Proposal to Replace Non-Residential Solar Photovoltaic Rebate and Net Metering Financial Incentives With A Solar Feed in Tariff

Gainesville Regional Utilities
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EXECUTIVE SUMMARY

Problem Statement

Operation of Gainesville Regional Utilities' (GRU) solar photovoltaic (PV) rebate and net metering program for the past three years has revealed the opportunity to make various improvements to the current program. For example, GRU's existing program does not reward performance and does not work well if a building is not occupied by the owner. Net metering does not easily accommodate third party investors which is critical because federal incentive programs only work for businesses that have substantial tax liabilities to offset (unlike most small local businesses). Also, net metering does not allow an investor to easily capture the future value of the electricity produced. Finally, net metering provides different prices for PV energy for different customer classes, because rates differ between these classes due to different load shapes and capacity factors.

Opportunity

Throughout Europe a completely different approach, called the "Feed in Tariff" (FIT) has proven very successful in overcoming most of these shortcomings. The basic premise is to set a price for the electricity from PV systems that makes it cost-effective to own and operate what is usually called a "reference system" and to structure the tariff under which the PV energy is purchased in a manner to encourage investment and innovation. This is accomplished with a long time guarantee of price levels.

Analysis and Results

A reference system design has been developed in order to evaluate a number of solar FIT designs that might be applicable in GRU's service territory. The data used, the methodologies employed, and the alternatives evaluated are described in detail in this report. The recommended solar FIT alternative is a fixed price per kilowatt hour, with the same price being offered to each customer class. The recommended FIT design is based on GRU's current total financial contribution per watt for solar rebates and net metering, based on the rate category with the highest net metering tariff (General Service Non-Demand). It also incorporates future anticipated energy cost increases into a price paid today. When the recommended solar FIT is applied to the reference system design, and assuming that the PV system owners can take advantage of all the available renewable energy tax benefits, it has been shown to significantly improve the return on the investment (see Table E-1).

Financial and Energy Supply Considerations

While the proposed solar FIT is based on the same financial commitment per watt as GRU's current rebate and net metering program, it is expected to increase GRU's overall financial commitment to solar PV energy for two reasons. First, it is based on the highest net metering rate for any rate category, making this higher price available to all of GRU's rate categories. Second, it means GRU will be purchasing 100% of the output from the PV systems installed under this proposal, instead of just the excess not used by the utility account holder. Third, it is expected (and intended to) accelerate the deployment of PV systems throughout Gainesville. Currently there are 301 kilowatts of PV systems installed in GRU's service territory after several years of the current program. If PV systems are accelerated to result in an average of 1,000 kilowatts of PV systems installed per year over the next 20 years, the effects on the average cost of electricity will be $.0024 per kilowatt-hour after crediting the PV FIT payments made by GRU for the fuel it will replace. If is assumed that the price of electricity increases 3.0% per year over this time period, this will represent less than 1% of the total GRU power production costs, while providing 11% of the community's energy efficiency goals.

Table E-1
Effects of Proposed Feed in Tariff
on Owner's Financial Return
From an Average Priced PV System

Rate Class	Scenario	
	Current Rebate and Net Metering Program[a]	Proposed Solar Feed in Tariff
First Year ROI (%/Year)		
Residential	4.29	6.65
Gen. Serv. Non-Demand	7.46	11.56
Gen. Service-Demand	5.09	11.56
Large Power	5.03	11.56
IRR Results (%)		
Residential	-2.11	0.02
Gen. Serv. Non-Demand	4.73	6.43
Gen. Service-Demand	-0.64	6.43
Large Power	-0.79	6.43

a. Assumes 100% of the local and state taxes associated with purchasing electricity are included in this scenario. This benefit does not accrue under the FIT scenario.

Recommendation

Staff is seeking conceptual approval for the following solar FIT program design as a prerequisite to developing ordinances changes and business system changes that would be required.

1. Adopt a Solar FIT payment program for GRU's service area, with all rate categories being eligible. In exchange for the renewable and environmental emission credits associated with solar PV energy, the Solar FIT rate will be fixed for at least twenty years at a price on the year of installation.

2. Set the Solar FIT rate for the first year of the program at GRU's current equivalent NPV cost per watt of PV system for the general Service Non-Demand rate category (rounded to $0.26/kWh). For subsequent years, include a 5% reduction in this rate in anticipation of solar system cost decreases until grid parity is reached. Table E-2 below contains the suggested Solar FIT payment schedule.

