnergyCharge

Cells(R + TTR + j, C + TTC + CCount).Value = Energy
Next j

UCount = UCount + 0 'still have to do riders'

Else:

For j = 1 To 12

Energy = 0

For i = 1 To SCSznCons

Energy = Energy + Cells(R + ExR + 1, C + i - 1).Value * Cells(R + TR + j, C + TC + i - 1).Value

Next i

Cells(R + TTR + j, C + TCC + CCount).Value = Energy

Next j

End If

If NGSumPeakCons = "No Peak" Then

If NGWintPeakCons = "Peak" Then

UCount = UCount + 2

End If

End If

If NGSumPeakCons = "Peak" Then

If NGWintPeakCons = "No Peak" Then

UCount = UCount + 2

ElseIf NGWintPeakCons = "Peak" Then

UCount = UCount + 3
End If

ExR = ExR + 2

CCount = CCount + 1

End If

If SCConsRider14 > 0 Then

Cells(R + TTR - 1, C + TTC + CCount).Value = "Riders Cost"

Cells(R + TTR, C + TTC + CCount).Value = "$(")"

For j = 1 To 12

TotalkWh = 0

If SCSznCons > 1 Then

For i = 1 To SCSznCons

    TotalkWh = TotalkWh + Cells(R + TR + j, C + TC + i - 1).Value

Next i

Else: TotalkWh = Cells(R + TR + j, C + TC).Value

End If

If SCConsRider14 > 0 Then

RiderSum = 0

For i = 1 To SCConsRider14

    RiderSum = RiderSum + TotalkWh * Cells(R + ExR + 1, C + i - 1).Value

End If
Next i
If SCConsRider58 > 0 Then
    For i = 1 To SCConsRider58
        RiderSum = RiderSum + TotalkWh * Cells(R + ExR + 1 + 2, C + i - 1).Value
    Next i
End If

Cells(R + TTR + j, C + TTC + CCount).Value = RiderSum
End If

Next j
End If

If SCConsRider14 > 0 Then
    CCount = CCount + 1
    ExR = ExR + 2
    If SCConsRider58 > 0 Then
        ExR = ExR + 2
    End If
End If

If ((NGConsumptionSeasons = "Yes" And NGWintPeakCons = "No Peak" And NGSumPeakCons = "No Peak") Or SCSznCons > 2 Or NGBlock = "Yes") Then
    UCount = UCount + 1
End If

'DEMAND CALCULATIONS'

NGDemandSeasons = Range("A19").Value

NGRatchMos = Range("A160").Value

Cells(R + TTR - 1, C + CCount).Value = "Demand Cost"

Cells(R + TTR, C + CCount).Value = "$(")

NGMinDem = Cells(R + ExR + 1 + 2, C + 1).Value

If (NGMinDem = "N/A" Or NGMinDem = 0) Then

    Cells(R + ExR + 1 + 2, C + 1).Value = 0

    NGMinDem = 0

End If

If (Cells(R + ExR + 1 + 2, C).Value = "N/A" Or Cells(R + ExR + 1 + 2, C).Value = 0) Then

    Cells(R + ExR + 1 + 2, C).Value = 0

    NGRatchMos = 0

End If

Subcount = 0

If NGDemandSeasons = "No" Then
For j = 1 To 12
    Billed = 0
    DemCost = 0
    Billed = Cells(R + TR + j, C + TC + UCount).Value
    If Billed < NGMinDem Then
        Billed = NGMinDem
    End If
    For i = 1 To NGRatchMos
        RM = i
        If j - RM <= 0 Then
            RM = RM - 12
        End If
        RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value
        If Billed < RatchDem Then
            Billed = RatchDem
        End If
    Next i
    DemCost = Cells(R + ExR + 1, C).Value * Billed
    Cells(R + TTR + j, C + TTC + CCount).Value = DemCost
Next j
UCount = UCount + 1
ElseIf NGDemandSeasons = "Yes" Then
For j = 1 To 12
    Billed = 0
    DemCost = 0

    Billed = Cells(R + TR + j, C + TC + UCount).Value
    If Billed < NGMinDem Then
        Billed = NGMinDem
    End If

    For i = 1 To NGRatchMos
        RM = i
        If j - RM <= 0 Then
            RM = RM - 12
        End If

        RatchDem = Cells(R + TR + j - RM, C + TC + UCount).Value * Cells(R + ExR + 1 + 2, C).Value
        If Billed < RatchDem Then
            Billed = RatchDem
        End If
    Next i

'Summer/Winter Determination'
M = MoNo + j - 1
If M > 12 Then
    M = M - 12

End If
If (M >= SumMo And M < SumMo + NGSummerLength) Then
    DemCharge = Cells(R + ExR + 1, C).Value
Else: DemCharge = Cells(R + ExR + 1, C + 1).Value
End If
DemCost = DemCharge * Billed
Cells(R + TTR + j, C + TTC + CCount).Value = DemCost
Next j
UCount = UCount + 0
End If
CCount = CCount + 1
ExR = ExR + 4

Do While Cells(R + TR, C + TC + SCSznEn + UDC).Value <> Empty
    'UDC = Usage Demand Column Count'
    UDC = UDC + 1
Loop
SCSznDemNG = UDC

If SCDemRider14 > 0 Then
    Cells(R + TTR - 1, C + TTC + CCount).Value = "Demand Riders Cost"
    Cells(R + TTR, C + TTC + CCount).Value = "$(")"
TotalDem = 0

For j = 1 To 12
    TotalDem = 0
    For i = 1 To SCSznDemNG
        TotalDem = TotalDem + Cells(R + TR + j, C + TC + UCount - SCSznDemNG + i).Value
    Next i
    If SCDemRider14 > 0 Then
        RiderSum = 0
        For i = 1 To SCDemRider14
            RiderSum = RiderSum + TotalDem * Cells(R + ExR + 1, C + i - 1).Value
        Next i
        If SCDemRider58 > 0 Then
            For i = 1 To SCDemRider58
                RiderSum = RiderSum + TotalDem * Cells(R + ExR + 1 + 2, C + i - 1).Value
            Next i
            Cells(R + TTR + j, C + TTC + CCount).Value = RiderSum
        End If
    End If
Next j
End If

If SCDemRider14 > 0 Then
CCount = CCount + 1
ExR = ExR + 2
If SCDemRider58 > 0 Then
    ExR = ExR + 2
End If
End If

' NGSubtotal is the sum of everything from the first column (i=0) to the previous column (i = CCount - 1) (CCount is the current column).'
' Each months NGSubtotal (for j = 1 to 12) is entered into the cell in the current column (CCount).'
Cells(R + TTR - 1, C + TTC + CCount).Value = "Subtotal"
Cells(R + TTR, C + TTC + CCount).Value = "$(")"
For j = 1 To 12
    NGSubtotal = 0
    For i = 0 To CCount - 1
        NGSubtotal = NGSubtotal + Cells(R + TTR + j, C + TTC + i).Value
    Next i
    NGCustomerCharge = Cells(R + ExR + 2 + 1, C).Value
    NGSubtotal = NGSubtotal + NGCustomerCharge
    Cells(R + TTR + j, C + TTC + CCount).Value = NGSubtotal

275
Next j
CCount = CCount + 1

' Franchise Fee  = (Municipal Tax Rate) * (Subtotal)'
' NGFranchiseRate = Municipal Tax Rate'
' NGFranchi
ese = Franchise Fee'
' NGSubFranch = NGFranchise + NGSubtotal
' Taxes = (Total Tax Rate) * (Subtotal + Franchise Fee)'
' NGTotalTaxRate = Total Tax Rate'
' NGTaxes = Total Taxes'

' Taxes and Franchise Fee will be combined in one column (CCount) and as one combined value'
' NGTaxesFees = Franchise Fee + Total Taxes'
Cells(R + TTR - 1, C + TTC + CCount).Value = "Taxes & Fees"
Cells(R + TTR, C + TTC + CCount).Value = "($)"
NGFranchiseRate = Cells(R + ExR + 1, C).Value
If NGFranchiseRate = "N/A" Then
    NGFranchiseRate = Empty
End If
NGTotalTaxRate = Cells(R + ExR + 1, C + 1).Value
If NGTotalTaxRate = "N/A" Then
    NGTotalTaxRate = Empty
End If
For j = 1 To 12
NGSubtotal = Cells(R + TTR + j, C + TTC + CCount - 1).Value
NGFranchise = NGFranchiseRate * NGSubtotal
NGSubFranch = NGFranchise + NGSubtotal
NGTaxes = NGSubFranch * NGTotalTaxRate
NGTaxesFees = NGFranchise + NGTaxes
Cells(R + TTR + j, C + TTC + CCount).Value = NGTaxesFees
Next j
CCount = CCount + 1

Cells(R + TTR - 1, C + TTC + CCount).Value = "Total"
Cells(R + TTR, C + TTC + CCount).Value = "($)"
For j = 1 To 12
    NGTotal = Cells(R + TTR + j, C + TTC + CCount - 2) + Cells(R + TTR + j, C + TTC + CCount - 1) + Cells(R + TTR + j, C + TTC + CCount)
    Cells(R + TTR + j, C + TTC + CCount).Value = NGTotal
Next j

'END OF PAGE Formatting (prepAre FOR FUTURE USE)'
CCC = 0
Do While Cells(R + TTR, C + TTC + CCC).Value <> Empty
    CCC = CCC + 1
Loop
UCC = 0
Do While Cells(R + TR, C + TC + UCC).Value <> Empty

    UCC = UCC + 1

Loop

For i = 0 To CCC - 1

    Cells(R + TTR - 1, C + TTC + i).Font.FontStyle = "Bold"
    Cells(R + TTR, C + TTC + i).Font.FontStyle = "Bold"

    For j = 1 To 12
        Cells(R + TTR + j, C + TTC + i).NumberFormat = "$#,##0.00"

        Next j

    Next i

    With Worksheets("DIY NG Rates")
        .Range("B1:Y100").HorizontalAlignment = xlCenter
        .Range("B1:Y100").VerticalAlignment = xlCenter
        For i = CCC - UCC To CCC - 1
            Columns(C + TTC + i).AutoFit

            If .Columns(C + TTC + i).ColumnWidth < 15 Then
                .Columns(C + TTC + i).ColumnWidth = 15
            End If

            Next i

        End With

    End Sub
Calculate CHP Thermal Inputs and Output

Private Sub CHPFillInfo_Click()

    If CHPElEffTB.Value >= 1 Then
        CHPThermInkWTB.Value = CHPElPowerTB.Value / (CHPElEffTB.Value / 100)

        CHPThermInMMTB.Value = CHPElPowerTB.Value / (CHPElEffTB / 100) * 0.003412
        CHPThermOutMMTB.Value = CHPElPowerTB.Value / (CHPElEffTB / 100) * 0.003412 * (CHPThermEffTB.Value / 100)

    End If

End Sub
**Calculate Proposed Utility Usages and Costs**

Private Sub CHPEnterButton_Click()

Dim CurrentPage As Integer
Dim ShiftNum As Single
Dim DailyHours As Single
Dim ShiftDays As Single
Dim Percentage As Single
Dim CHPElPower As Single
Dim CHPEIEff As Single
Dim CHPThermEff As Single

Worksheets("CHP Info").Activate

CurrentPage = 4
ShiftNum = Val(ShiftNumTB)
ShiftLength = Val(ShiftLengthTB)
DailyHours = ShiftNum * ShiftLength
ShiftDays = Val(ShiftDaysTB)
Percentage = Val(PercentageTB)
CHPElPower = Val(CHPElPowerTB)
CHPEIEff = Val(CHPEIEffTB) / 100
CHPThermEff = Val(CHPThermEffTB) / 100
CHPTermInkW = Val(CHPTermInkWTB)
CHPTermInMMBtu = Val(CHPTermInMMTB)

CHPTermOutMMBtu = Val(CHPTermOutMMTB)

MonthlyOH = (365 / 12) * DailyHours * Val(ShiftDaysTB) / 7

ElLF = Val(ElLFTB)

ThLF = Val(ThLFTB)

CHPkWh = CHPElPower * MonthlyOH

MonthlyMMBtuIn = MonthlyOH * CHPTermInMMBtu

MonthlyMMBtuOut = MonthlyOH * CHPTermOutMMBtu

CreditsRate = CreditsRateTB.Value

ShiftStart = Val(ShiftStartTB)

'Transfer Values from Main UserForm to CHP Info Page'

With Worksheets("CHP Info")

.Range("B2") = CHPElPower

.Range("B2").NumberFormat = ",###"

.Range("B3").Value = CHPElEff

.Range("B3").NumberFormat = "0.0%"

.Range("B4").Value = CHPThermEff
.Range("B16").Value = Percentage
.Range("B16").NumberFormat = "0.00"
.Range("B17").Value = CreditsRate
.Range("B17").NumberFormat = "$0.00####"
.Range("B18").Value = ThLF
.Range("B18").NumberFormat = "0.00"

End With

'Create columns (based on Ground Zero tables) for total charged kWh, kW-mo, MMBtu consumption and MMBtu Demand.'

With Worksheets("Ground Zero")

    kWhC = 0

    Do While .Cells(3, 4 + kWhC).Value = "kWh"

        kWhC = kWhC + 1

    Loop

    kWmoC = 0

    Do While .Cells(3, 4 + kWhC + kWmoC).Value = "kW-mo"

        kWmoC = kWmoC + 1

    Loop

    Do While .Cells(3, 4 + kWhC + kWmoC + CCC).Value <> Empty

        CCC = CCC + 1

    Loop
MonthlykWhSum = 0

For j = 0 To 11

' Total Charged kWh'

MonthlykWh = 0

For i = 0 To kWhC - 1

    MonthlykWh = MonthlykWh + .Cells(4 + j, 4 + i).Value

    Next i

    MonthlykWhSum = MonthlykWhSum + MonthlykWh

Worksheets("CHP Info").Cells(4 + j, 6).Value = MonthlykWh

Worksheets("CHP Info").Cells(4 + j, 6).NumberFormat = "#,###"

    Next j

Worksheets("CHP Info").Cells(4 + 12, 6).Value = MonthlykWhSum

Worksheets("CHP Info").Cells(4 + 12, 6).NumberFormat = "#,###"

'Total Charged kW-mo'

kWmoPeakSum = 0

MonthlykWmoSum = 0

For j = 0 To 11

    MonthlykWmo = 0

    CHPkWmo = 0

    kWmoPeak = 0

    For i = kWhC To kWhC + kWmoC - 1

        MonthlykWmo = MonthlykWmo + .Cells(4 + j, 4 + i).Value

        If .Cells(4 + j, 4 + i).Value > kWmoPeak Then
kWmoPeak = .Cells(4 + j, 4 + i).Value
End If
Next i
MonthlykWmoSum = MonthlykWmoSum + MonthlykWmo
kWmoPeakSum = kWmoPeakSum + kWmoPeak
Worksheets("CHP Info").Cells(4 + j, 7).Value = MonthlykWmo
Worksheets("CHP Info").Cells(4 + j, 7).NumberFormat = ",###"
Worksheets("CHP Info").Cells(4 + j, 8).Value = kWmoPeak
Worksheets("CHP Info").Cells(4 + j, 8).NumberFormat = ",###"
Next j
Worksheets("CHP Info").Cells(4 + 12, 7).Value = MonthlykWmoSum
Worksheets("CHP Info").Cells(4 + 12, 7).NumberFormat = ",###"
Worksheets("CHP Info").Cells(4 + 12, 8).Value = kWmoPeakSum
Worksheets("CHP Info").Cells(4 + 12, 8).NumberFormat = ",###"
'Total Charged MMBtu Consumption'
If .Range("B21").Value <> "Customizable Natural Gas Rate Schedule" Then
    MonthlyMMBtu = 0
    MonthlyMMBtuSum = 0
    For j = 0 To 11
        MonthlyMMBtu = .Cells(25 + j, 5).Value
        Worksheets("CHP Info").Cells(4 + j, 9).Value = MonthlyMMBtu
        MonthlyMMBtuSum = MonthlyMMBtuSum + MonthlyMMBtu
    Next j
End If
Next j

Worksheets("CHP Info").Cells(4 + 12, 9).Value = MonthlyMMBtuSum

'Total Charged MMBtu Demand'

'If the Rate Schedule includes Demand then it will transfer the MMBtu
'Demand Values or convert MCF Demand Values to MMBtu Demand Values
' and then transfer it.'

MonthlyDem = 0

MonthlyDemSum = 0

MonthlyPeak = 0

MonthlyPeakSum = 0

For j = 0 To 11

MonthlyMMBtu = Worksheets("CHP Info").Cells(4 + j, 9).Value

If .Range("B21").Value = "Large Business Sales" Then

    MonthlyDem = .Cells(25 + j, 6).Value * 1.023


End If

MonthlyPeak = MonthlyMMBtu / (ThLF * MonthlyOH)

Worksheets("CHP Info").Cells(4 + j, 10).Value = MonthlyDem

If MonthlyDem = "N/A" Then

    MonthlyDem = 0

End If

Worksheets("CHP Info").Cells(4 + j, 11).Value = MonthlyPeak

MonthlyDemSum = MonthlyDemSum + MonthlyDem
MonthlyPeakSum = MonthlyPeakSum + MonthlyPeak

Next j

Worksheets("CHP Info").Cells(4 + 12, 10).Value = MonthlyDemSum
Worksheets("CHP Info").Cells(4 + 12, 10).NumberFormat = ",##0.0"
Worksheets("CHP Info").Cells(4 + 12, 11).Value = MonthlyPeakSum
Worksheets("CHP Info").Cells(4 + 12, 11).NumberFormat = ",##0.0"
If Worksheets("CHP Info").Cells(4 + 11, 10).Value = "N/A" Then
    Worksheets("CHP Info").Cells(4 + 12, 10).Value = "N/A"
End If

Else:
    MMCC = 0
    Do While .Cells(24, 4 + MMCC).Value = "MMBtu"
        MMCC = MMCC + 1
    Loop
    MMDC = 0
    Do While .Cells(24, 4 + MMCC + MMDC).Value = "MMBtu Demand"
        MMDC = MMDC + 1
    Loop
    Sum = 0
    For j = 0 To 11
        MonthlyMMBtu = 0
        For i = 0 To MMCC - 1

287
MonthlyMMBtu = MonthlyMMBtu + .Cells(25 + j, 4 + i).Value

Next i
Worksheets("CHP Info").Cells(4 + j, 9).Value = MonthlyMMBtu
Worksheets("CHP Info").Cells(4 + j, 9).NumberFormat = "#,###"
Sum = Sum + MonthlyMMBtu