3. Discontinue PV rebates and net metering for all customer rate categories other than residential.

4. Grandfather all customers and PV systems currently enlisted in GRU's net metering program.

Table E-2
Proposed Renewable Energy Payment
Rate Schedule for PV Energy
($/KWh Delivered)

If PV System is Installed in Calendar Year...	Solar FIT Shall be…	And Applied Uniformly From the Date of installation through Dec. 31,
2009	0.260	2029
2010	0.247	2030
2011	0.234	2031
2012	0.223	2032
2013	0.212	2033
2014	0.201	2034
2015	0.191	2035
	Grid Parity	

Summary of Benefits

The proposed solar FIT program is anticipated to have the following benefits.

- Leverages and maximizes existing federal incentives
- More flexible ownership models
- Simple and easy to administer
- Rewards performance, not capacity
- More predictable business investment for customers
- Accelerated achievement of renewable energy goals
- Less upfront commitment of capital from GRU
- Equity across rate categories
- Less erosion of utility tax/surcharge revenue
- Increased incentive for PV system maintenance by the owner
- Hedges against greenhouse gas regulations
- Maximizes GRU's renewable energy credits.

A benefit that can not be ignored about the FIT model is that is simple and easy to explain. Instead of requiring an explanation of how net metering will work, and when or how credits will be applied, the FIT can be explained in a simple sentence:

> *"GRU will purchase the energy produced for $X per kilowatt hour."*

INTRODUCTION

An important component of Gainesville Regional Utilities' (GRU) energy conservation and supply plan is the use of solar photovoltaic (PV) arrays to conserve energy and displace fossil fuels. Because GRU is not eligible for the substantial incentives provided at the state and federal level, customers benefit from additional tax credits if GRU does not own the PV system. Instead, GRU's strategy is to leverage state and federal incentives with its own financial incentives to encourage the private sector to make PV investments. GRU's current incentives for photovoltaic systems include a rebate per watt installed and a "net metering" payment for any PV energy not immediately needed by the host utility account.

Operation of GRU's solar PV rebate and net metering program has revealed a number of the technical, institutional, and financial shortcomings of this approach. Throughout Europe a completely different approach, called the "Feed in Tariff" (FIT) has proven very successful in overcoming most of these shortcomings.

PURPOSE AND SCOPE

The purpose of this report is to compare a FIT model with GRU's current program for PV rebates and net metering. In Europe, FITs apply to a wide range of renewable energy types. Because the work done on FITs by GRU to date has only focused on solar photovoltaic energy, the proposed new paradigm has been labeled a "Solar FIT". This report will show that by changing the incentive model for PV systems, GRU will be able to increase the rate of return for investors with the equivalent level of GRU's current financial commitment per watt installed. At the same time, changing the incentive model will mitigate technical, institutional, and financial barriers that exist with the current incentive model. The proposed Solar FIT also offers additional flexibility which may lead to new models for collaborative investment in PV systems by the private sector.

Accordingly, this report is organized into seven sections:

1. GRU's existing PV system incentive program;
2. The German FIT model for renewable energy;
3. Local PV system cost and performance trends;
4. A model for PV financial analysis;
5. Results of financial studies;
6. Potential fuel adjustment cost and energy conservation impacts; and
7. Discussion and recommendations.

HISTORY AND BACKGROUND

Solar has not been and is still not economic without incentives. The primary vehicle for reducing the hurdle presented by the steep initial cost of PV systems has been in the form of direct or tax-related subsidies. Federal, state and local agencies provide a varied package of cash subsidies, tax credits and tax deductions which have been enacted to offset the capital outlay for solar. Many utility companies provide a direct cash rebate in proportion to the installed capacity of the solar system.

In 2006 the City of Gainesville initiated a commitment to conservation and to generation from renewable resources. A significant part of this program has been the promotion of PV generation on customers' homes and businesses. Part of this support has come from budgeting funds to be paid in the form of rebates to customers who purchase and install PV systems. In 2008 an additional incentive in the form of net metering was adopted by GRU.

Although the approach of coupling rebates with net metering offers some level of incentive to both business and residential customers, there are some shortcomings. Even with the combination of rebates and net metering, the financial feasibility of purchasing a solar PV system is often marginal and differs for each individual customer. Another powerful and popular approach to overcoming this obstacle is adoption of a renewable energy payment, often referred to as a “feed-in tariff” (FIT). Common throughout Europe, the FIT model is strictly a payment for performance set at a level to assure profitability under assumed normal conditions. If a PV system costs less or performs better, the owner is much better off financially.