Next j
Worksheets("CHP Info").Cells(4 + 12, 9).Value = Sum
Worksheets("CHP Info").Cells(4 + 12, 9).Font.FontStyle = "Bold"
Worksheets("CHP Info").Cells(4 + 12, 9).NumberFormat = "#,###"

' Total MMBtu Charged and keep track of Max Peak Demand'
Sum = 0
MaxPeakSum = 0
For j = 0 To 11
    MaxPeak = 0
    MonthlyMMDem = 0
    MonthlyMMBtu = Worksheets("CHP Info").Cells(4 + j, 9).Value
    For i = MMCC To MMDC + MMCC - 1
        MonthlyMMDem = MonthlyMMDem + .Cells(25 + j, 4 + i).Value
    Next i
    MaxPeak = MonthlyMMBtu / (MonthlyOH * ThLF)
    Worksheets("CHP Info").Cells(4 + j, 10).Value = MonthlyMMDem
    Worksheets("CHP Info").Cells(4 + j, 10).NumberFormat = "#,###"
Worksheets("CHP Info").Cells(4 + j, 11).Value = MaxPeak
Worksheets("CHP Info").Cells(4 + j, 11).NumberFormat = "#,###"
Sum = Sum + MonthlyMMDem
MaxPeakSum = MaxPeakSum + MaxPeak

Next j

Worksheets("CHP Info").Cells(4 + 12, 10).Value = Sum
Worksheets("CHP Info").Cells(4 + 12, 10).Font.FontStyle = "Bold"
Worksheets("CHP Info").Cells(4 + 12, 10).NumberFormat = "#,###"
Worksheets("CHP Info").Cells(4 + 12, 11).Value = MaxPeakSum
Worksheets("CHP Info").Cells(4 + 12, 11).Font.FontStyle = "Bold"
Worksheets("CHP Info").Cells(4 + 12, 11).NumberFormat = "#,###"

End If

End With

'Export Months to Load Profiles page'

With Worksheets("Load Profiles")
For j = 0 To 11
.Cells(2, 4 + j * 2).Value = _
Worksheets("CHP Info").Cells(4 + j, 9).Value
.Cells(3, 4 + j * 2).Value = _
Worksheets("CHP Info").Cells(4 + j, 11).Value
Next j

.Range("A1").Value = ShiftStartTB
n = ShiftNum * ShiftLength * 4
M = n / 2
P = M - 4
'.Range("Q6").Value = n
'.Range("Q7").Value = M
'.Range("Q8").Value = p
StartSegment = Val(ShiftStartTB) * 4

.Range("C6:AA101").ClearContents

For i = 1 To n
    If .Cells(5 + StartSegment + i, 1) = Empty Then
        .Cells(5 + i - Offset, 3).Value = i
    Else:
        .Cells(5 + StartSegment + i, 3).Value = i
        Offset = i
    End If
End For
Next i

DaysPerMonth = ShiftDays / 7 * (365 / 12)

For j = 0 To 11

    MonthlyCons = .Cells(2, 4 + j * 2).Value
    DailyCons = MonthlyCons / DaysPerMonth
    MonthlyPeak = .Cells(3, 4 + j * 2).Value
    NonPeakAve = (DailyCons - MonthlyPeak) / (M + P)

For nn = 1 To 24 * 4

    i = .Cells(5 + nn, 3).Value

    If MonthlyPeak / 4 - NonPeakAve > NonPeakAve Then

        MaxMin = NonPeakAve
    Else: MaxMin = (MonthlyPeak / 4 - NonPeakAve)

    End If

    If (i <> Empty And i <= M) Then

        .Cells(5 + nn, 4 + j * 2).Value = (NonPeakAve - (1 - Percentage) * MaxMin) + _

        ((2 * i - 1) / 2) * ((((1 - Percentage) * MaxMin) * 2) / (M)

    '((DailyCons / N - MonthlyPeak / 4) / (N - 4) * i

    ElseIf (i > M And i <= M + 4) Then
.Cells(5 + nn, 4 + j * 2).Value = MonthlyPeak / 4

ElseIf (i > M + 4 And i <= n) Then

.Cells(5 + nn, 4 + j * 2).Value = (NonPeakAve + (1 - Percentage) * MaxMin) - 

((2 * (i - M - 4) - 1) / 2) * (((1 - Percentage) * MaxMin) * 2) / (P)

End If

Recoverable = 0

CHPTh15Out = CHPThermOutMMBtu / 4

If .Cells(5 + nn, 4 + j * 2).Value > CHPTh15Out Then

Recoverable = CHPTh15Out

Else: Recoverable = .Cells(5 + nn, 4 + j * 2).Value

End If

.Cells(5 + nn, 4 + j * 2 + 1).Value = Recoverable

Next nn

Next j

'Daily Example Profile is all set. Now to Sum up the days into monthly usage

' (just for double checking) and monthly recoverable heat'

MonthlyCons = 0

For j = 0 To 11

MonthlyCons = .Cells(104, 4 + j * 2).Value * DaysPerMonth

.Cells(105, 4 + j * 2).Value = MonthlyCons

MonthlyRec = .Cells(104, 4 + j * 2 + 1).Value * DaysPerMonth

.Cells(105, 4 + j * 2 + 1).Value = MonthlyRec
With Worksheets("CHP Info")

'NEW KWH CALCULATIONS'

NewkWhSum = 0

kWhCreditSum = 0

For j = 0 To 11

NewkWh = 0

kWhCredit = 0

NewkWh = .Cells(4 + j, 6).Value - CHPkWh

If NewkWh <= 0 Then

    kWhCredit = -NewkWh

    NewkWh = 0

End If

.Cells(4 + j, 12).Value = NewkWh

.Cells(4 + j, 12).NumberFormat = ",##0"

.Cells(4 + j, 13).Value = kWhCredit

.Cells(4 + j, 13).NumberFormat = ",##0"

kWhCreditSum = kWhCreditSum + kWhCredit

Next j

End With
NewkWhSum = NewkWhSum + NewkWh

Next j
.Cells(4 + 12, 12).Value = NewkWhSum
.Cells(4 + 12, 12).NumberFormat = "#,##0"
.Cells(4 + 12, 13).Value = kWhCreditSum
.Cells(4 + j, 13).NumberFormat = "#,##0"

'NEW NG CONSUMPTION (MMBtu) CALCULATIONS'

NewMMBtuSum = 0

For j = 0 To 11

    NewMMBtu = 0

    MonthlyRec = Worksheets("Load Profiles").Cells(105, 5 + 2 * j).Value

    'New MMBtu is (Current Consumption) + (NG to run CHP) - (Useful CHP Heat in MMBtu)

    NewMMBtu = .Cells(4 + j, 9).Value + MonthlyMMBtuIn - MonthlyRec
    .Cells(4 + j, 15).Value = NewMMBtu
    .Cells(4 + j, 15).NumberFormat = "#,##0"

    NewMMBtuSum = NewMMBtuSum + NewMMBtu

Next j
.Cells(4 + 12, 15).Value = NewMMBtuSum
.Cells(4 + 12, 15).NumberFormat = "#,##0"

End With
Dim C As Integer
Dim R As Integer
Dim TC As Integer
Dim TR As Integer
Dim TTC As Integer
Dim TTR As Integer

'RECULATION OF COSTS'

'Send New kWh usage from CHP Info worksheet to corresponding rate schedule page'

'ENTERGY'

'Large General Service (LGS)

If Worksheets("Ground Zero").Range("B1").Value = "Large General Service (LGS)" Then

For j = 0 To 11
    Worksheets("Entergy").Cells(114 + j, 4).Value = 
    Worksheets("CHP Info").Cells(4 + j, 12).Value
    Worksheets("Cost Savings").Cells(4 + j, 6).Value = 
    Worksheets("Ground Zero").Cells(4 + j, 10).Value
    kWmo = Worksheets("CHP Info").Cells(4 + j, 7).Value
    NewkWmo = kWmo - CHPElPower
    If NewkWmo < 0 Then
NewkWmo = 0

End If

Worksheets("Entergy").Cells(114 + j, 5).Value = NewkWmo

Worksheets("CHP Info").Cells(4 + j, 14).Value = NewkWmo

CostSum = CostSum + Worksheets("Ground Zero").Cells(4 + j, 10).Value

Next j

Worksheets("CHP Info").Cells(4 + 12, 14).Value = NewkWmoSum

Worksheets("Cost Savings").Cells(4 + 12, 6).Value = CostSum

For j = 0 To 11
    Worksheets("Cost Savings").Cells(4 + j, 9).Value = _
    Worksheets("Entergy").Cells(114 + j, 10).Value - _
    CreditsRate * Worksheets("CHP Info").Cells(4 + j, 13).Value
    NewCostSum = NewCostSum + Worksheets("Cost Savings").Cells(4 + j, 9).Value

Next j

Worksheets("Cost Savings").Cells(4 + 12, 9).Value = NewCostSum

'Large General Service - Time-Of-Use (GST)

ElseIf Worksheets("Ground Zero").Range("B1").Value = "Large General Service - Time-Of-Use (GST)" Then

    NewkWmoSum = 0

    For j = 0 To 11
OnkWh = Worksheets("Ground Zero").Cells(4 + j, 4).Value
OffkWh = Worksheets("Ground Zero").Cells(4 + j, 5).Value
OnkWmo = Worksheets("Ground Zero").Cells(4 + j, 6).Value
ExcesskWmo = Worksheets("Ground Zero").Cells(4 + j, 7).Value
MonthlykWh = OnkWh + OffkWh
OnkWhFract = OnkWh / MonthlykWh
OffkWhFract = OffkWh / MonthlykWh
MonthlykWmo = OnkWmo + ExcesskWmo
NewOnkWh = OnkWhFract * Worksheets("CHP Info").Cells(4 + j, 12).Value
NewOffkWh = OffkWhFract * Worksheets("CHP Info").Cells(4 + j, 12).Value
Worksheets("Entergy").Cells(132 + j, 4).Value = NewOnkWh
Worksheets("Entergy").Cells(132 + j, 5).Value = NewOffkWh
If CHPElPower <= OnkWmo Then
    NewOnkWmo = OnkWmo - CHPElPower
    NewExcesskWmo = ExcesskWmo
ElseIf CHPElPower > OnkWmo Then
    NewOnkWmo = 0
    NewExcesskWmo = OnkWmo + ExcesskWmo - CHPElPower
If NewExcesskWmo < 0 Then
    NewExcesskWmo = 0
End If
End If
NewMonthlykWmo = NewOnkWmo + NewExcesskWmo
NewkWmoSum = NewkWmoSum + NewMonthlykWmo

Worksheets("Entergy").Cells(132 + j, 6).Value = NewOnkWmo

Worksheets("Entergy").Cells(132 + j, 7).Value = NewExcesskWmo

Worksheets("CHP Info").Cells(4 + j, 14).Value = NewMonthlykWmo

'Putting Before/After Costs on Cost Savings worksheet table'

Worksheets("Cost Savings").Cells(4 + j, 6).Value = _

Worksheets("Ground Zero").Cells(4 + j, 12).Value

CostSum = CostSum + Worksheets("Cost Savings").Cells(4 + j, 6).Value

Next j

Worksheets("CHP Info").Cells(4 + 12, 14).Value = NewkWmoSum

Worksheets("Cost Savings").Cells(4 + j, 6).Value = CostSum

For j = 0 To 11

     Worksheets("Cost Savings").Cells(4 + j, 9).Value = _

     Worksheets("Entergy").Cells(132 + j, 12).Value = _

     CreditsRate * Worksheets("CHP Info").Cells(4 + j, 13).Value

     NewCostSum = NewCostSum + Worksheets("Cost Savings").Cells(4 + j, 9).Value

Next j

Worksheets("Cost Savings").Cells(4 + j, 9).Value = NewCostSum

'Large Power Service (LPS)

ElseIf Worksheets("Ground Zero").Range("B1").Value = "Large Power Service (LPS)" Then
For \( j = 0 \) To 11

\[
\begin{align*}
\text{Worksheets("Entergy").Cells(150 + j, 4).Value} &= \_ \\
\text{Worksheets("CHP Info").Cells(4 + j, 12).Value} \\
\text{Worksheets("Cost Savings").Cells(4 + j, 6).Value} &= \_ \\
\text{Worksheets("Ground Zero").Cells(4 + j, 10).Value} \\
\text{CostSum} &= \text{CostSum} + \text{Worksheets("Cost Savings").Cells(4 + j, 6).Value} \\
kWmo &= \text{Worksheets("CHP Info").Cells(4 + j, 7).Value} \\
n< newKwmo >= \text{Kwmo} - \text{CHPElPower} \\
\text{If} \ newKwmo < 0 \text{ Then} \\
\quad newKwmo &= 0 \\
\text{End If} \\
\text{NewKwmoSum} &= \text{NewKwmoSum} + newKwmo \\
\text{Worksheets("Entergy").Cells(150 + j, 5).Value} &= newKwmo \\
\text{Worksheets("CHP Info").Cells(4 + j, 14).Value} &= newKwmo \\
\end{align*}
\]

Next \( j \)

\[
\begin{align*}
\text{Worksheets("CHP Info").Cells(4 + 12, 14).Value} &= \text{NewKwmoSum} \\
\text{Worksheets("Cost Savings").Cells(4 + 12, 6).Value} &= \text{CostSum} \\
\end{align*}
\]

For \( j = 0 \) To 11

\[
\begin{align*}
\text{Worksheets("Cost Savings").Cells(4 + j, 9).Value} &= \_ \\
\text{Worksheets("Entergy").Cells(150 + j, 10).Value} &= \_ \\
\text{CreditsRate} \times \text{Worksheets("CHP Info").Cells(4 + j, 13).Value} \\
\end{align*}
\]
NewCostSum = NewCostSum + Worksheets("Cost Savings").Cells(4 + j, 9).Value
Next j
Worksheets("Cost Savings").Cells(4 + 12, 9).Value = NewCostSum

'Large Power Service - Time-Of-Use (PST)
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Large Power Service - Time-Of-Use (PST)" Then

NewkWmoSum = 0
For j = 0 To 11
OnkWh = Worksheets("Ground Zero").Cells(4 + j, 4).Value
OffkWh = Worksheets("Ground Zero").Cells(4 + j, 5).Value
OnkWmo = Worksheets("Ground Zero").Cells(4 + j, 6).Value
ExcesskWmo = Worksheets("Ground Zero").Cells(4 + j, 7).Value
MonthlykWh = OnkWh + OffkWh
OnkWhFract = OnkWh / MonthlykWh
OffkWhFract = OffkWh / MonthlykWh
MonthlykWmo = OnkWmo + ExcesskWmo
NewOnkWh = OnkWhFract * Worksheets("CHP Info").Cells(4 + j, 12).Value
NewOffkWh = OffkWhFract * Worksheets("CHP Info").Cells(4 + j, 12).Value
Worksheets("Entergy").Cells(168 + j, 4).Value = NewOnkWh
Worksheets("Entergy").Cells(168 + j, 5).Value = NewOffkWh
If CHPElPower <= OnkWmo Then

    NewOnkWmo = OnkWmo - CHPElPower
    NewExcesskWmo = ExcesskWmo

ElseIf CHPElPower > OnkWmo Then

    NewOnkWmo = 0
    NewExcesskWmo = OnkWmo + ExcesskWmo - CHPElPower

    If NewExcesskWmo < 0 Then
        NewExcesskWmo = 0
    End If

End If

NewMonthlykWmo = NewOnkWmo + NewExcesskWmo
NewkWmoSum = NewkWmoSum + NewMonthlykWmo
Worksheets("Entergy").Cells(168 + j, 6).Value = NewOnkWmo
Worksheets("Entergy").Cells(168 + j, 7).Value = NewExcesskWmo
Worksheets("CHP Info").Cells(4 + j, 14).Value = NewMonthlykWmo

Next j

Worksheets("CHP Info").Cells(4 + 12, 14).Value = NewkWmoSum

'Putting Before/After Costs on Cost Savings worksheet table'

For j = 0 To 11

    Worksheets("Cost Savings").Cells(4 + j, 6).Value =

    Worksheets("Ground Zero").Cells(4 + j, 12).Value
CostSum = CostSum + Worksheets("Cost Savings").Cells(4 + j, 6).Value
Worksheets("Cost Savings").Cells(4 + j, 9).Value = _
Worksheets("Entergy").Cells(168 + j, 12).Value - _
CreditsRate * Worksheets("CHP Info").Cells(4 + j, 13).Value
NewCostSum = NewCostSum + Worksheets("Cost Savings").Cells(4 + j, 9).Value
Next j
Worksheets("Cost Savings").Cells(4 + 12, 6).Value = CostSum
Worksheets("Cost Savings").Cells(4 + 12, 9).Value = NewCostSum

'OG&E'

'Lighting & Power (PL-1)

ElseIf Worksheets("Ground Zero").Range("B1").Value = "Lighting & Power (PL-1)" Then

For j = 0 To 11
    Worksheets("OG&E").Cells(94 + j, 4).Value = _
    Worksheets("CHP Info").Cells(4 + j, 12).Value
    Worksheets("Cost Savings").Cells(4 + j, 6).Value = _
    Worksheets("Ground Zero").Cells(4 + j, 10).Value
    CostSum = CostSum + Worksheets("Cost Savings").Cells(4 + j, 6).Value
    kWmo = Worksheets("CHP Info").Cells(4 + j, 7).Value
    NewkWmo = kWmo - CHPElPower
    If NewkWmo < 0 Then
        NewkWmo = 0

302
End If

NewkWmoSum = NewkWmoSum + NewkWmo

Worksheets("OG&E").Cells(94 + j, 5).Value = NewkWmo

Worksheets("CHP Info").Cells(4 + j, 14).Value = NewkWmo

Next j

Worksheets("CHP Info").Cells(4 + 12, 14).Value = NewkWmoSum

Worksheets("Cost Savings").Cells(4 + 12, 6).Value = CostSum

For j = 0 To 11

Worksheets("Cost Savings").Cells(4 + j, 9).Value = _

Worksheets("OG&E").Cells(94 + j, 10).Value - _

CreditsRate * Worksheets("CHP Info").Cells(4 + j, 13).Value

NewCostSum = NewCostSum + Worksheets("Cost Savings").Cells(4 + j, 9).Value

Next j

Worksheets("Cost Savings").Cells(4 + 12, 9).Value = NewCostSum

'Lighting & Power Time-Of-Use Demand (PL-TOU-D)