GRU’S EXISTING PV INCENTIVE PROGRAMS

GRU’s Incentive Program

GRU offers both a rebate for installing PV systems and a purchase price for any PV energy not used by the host utility account (“net metering payment”). The PV rebate level has been set at $1.50 per watt of nominal nameplate capacity installed. This rebate level was based on the net present value (NPV) of the capacity benefits and avoided fuel costs resulting from a typical PV system (assuming a 35% coincident demand factor and a 17% capacity factor). The same value for avoided capacity and fuel cost benefits applied to GRU’s other energy conservation rebate programs were employed to set this rebate level.

GRU’s PV net metering payment in terms of $/kilowatt-hr ($/kWh) is almost double the cost of the conventionally generated energy it replaces. It has been set at the average retail price (before taxes) of energy for each of GRU’s retail rate and includes the value of not only avoided generation costs, but transmission, distribution generation, and all other costs associated with that rate category as well. As shown in Table 1, the net metering rate is lowest for the General Service Demand (GSD) and Large Power (LP) customer classes. These customers are metered and billed for energy separately from demand. For the GSD and LP customers, the value of the PV system in reducing electrical demand charges is very difficult to predict month to month, depending on both the cloud cover and the time of day in which the peak for that customer is set.

Under the current program, excess energy sold back to GRU has less economic benefit than avoiding the purchase of energy from the grid. Purchased electricity is accompanied by taxes on that purchase, such as the City and County utility taxes and the state’s gross receipt tax and sales tax applicable to business customers). Under net metering PV energy reduces the electricity purchased and thus avoids the payment of this tax, improving the value of the PV energy to the System owner. The net metering tariff only applies to PV energy not immediately needed by the customer, thus only applies to “excess” production. The applicability of these taxes to each customer class is shown in Table 1, and this consideration was taken into account in this study.

State and Federal Incentive Programs

State and Federal PV system incentive programs are summarized in Table 2. The state of Florida offers an incentive of $4.00 per installed watt of solar PV; however, the budget is already exhausted for the future two years of the program without any guarantees of renewed funding. All of the financial analyses presented here assume this source of assistance is not widely available, but if this situation were to change, the analysis would result in a lower FIT payment.

Table 1
Comparison of PV Benefits Between
GRU Rate Classes[1]
$/kWh

Parameter	Rate Class			
	Res	GSN	GSD	LP
Net Metering Tariff For Excess PV Production	.125	.140	.095	.094
Taxes Avoided – Inside City				
City Utility Tax	.0062	.0077	.0032	.0031
Other Non-Local	.0031	.0134	.0093	.0092
Taxes Avoided – Outside City				
City Electric Surcharge	.0062	.0077	.0032	.0031
County Utility	.0068	.0085	.0035	.0038
Other Non-Local	.0035	.0137	.0094	.0093

As summarized in Table 2, federal incentives for residential systems are much less substantial than for non-residential systems. Although production tax credits and tax credits for businesses are substantial, depreciation and business expense deductions are even more valuable, provided that the business concerned has tax liabilities that allow it to capture these benefits.

Table 2
State and Federal[2] PV System Incentive Programs

Source	Residential Benefits	Non-Residential Benefits
Federal		
30% Investment Tax Credit	Unlimited	Unlimited
MACRS accelerated depreciation	Not Available	Limited to Tax Liability
Sec. 179 accelerated depreciation	Not Available	Limited to Tax Liability
Business expense deductions	Not Available	Limited to Tax Liability
$.02/kWh Production tax credit	Not Available	Limited to 5 Years
State of Florida		
$4.00/watt Rebate (up to annual appropriated amount)	Limited to 5 Kilowatts	Limited to 25 Kilowatts

<u>Technical Issues Related to Incentive Structure</u>

GRU's PV rebate program, as currently implemented is based on the nominal capacity of the installed PV system. This model does not reward customers for actual performance but rather installed capacity. Although systems are inspected to ensure compliance with GRU's guidelines, a system's orientation, the amount of shade, the difference across various types of system related to temperature

[1] The net metering payment tariff includes the prevailing fuel adjustment (currently 63 mils). Res= Residential; GSN= General Service Non Demand; GSD= General Service Demand; and LP= Large Power.
[2] Federal incentives have been renewed for eight years.

sensitivity, the manner and quality of installation and cabling, lightning and surge protection, performance degradation through time, resistance to hail, and the inverter configuration can all affect system performance. Furthermore, a PV system can be moved or stolen, meaning that GRU's customers did not receive full value for the PV rebate. In short, rebates are one time payments that are not related at all to performance through time. While the requirements for rebates can be made more stringent, this imposes additional administrative burdens whose costs might best be used to offset PV system costs.