ElseIf Worksheets("Ground Zero").Range("B1").Value = "Lighting & Power Time-of-Use Demand (PL-TOU-D)" Then

NewkWmoSum = 0

For j = 0 To 11

MonthlykWh = Worksheets("Ground Zero").Cells(4 + j, 4).Value
OnkWh = Worksheets("Ground Zero").Cells(4 + j, 5).Value
MaxkWmo = Worksheets("Ground Zero").Cells(4 + j, 6).Value
OnkWmo = Worksheets("Ground Zero").Cells(4 + j, 7).Value
OnkWhFract = OnkWh / MonthlykWh
NewMonthlykWh = 1 * Worksheets("CHP Info").Cells(4 + j, 12).Value
NewOnkWh = OnkWhFract * Worksheets("CHP Info").Cells(4 + j, 12).Value
Worksheets("OG&E").Cells(114 + j, 4).Value = NewMonthlykWh
Worksheets("OG&E").Cells(114 + j, 5).Value = NewOnkWh
If CHPElPower <= OnkWmo Then
    NewOnkWmo = OnkWmo - CHPElPower
    NewMaxkWmo = MaxkWmo - CHPElPower
ElseIf CHPElPower > OnkWmo Then
    NewOnkWmo = 0
    NewMaxkWmo = MaxkWmo - CHPElPower
    If NewMaxkWmo < 0 Then
        NewMaxkWmo = 0
    End If
End If
NewMonthlykWmo = NewOnkWmo + NewMaxkWmo
NewkWmoSum = NewkWmoSum + NewMonthlykWmo
Worksheets("OG&E").Cells(114 + j, 6).Value = NewOnkWmo
Worksheets("OG&E").Cells(114 + j, 7).Value = NewMaxkWmo
Worksheets("CHP Info").Cells(4 + j, 14).Value = NewMonthlykWmo
Next j

Worksheets("CHP Info").Cells(4 + 12, 14).Value = NewkWmoSum

'Putting Before/After Costs on Cost Savings worksheet table'

For j = 0 To 11

    Worksheets("Cost Savings").Cells(4 + j, 6).Value = _

    Worksheets("Ground Zero").Cells(4 + j, 12).Value

    CostSum = CostSum + Worksheets("Cost Savings").Cells(4 + j, 6).Value

    Worksheets("Cost Savings").Cells(4 + j, 9).Value = _

    Worksheets("OG&E").Cells(114 + j, 12).Value - _

    CreditsRate * Worksheets("CHP Info").Cells(4 + j, 13).Value

    NewCostSum = NewCostSum + Worksheets("Cost Savings").Cells(4 + j, 9).Value

Next j

Worksheets("Cost Savings").Cells(4 + 12, 6).Value = CostSum

Worksheets("Cost Savings").Cells(4 + 12, 9).Value = NewCostSum

'Lighting & Power Time-Of-Use Energy (PL-TOU-E)

ElseIf Worksheets("Ground Zero").Range("B1").Value = "Lighting & Power Time-of-Use Energy (PL-TOU-E)" Then
NewkWmoSum = 0

For j = 0 To 11

    MonthlykWh = Worksheets("Ground Zero").Cells(4 + j, 4).Value
    OnkWh = Worksheets("Ground Zero").Cells(4 + j, 5).Value
    SuperkWh = Worksheets("Ground Zero").Cells(4 + j, 6).Value
    MaxkWmo = Worksheets("Ground Zero").Cells(4 + j, 7).Value

    OnkWhFract = OnkWh / MonthlykWh
    SuperkWhFract = SuperkWh / MonthlykWh

    NewMonthlykWh = 1 * Worksheets("CHP Info").Cells(4 + j, 12).Value
    NewOnkWh = OnkWhFract * Worksheets("CHP Info").Cells(4 + j, 12).Value
    NewSuperkWh = SuperkWhFract * Worksheets("CHP Info").Cells(4 + j, 12).Value

    Worksheets("OG&E").Cells(134 + j, 4).Value = NewMonthlykWh
    Worksheets("OG&E").Cells(134 + j, 5).Value = NewOnkWh
    Worksheets("OG&E").Cells(134 + j, 6).Value = NewSuperkWh

    If CHPElPower <= MaxkWmo Then
        NewMaxkWmo = MaxkWmo - CHPElPower
    ElseIf CHPElPower > OnkWmo Then
        NewMaxkWmo = 0
    End If

    NewkWmoSum = NewkWmoSum + NewMaxkWmo

    Worksheets("OG&E").Cells(134 + j, 7).Value = NewMaxkWmo
    Worksheets("CHP Info").Cells(4 + j, 14).Value = NewMaxkWmo
Worksheets("CHP Info").Cells(4 + 12, 14).Value = NewkWmoSum

'Putting Before/After Costs on Cost Savings worksheet table'

For j = 0 To 11
    Worksheets("Cost Savings").Cells(4 + j, 6).Value = _
    Worksheets("Ground Zero").Cells(4 + j, 12).Value
    CostSum = CostSum + Worksheets("Cost Savings").Cells(4 + j, 6).Value
    Worksheets("Cost Savings").Cells(4 + j, 9).Value = _
    Worksheets("OG&E").Cells(134 + j, 12).Value - _
    CreditsRate * Worksheets("CHP Info").Cells(4 + j, 13).Value
    NewCostSum = NewCostSum + Worksheets("Cost Savings").Cells(4 + j, 9).Value
Next j

Worksheets("Cost Savings").Cells(4 + 12, 6).Value = CostSum
Worksheets("Cost Savings").Cells(4 + 12, 9).Value = NewCostSum

'SWEPCO'

'Lighting & Power

ElseIf Worksheets("Ground Zero").Range("B1").Value = "Lighting & Power" Then

For j = 0 To 11
    Worksheets("SWEPCO").Cells(93 + j, 4).Value = _
    Worksheets("CHP Info").Cells(4 + j, 12).Value
    Worksheets("Cost Savings").Cells(4 + j, 6).Value = _
Worksheets("Ground Zero").Cells(4 + j, 10).Value

CostSum = CostSum + Worksheets("Cost Savings").Cells(4 + j, 6).Value

kWmo = Worksheets("CHP Info").Cells(4 + j, 7).Value

NewkWmo = kWmo - CHPElPower

If NewkWmo < 0 Then
    NewkWmo = 0
End If

NewkWmoSum = NewkWmoSum + NewkWmo

Worksheets("SWEPCO").Cells(93 + j, 5).Value = NewkWmo

Worksheets("CHP Info").Cells(4 + j, 14).Value = NewkWmo

Next j

Worksheets("CHP Info").Cells(4 + 12, 14).Value = NewkWmoSum

Worksheets("Cost Savings").Cells(4 + 12, 6).Value = CostSum

For j = 0 To 11
    Worksheets("Cost Savings").Cells(4 + j, 9).Value = _
    Worksheets("SWEPCO").Cells(93 + j, 10).Value = _
    CreditsRate * Worksheets("CHP Info").Cells(4 + j, 13).Value
    NewCostSum = NewCostSum + Worksheets("Cost Savings").Cells(4 + j, 9).Value
    Next j

Worksheets("Cost Savings").Cells(4 + 12, 9).Value = NewCostSum
'Large Lighting & Power

ElseIf Worksheets("Ground Zero").Range("B1").Value = "Large Lighting & Power" Then

    For j = 0 To 11
        Worksheets("SWEPCO").Cells(112 + j, 4).Value = _
        Worksheets("CHP Info").Cells(4 + j, 12).Value
        Worksheets("Cost Savings").Cells(4 + j, 6).Value = _
        Worksheets("Ground Zero").Cells(4 + j, 10).Value
        CostSum = CostSum + Worksheets("Cost Savings").Cells(4 + j, 6).Value
        kWmo = Worksheets("CHP Info").Cells(4 + j, 7).Value
        NewkWmo = kWmo - CHPElPower
        If NewkWmo < 0 Then
            NewkWmo = 0
        End If
        NewkWmoSum = NewkWmoSum + NewkWmo
        Worksheets("SWEPCO").Cells(112 + j, 5).Value = NewkWmo
        Worksheets("CHP Info").Cells(4 + j, 14).Value = NewkWmo
    Next j

    Worksheets("CHP Info").Cells(4 + 12, 14).Value = NewkWmoSum
    Worksheets("Cost Savings").Cells(4 + 12, 6).Value = CostSum

    For j = 0 To 11
Worksheets("Cost Savings").Cells(4 + j, 9).Value = _
Worksheets("SWEPCO").Cells(112 + j, 10).Value = _
CreditsRate * Worksheets("CHP Info").Cells(4 + j, 13).Value

NewCostSum = NewCostSum + Worksheets("Cost Savings").Cells(4 + j, 9).Value
Next j

Worksheets("Cost Savings").Cells(4 + 12, 9).Value = NewCostSum

'Lighting & Power Time Of Use
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Lighting & Power - Time-of-Use"
Then

NewkWmoSum = 0
For j = 0 To 11
    OnkWh = Worksheets("Ground Zero").Cells(4 + j, 4).Value
    OffkWh = Worksheets("Ground Zero").Cells(4 + j, 5).Value
    OnkWmo = Worksheets("Ground Zero").Cells(4 + j, 6).Value
    OffkWmo = Worksheets("Ground Zero").Cells(4 + j, 7).Value
    MonthlykWh = OnkWh + OffkWh
    OnkWhFract = OnkWh / MonthlykWh
    OffkWhFract = OffkWh / MonthlykWh
    NewOnkWh = OnkWhFract * Worksheets("CHP Info").Cells(4 + j, 12).Value
    NewOffkWh = OffkWhFract * Worksheets("CHP Info").Cells(4 + j, 12).Value
    Worksheets("SWEPCO").Cells(131 + j, 4).Value = NewOnkWh

310
Worksheets("SWEPCO").Cells(131 + j, 5).Value = NewOffkWh

NewOnkWmo = OnkWmo - CHPElPower

NewOffkWmo = OffkWmo - CHPElPower

If OnkWmo < 0 Then
    NewOnkWmo = 0
End If

If NewOffkWmo < 0 Then
    NewOffkWmo = 0
End If

NewMonthlykWmo = NewOnkWmo + NewOffkWmo

NewkWmoSum = NewkWmoSum + NewMonthlykWmo

Worksheets("SWEPCO").Cells(131 + j, 6).Value = NewOnkWmo

Worksheets("SWEPCO").Cells(131 + j, 7).Value = NewOffkWmo

Worksheets("CHP Info").Cells(4 + j, 14).Value = NewMonthlykWmo

Next j

Worksheets("CHP Info").Cells(4 + 12, 14).Value = NewkWmoSum

'Putting Before/After Costs on Cost Savings worksheet table'

For j = 0 To 11
    Worksheets("Cost Savings").Cells(4 + j, 6).Value = _
    Worksheets("Ground Zero").Cells(4 + j, 12).Value
    CostSum = CostSum + Worksheets("Cost Savings").Cells(4 + j, 6).Value
Worksheets("Cost Savings").Cells(4 + j, 9).Value = _
Worksheets("SWEPCO").Cells(131 + j, 12).Value - _
CreditsRate * Worksheets("CHP Info").Cells(4 + j, 13).Value
NewCostSum = NewCostSum + Worksheets("Cost Savings").Cells(4 + j, 9).Value
Next j
Worksheets("Cost Savings").Cells(4 + 12, 6).Value = CostSum
Worksheets("Cost Savings").Cells(4 + 12, 9).Value = NewCostSum

'CUSTOM'
ElseIf Worksheets("Ground Zero").Range("B1").Value = "Customizable Electric Rate Schedule" Then

With Worksheets("DIY El. Rates")
    C = .Cells(116, 1).Value
    R = .Cells(118, 1).Value
    TC = .Cells(120, 1).Value
    TR = .Cells(122, 1).Value
    TTC = .Cells(124, 1).Value
    TTR = .Cells(126, 1).Value

'New CCC Calculated For the Costs Table on the DIY El. Rates sheet instead of counting the Ground Zero Costs columns'
CCC = 0

Do While .Cells(R + TTR, C + TTC + CCC).Value <> Empty

    CCC = CCC + 1

Loop

End With

'Count Total Usage Columns (UCC), Then kWh Columns (kWhC), Then kW-mo Columns (kWC)

UCC = kWhC + kWmoC

With Worksheets("Ground Zero")

'kWh column fraction calculations and New kWh after CHP values entered into original
' usage table.'

For j = 0 To 11

    MonthlykWh = 0

    For i = 0 To kWhC - 1

        MonthlykWh = MonthlykWh + .Cells(4 + j, 4 + i).Value

        If i = 1 - 1 Then

            kWh1 = .Cells(4 + j, 4 + i).Value

        ElseIf i = 2 - 1 Then

            kWh2 = .Cells(4 + j, 4 + i).Value

        ElseIf i = 3 - 1 Then

            kWh3 = .Cells(4 + j, 4 + i).Value

    End If

Next i

Next j
ElseIf i = 4 - 1 Then
  kWh4 = .Cells(4 + j, 4 + i).Value
End If
Next i

kWhFract1 = kWh1 / MonthlykWh
kWhFract2 = kWh2 / MonthlykWh
kWhFract3 = kWh3 / MonthlykWh
kWhFract4 = kWh4 / MonthlykWh

NewkWh1 = kWhFract1 * Worksheets("CHP Info").Cells(4 + j, 12).Value
NewkWh2 = kWhFract2 * Worksheets("CHP Info").Cells(4 + j, 12).Value
NewkWh3 = kWhFract3 * Worksheets("CHP Info").Cells(4 + j, 12).Value
NewkWh4 = kWhFract4 * Worksheets("CHP Info").Cells(4 + j, 12).Value
For i = 0 To kWhC - 1
  If i = 1 - 1 Then
    If Worksheets("DIY El. Rates").Cells(R + TR + j + 1, C + i).Value <> Empty Then
      Worksheets("DIY El. Rates").Cells(R + TR + j + 1, C + i).Value = NewkWh1
    End If
  End If
ElseIf i = 2 - 1 Then
  If Worksheets("DIY El. Rates").Cells(R + TR + j + 1, C + i).Value <> Empty Then
    Worksheets("DIY El. Rates").Cells(R + TR + j + 1, C + i).Value = NewkWh2
  End If
ElseIf i = 3 - 1 Then
  If Worksheets("DIY El. Rates").Cells(R + TR + j + 1, C + i).Value <> Empty Then
Worksheets("DIY El. Rates").Cells(R + TR + j + 1, C + i).Value = NewkWh3

End If

ElseIf i = 4 - 1 Then

If Worksheets("DIY El. Rates").Cells(R + TR + j + 1, C + i).Value <> Empty Then

Worksheets("DIY El. Rates").Cells(R + TR + j + 1, C + i).Value = NewkWh4

End If

End If

Next i

Next j

End With

'kW-mo column calculations and New kW-mo after-CHP values entered into
' original usage table.'

With Worksheets("Ground Zero")

For j = 0 To 11

NewMonthlykWmo = 0

For i = kWhC To kWhC + kWmoC - 1

If .Cells(4 + j, 4 + i).Value <> Empty Then

NewSpkWmo = 0

NewSpkWmo = .Cells(4 + j, 4 + i).Value - CHPElPower

If NewSpkWmo < 0 Then

NewSpkWmo = 0

End If

ElseIf .Cells(4 + j, 4 + i).Value = Empty Then
NewSpkWmo = Empty

End If

Worksheets("DIY El. Rates")
.Cells(R + TR + j + 1, C + TC + i).Value = NewSpkWmo

NewMonthlykWmo = NewMonthlykWmo + NewSpkWmo

Next i

Worksheets("CHP Info").Cells(4 + j, 14).Value = NewMonthlykWmo

NewMonthlykWmoSum = NewMonthlykWmoSum + NewMonthlykWmo

Next j

Worksheets("CHP Info").Cells(4 + 12, 14).Value = NewMonthlykWmoSum

End With

'Calculate Costs based on new kWh and kW-mo information, which was re-entered into the
' DIY El. Rates worksheet'

Worksheets("DIY El. Rates").Calculate_Costs_Click

'Transfer Original Costs

MonthlyCost = 0

CostSum = 0

For j = 0 To 11

    MonthlyCost = Worksheets("Ground Zero").Cells(4 + j, 4 + UCC + 5 - 1).Value

    Worksheets("Cost Savings").Cells(4 + j, 6).Value = MonthlyCost

    CostSum = CostSum + MonthlyCost

Next j
Worksheets("Cost Savings").Cells(4 + 12, 6).Value = CostSum

'Transfer New Costs'

NewMonthlyCost = 0

NewCostSum = 0

For j = 0 To 11

    NewMonthlyCost = Worksheets("DIY El. Rates").Cells(R + TTR + j + 1, C + TTC + CCC - 1).Value


    NewCostSum = NewCostSum + NewMonthlyCost

Next j

Worksheets("Cost Savings").Cells(4 + 12, 9).Value = NewCostSum

End If

'AOGC-Ark'

If Worksheets("Ground Zero").Range("B21").Value = "Medium Business Sales" Then

For j = 0 To 11

    Worksheets("AOGC-Ark").Cells(36 + j, 3).Value = _

    Worksheets("CHP Info").Cells(4 + j, 15).Value * 1.023

    Worksheets("AOGC-Ark").Cells(36 + j, 4).Value = _

317
Worksheets("AOGC-Ark").Cells(36 + j, 3).Value / 1.023
Worksheets("AOGC-Ark").Cells(36 + j, 5).Value = "N/A"
Next j

For j = 0 To 11
    Worksheets("Cost Savings").Cells(4 + j, 7).Value = _
    Worksheets("AOGC-Ark").Cells(17 + j, 13).Value
    Worksheets("Cost Savings").Cells(4 + j, 10).Value = _
    Worksheets("AOGC-Ark").Cells(36 + j, 13).Value
Next j

ElseIf Worksheets("Ground Zero").Range("B21").Value = "Large Business Sales" Then

    For j = 0 To 11
        Worksheets("AOGC-Ark").Cells(36 + j, 3).Value = _
        Worksheets("CHP Info").Cells(4 + j, 15).Value * 1.023
        Worksheets("AOGC-Ark").Cells(36 + j, 4).Value = _
        Worksheets("AOGC-Ark").Cells(36 + j, 3).Value / 1.023
        Worksheets("AOGC-Ark").Cells(36 + j, 5).Value = _
        DailyHours * (CHPThermInMMBtu - CHPThermOutMMBtu) * 1.023 + _
    Worksheets("AOGC-Ark").Cells(17 + j, 5).Value
Next j

For j = 0 To 11
    Worksheets("Cost Savings").Cells(4 + j, 7).Value = _
    Worksheets("AOGC-Ark").Cells(17 + j, 13).Value
    Worksheets("Cost Savings").Cells(4 + j, 10).Value = _
    Worksheets("AOGC-Ark").Cells(36 + j, 13).Value
Next j

'Black Hills'
ElseIf Worksheets("Ground Zero").Range("B21").Value = "Business 3 Sales" Then

For j = 0 To 11
    'New Monthly MMBtu Consumption converted to CCF and entered in Black Hills table'
    Worksheets("Black Hills").Cells(44 + j, 3).Value = _
    Worksheets("CHP Info").Cells(4 + j, 15).Value * 10.23

    'CCF in Black Hills table converted to MMBtu'
    Worksheets("Black Hills").Cells(44 + j, 4).Value = _
    Worksheets("Black Hills").Cells(44 + j, 3).Value / 10.23

    'No Peak-Day Consumption (Demand Charge) in this rate schedule'
    Worksheets("Black Hills").Cells(44 + j, 5).Value = "N/A"

319
Next j

For j = 0 To 11

'Original Costs entered on Cost Savings Page'
Worksheets("Cost Savings").Cells(4 + j, 7).Value = _
Worksheets("Black Hills").Cells(25 + j, 13).Value

'New Costs entered on Cost Savings Page'
Worksheets("Cost Savings").Cells(4 + j, 10).Value = _
Worksheets("Black Hills").Cells(44 + j, 13).Value

Next j

ElseIf Worksheets("Ground Zero").Range("B21").Value = "Business 4 Sales" Then

For j = 0 To 11

'New Monthly MMBtu Consumption converted to CCF and entered in Black Hills table'
Worksheets("Black Hills").Cells(44 + j, 3).Value = _
Worksheets("CHP Info").Cells(4 + j, 15).Value * 10.23

'CCF in Black Hills table converted to MMBtu'
Worksheets("Black Hills").Cells(44 + j, 4).Value = _
Worksheets("Black Hills").Cells(44 + j, 3).Value / 10.23

'No Peak-Day Consumption (Demand Charge) in this rate schedule'
Worksheets("Black Hills").Cells(44 + j, 5).Value = "N/A"

320
Next j

For j = 0 To 11

'Original Costs entered on Cost Savings Page'
Worksheets("Cost Savings").Cells(4 + j, 7).Value = _
Worksheets("Black Hills").Cells(25 + j, 13).Value

'New Costs entered on Cost Savings Page'
Worksheets("Cost Savings").Cells(4 + j, 10).Value = _
Worksheets("Black Hills").Cells(44 + j, 13).Value

Next j

ElseIf Worksheets("Ground Zero").Range("B21").Value = "Business 5 Sales" Then

For j = 0 To 11

'New Monthly MMBtu Consumption converted to CCF and entered in Black Hills table'
Worksheets("Black Hills").Cells(44 + j, 3).Value = _
Worksheets("CHP Info").Cells(4 + j, 15).Value * 10.23

'CCF in Black Hills table converted to MMBtu'
Worksheets("Black Hills").Cells(44 + j, 4).Value = _
Worksheets("Black Hills").Cells(44 + j, 3).Value / 10.23

'New Peak Day Consumption entered in Black Hills Table'
Worksheets("Black Hills").Cells(44 + j, 5).Value = _
DailyHours * (CHPTermInMMBtu - CHPTermOutMMBtu) + _
Worksheets("Black Hills").Cells(25 + j, 5).Value

Next j

For j = 0 To 11
    'Original Costs entered on Cost Savings Page'
    Worksheets("Cost Savings").Cells(4 + j, 7).Value = _
    Worksheets("Black Hills").Cells(25 + j, 13).Value
    'New Costs entered on Cost Savings Page'
    Worksheets("Cost Savings").Cells(4 + j, 10).Value = _
    Worksheets("Black Hills").Cells(44 + j, 13).Value
    Next j

'CenterPoint'

ElseIf Worksheets("Ground Zero").Range("B21").Value = "Small Commercial Firm Sales Service (SCS-1)" Then

For j = 0 To 11
    'New Monthly MMBtu Consumption converted to CCF and entered in Black Hills table'
    Worksheets("CenterPoint").Cells(55 + j, 3).Value = _
    Worksheets("CHP Info").Cells(4 + j, 15).Value * 10.23
    'CCF in Black Hills table converted to MMBtu'

322
Worksheets("CenterPoint").Cells(55 + j, 4).Value = _
Worksheets("CenterPoint").Cells(55 + j, 3).Value / 10.23
'New Peak Day Consumption entered in Black Hills Table
Worksheets("CenterPoint").Cells(55 + j, 5).Value = "N/A"

Next j

For j = 0 To 11
'Origingal Costs entered on Cost Savings Page'
Worksheets("Cost Savings").Cells(4 + j, 7).Value = _
Worksheets("CenterPoint").Cells(35 + j, 12).Value
'New Costs entered on Cost Savings Page'
Worksheets("Cost Savings").Cells(4 + j, 10).Value = _
Worksheets("CenterPoint").Cells(55 + j, 12).Value
Next j

ElseIf Worksheets("Ground Zero").Range("B21").Value = "Large Commercial Firm Service (LCS-1)" Then

For j = 0 To 11
'New Monthly MMBtu Consumption converted to CCF and entered in CenterPoint table'
Worksheets("CenterPoint").Cells(55 + j, 3).Value = _
Worksheets("CHP Info").Cells(4 + j, 15).Value * 10.23

'CCF in CenterPoint table converted to MMBtu'

Worksheets("CenterPoint").Cells(55 + j, 4).Value = _

Worksheets("CenterPoint").Cells(55 + j, 3).Value / 10.23

'New Peak Day Consumption entered in CenterPoint Table'

Worksheets("CenterPoint").Cells(55 + j, 5).Value = _

DailyHours * (CHPThermInMMBtu - CHPThermOutMMBtu) + _

Worksheets("CenterPoint").Cells(35 + j, 5).Value

Next j

For j = 0 To 11

'Original Costs entered on Cost Savings Page'

Worksheets("Cost Savings").Cells(4 + j, 7).Value = _

Worksheets("CenterPoint").Cells(35 + j, 12).Value

'New Costs entered on Cost Savings Page'

Worksheets("Cost Savings").Cells(4 + j, 10).Value = _

Worksheets("CenterPoint").Cells(55 + j, 12).Value

Next j

ElseIf Worksheets("Ground Zero").Range("B21").Value = "Small Commercial Firm Sales Service - Off-Peak (SCS-2)" Then
For j = 0 To 11

'New Monthly MMBtu Consumption converted to CCF and entered in Black Hills table'

    Worksheets("CenterPoint").Cells(55 + j, 3).Value = _

    Worksheets("CHP Info").Cells(4 + j, 15).Value * 10.23

'CCF in Black Hills table converted to MMBtu'

    Worksheets("CenterPoint").Cells(55 + j, 4).Value = _

    Worksheets("CenterPoint") . Cells(55 + j, 3).Value / 10.23

'New Peak Day Consumption entered in Black Hills Table

    Worksheets("CenterPoint") . Cells(55 + j, 5).Value = "N/A"

Next j

For j = 0 To 11

'Original Costs entered on Cost Savings Page'

    Worksheets("Cost Savings").Cells(4 + j, 7).Value = _

    Worksheets("CenterPoint") . Cells(35 + j, 12).Value

'New Costs entered on Cost Savings Page'

    Worksheets("Cost Savings") . Cells(4 + j, 10).Value = _

    Worksheets("CenterPoint") . Cells(55 + j, 12).Value

Next j

'CUSTOM'
ElseIf Worksheets("Ground Zero").Range("B21").Value = "Customizable Natural Gas Rate Schedule" Then

    With Worksheets("DIY NG Rates")
    C = .Cells(116, 1).Value
    R = .Cells(118, 1).Value
    TC = .Cells(120, 1).Value
    TR = .Cells(122, 1).Value
    TTC = .Cells(124, 1).Value
    TTR = .Cells(126, 1).Value
    'New CCC Calculated For the Costs Table on the DIY El. Rates sheet instead of counting the Ground Zero Costs columns'
    CCC = 0
    Do While .Cells(R + TTR, C + TTC + CCC).Value <> Empty
        CCC = CCC + 1
    Loop
    End With
    'Count Total Usage Columns (UCC), Then kWh Columns (kWhC), Then kW-mo Columns (kWC)

    UCC = MMCC + MMDC
With Worksheets("Ground Zero")

'kWh column fraction calculations and New kWh after CHP values entered into original
' usage table.'

For j = 0 To 11

MonthlyMMBtu = 0

For i = 0 To MMCC - 1

    MonthlyMMBtu = MonthlyMMBtu + .Cells(25 + j, 4 + i).Value

    If i = 1 - 1 Then
        MMBtu1 = .Cells(25 + j, 4 + i).Value
    ElseIf i = 2 - 1 Then
        MMBtu2 = .Cells(25 + j, 4 + i).Value
    ElseIf i = 3 - 1 Then
        MMBtu3 = .Cells(25 + j, 4 + i).Value
    ElseIf i = 4 - 1 Then
        MMBtu4 = .Cells(25 + j, 4 + i).Value
    End If

Next i

MMBtuFract1 = MMBtu1 / MonthlyMMBtu
MMBtuFract2 = MMBtu2 / MonthlyMMBtu
MMBtuFract3 = MMBtu3 / MonthlyMMBtu
MMBtuFract4 = MMBtu4 / MonthlyMMBtu

NewMMBtu1 = MMBtuFract1 * Worksheets("CHP Info").Cells(4 + j, 15).Value
NewMMBtu2 = MMBtuFract2 * Worksheets("CHP Info").Cells(4 + j, 15).Value
NewMMBtu3 = MMBtuFract3 * Worksheets("CHP Info").Cells(4 + j, 15).Value
NewMMBtu4 = MMBtuFract4 * Worksheets("CHP Info").Cells(4 + j, 15).Value

For i = 0 To MMCC - 1
    If i = 1 - 1 Then
        Worksheets("DIY NG Rates").Cells(R + TR + j + 1, C + i).Value = NewMMBtu1
    ElseIf i = 2 - 1 Then
        Worksheets("DIY NG Rates").Cells(R + TR + j + 1, C + i).Value = NewMMBtu2
    ElseIf i = 3 - 1 Then
        Worksheets("DIY NG Rates").Cells(R + TR + j + 1, C + i).Value = NewMMBtu3
    ElseIf i = 4 - 1 Then
        Worksheets("DIY NG Rates").Cells(R + TR + j + 1, C + i).Value = NewMMBtu4
    End If
    Next i

Next j
End With

' MMBtu Demand column calculations and New MMBtu Demand after-CHP values entered into
' original usage table.'

With Worksheets("Ground Zero")
    For j = 0 To 11
        NewPeakDayMMBtu = 0
        For i = MMCC To MMCC + MMDC - 1
            PeakDayMMBtu = .Cells(25 + j, 4 + i).Value
            NewPeakDayMMBtu = NewPeakDayMMBtu + PeakDayMMBtu
        Next i
        Worksheets("Ground Zero").Cells(R + TR + j + 1, C + 1).Value = NewPeakDayMMBtu
    Next j
End With

328
DailyCHPMMBtuIn = DailyHours * CHPThermInMMBtu

If PeakDayMMBtu <> Empty Then
    NewPeakDayMMBtu = DailyCHPMMBtuIn + PeakDayMMBtu
Else: NewPeakDayMMBtu = PeakDayMMBtu
End If

Worksheets("DIY NG Rates").Cells(R + TR + j + 1, C + TC + i).Value = NewPeakDayMMBtu

Next i

Worksheets("CHP Info").Cells(4 + j, 16).Value = NewPeakDayMMBtu

NewPeakDayMMBtuSum = NewPeakDayMMBtuSum + NewPeakDayMMBtu

Next j

Worksheets("CHP Info").Cells(4 + 12, 16).Value = NewPeakDayMMBtuSum

If Worksheets("CHP Info").Cells(4 + 11, 16).Value = Empty Then
    Worksheets("CHP Info").Cells(4 + 12, 16).Value = Empty
End If

End With

'Calculate Costs based on new kWh and kW-mo information, which was re-entered into the
' DIY El. Rates worksheet'

Worksheets("DIY NG Rates").NGCalculateButton_Click

'Transfer Original Costs

MonthlyCost = 0
CostSum = 0

For j = 0 To 11
    MonthlyCost = Worksheets("Ground Zero").Cells(25 + j, 4 + CCC - 1).Value
    Worksheets("Cost Savings").Cells(4 + j, 7).Value = MonthlyCost
    CostSum = CostSum + MonthlyCost
    Next j

Worksheets("Cost Savings").Cells(4 + 12, 7).Value = CostSum

'Transfer New Costs'

NewMonthlyCost = 0

NewCostSum = 0

For j = 0 To 11
    NewMonthlyCost = Worksheets("DIY NG Rates").Cells(R + TTR + j + 1, C + TTC + CCC - 1).Value
    Worksheets("Cost Savings").Cells(4 + j, 10).Value = NewMonthlyCost
    NewCostSum = NewCostSum + NewMonthlyCost
    Next j

Worksheets("Cost Savings").Cells(4 + 12, 10).Value = NewCostSum

End If

Worksheets("Cost Savings").Cells(4 + 12, 7).Formula = "=Sum(G4:G15)"

Worksheets("Cost Savings").Cells(4 + 12, 10).Formula = "=Sum(J4:J15)"

Worksheets("Cost Savings").Cells(4 + 12, 6).Formula = "=Sum(F4:F15)"
Worksheets("Cost Savings").Cells(4 + 12, 9).Formula = "=Sum(I4:I15)"

NextPage = CurrentPage + 1

Worksheets("Ground Zero").Range("Z1").Value = NextPage

MultiPage1.Value = NextPage

End Sub
Calculate Economic Performance

Private Sub RedoCostsButton_Click()

Worksheets("Cost Savings").Activate

ShiftNum = Val(ShiftNumTB)
ShiftLength = Val(ShiftLengthTB)
DailyHours = ShiftNum * ShiftLength
MonthlyOH = (365 / 12) * DailyHours * Val(ShiftDaysTB) / 7
AnnualOH = MonthlyOH * 12
CHPElPower = Val(CHPElPowerTB)
CHPkWh = CHPElPower * MonthlyOH
AnnualCHPkWh = CHPkWh * 12
CostofCHP = CostofCHPTB.Value
AdditionalCosts = AdditionalCostsTB.Value
MaintenanceCost = MaintenanceCostTB.Value

If ICEMTCB.Value = "MicroTurbine" Then
    Worksheets("Cost Savings").Range("A2").MergeArea.Value = "MicroTurbine"
End If

If ICEMTCB.Value = "Internal Combustion Engine" Then
    Worksheets("Cost Savings").Range("A2").MergeArea.Value = "IC Engine"
End If
Worksheets("Cost Savings").Range("B3").Value = CostofCHP
CostofCHPTB = Format(CostofCHPTB, "$#,##0")
Worksheets("Cost Savings").Range("B3").NumberFormat = "$#,##0"

Worksheets("Cost Savings").Range("B4").Value = AdditionalCosts
AdditionalCostsTB = Format(AdditionalCostsTB, "$#,##0")
Worksheets("Cost Savings").Range("B4").NumberFormat = "$#,##0"

Worksheets("Cost Savings").Range("B5").Value = MaintenanceCost
MaintenanceCostTB = Format(MaintenanceCostTB, "$0.0000#")
Worksheets("Cost Savings").Range("B5").NumberFormat = "$0.0000#"

IncentiveMax = 200 * CHPEIPOWER
If (IncentiveCB.Value = "No" Or IncentiveCB.Value = Empty) Then
    IncentiveTotal = 0
ElseIf IncentiveCB.Value = "Yes" Then
    IncentiveTotal = (CostofCHPTB + AdditionalCosts) * 0.1
    If IncentiveTotal > IncentiveMax Then
        IncentiveTotal = IncentiveMax
    End If
End If
End If
'n = number of years to plot costs/savings'

Dim IRRnum As Single
Static Values(26) As Double

With Worksheets("Cost Savings")

    n = 25
    AnnualSavings = .Cells(16, 12).Value
    AnnualMaintCost = MaintenanceCost * AnnualCHPkWh
    AnnualNGOffset = Worksheets("CHP Info").Range("B14").Value * 12
    ElCostSavings = .Range("F16").Value - .Range("I16").Value
    NGCostOffset = .Range("J16").Value - .Range("G16").Value

    .Cells(2 + 1, 30).Value = -CostofCHP - AdditionalCosts + IncentiveTotal

    .Range("B6").Value = IncentiveTotal
    .Range("B6").NumberFormat = "$#,##0"
    .Range("B7").Value = AnnualCHPkWh
    .Range("B8").Value = AnnualNGOffset
    .Range("B9").Formula = "=(F16 - I16)"
    '.Range("B9").Value = ElCostSavings
    .Range("B10").Formula = "=(J16-G16)"
    '.Range("B10").Value = NGCostOffset
.Range("B11").Formula = "+(B9-B10)"
'.Range("B11").Value = AnnualSavings
.Range("B12").Value = AnnualMaintCost
.Range("B13").Formula = "+(B11-B12)"
'.Range("B13").Value = AnnualSavings - AnnualMaintCost

Values(0) = -CostofCHP - AdditionalCosts + IncentiveTotal

For i = 1 To n
    .Cells(2 + i, 27).Value = i
    .Cells(2 + i, 28).Value = AnnualSavings
    .Cells(2 + i, 29).Value = -AnnualMaintCost
    Values(i) = AnnualSavings - AnnualMaintCost
    .Cells(29 + i, 28).Value = Values(i)
Next i

If ((-CostofCHP - AdditionalCosts) * (AnnualSavings - AnnualMaintCost) > 0 Or Values(1) * n + Values(0) < 0) Then
    .Range("B14").Value = "Error"
Else: IRRnum = IRR(Values())
.Range("B14").Value = IRRnum
End If

.Range("B15").Formula = "=(B3+B4-B6)/(B13)"
.Range("B16").Formula = "/(B15)"

End With

End Sub