Institutional Issues Related to Incentive Structure

Net metering and rebates provide financial incentives most strongly when the utility account holder is also the building owner. This does not hold true for many residential dwellings and does not hold true for most businesses. It becomes very complicated to install a PV system and assign benefits when there is a term lease in place and the roof may be affected. Often, the best time to install a PV system is just after a roof has been replaced, which is under a building owner's schedule, not the tenant. The benefit of the PV system depends on the tax status of the occupant and the occupant's energy using patterns. Often a building has many several utility accounts associated with a number of tenants, further complicating the assignment of benefits.

Net metering and rebates also do not provide enough incentive for the development of green field systems or systems financed by a consortium. A green field system is unlikely to have a utility account associated with it. This is particularly unfortunate because a syndicated system is one way to allow participation by small investors, and allow those investors to capture the substantial economy of scale (lower cost per watt) associated with larger PV systems.

Financial Issues Related to Incentive Structure

Federal tax incentives can potentially pay for a major portion of the cost of a PV system provided the owner has ample tax liabilities which is often not the case. In many markets third parties are able to monetize their tax liabilities in order to facilitate a financial transaction. The value from the savings derived from a PV system under a net metering scheme is difficult to bring to financial settlement for any agreement involving any investor other than the utility account holder. This difficulty derives from the fact that the value is an avoided cost (and not cash) and assigning a future market value to it requires significant assumptions as to the future price of electricity. Not only that, there are additional financial risks for a third party investor under a net metering scheme, such as the credit quality or the term of tenancy of the counter party (utility account holder). Finally it is expected that utility rates will increase through time, thus improving the rate of return of investment. However, private investors are heavily influenced by the rate of return in the early years of an investment.

THE GERMAN FIT MODEL FOR RENEWABLE ENERGY

Feed in tariffs are prevalent throughout the European Union but Germany was one of the first to adopt such a program and their program design is particularly well suited for promoting both small and larger systems. The basic concept consists of three key elements:

1. Provide a socialized price (Feed In Tariff -FIT) to purchase the output for each form of renewable energy, set at a level to make it a good investment. The FIT is set based on the cost of an applicable reference system design to utilize that form of renewable energy. Funds to make the payments are obtained by collecting the revenues required to make the FIT payments on a uniform per kWh basis from all electric ratepayers[3]. The FIT payments in Germany also provided for degression[4] of this payment based on the year of installation. In GRU's case, the ability to socialize costs is limited to only GRU's local ratepayers.

2. Make it a safe investment by guaranteeing the price for the energy produced over the life of the investment and backing the price with a strong credit (in this case the German government). This was accomplished with legislation guaranteeing that the FIT payment applicable in the year of installation would be fixed and paid for the subsequent twenty (20) years for each unit of energy produced. Locally, GRU's tariff could supply a strong credit backing.

3. Mandating priority access to the electric grid in order to allow the energy to be sold. This was accomplished through utility regulation. GRU is prepared to make a similar commitment locally.

Benefits of the FIT Model

These simple premises, although expensive, have had some profound effects on all forms of renewable energy in Germany. Solar PV systems are sprouting up everywhere, ranging from small household systems of a few kilowatts to huge green field arrays with the solar industry providing megawatts of energy. It is not uncommon for syndicates to be formed to fund arrays, and for all kinds of buildings to lease their roof tops to the third party owners. Furthermore, the FIT model only pays for performance, which appropriately aligns the system owner's interests with that of the community footing the bill. The FIT resolves most of the technical, institutional, and financial obstacles associated with rebates and net metering.

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[3] In Germany certain manufacturing industries are granted exceptions to this requirement in order to promote the international export of manufactured goods)

[4] Degression is an annual percentage reduction of the FIT payment, currently 6% for solar PV systems. This is to promote innovation and early market entrance as well as in anticipation of declining reference system costs through time, and has been reported to be quite beneficial.

A benefit that can not be ignored about the FIT model is that is simple and easy to explain. Instead of requiring an explanation of how metering will work, and when or how credits will be applied, the FIT can be explained in a simple sentence:

"GRU will purchase the energy produced for $X per kilowatt hour."

Methodology for Adapting the German Model to a Solar FIT for GRU

Adapting the German FIT model to GRU is much less expensive in that substantial federal incentives already exist. The federal incentives are quite a bit more complicated than a FIT, but GRU can not afford to replace this level of socialized subsidy. There is more demand for state rebates than funding allows and due to the uncertainty this creates, state rebates have been left out of the analyses that are presented here. If this situation were to change, it would be appropriate to revisit the analyses presented here.

GRU's financial commitment to promoting PV systems through rebates and net metering, on a per watt basis is substantial. The starting point for the studies presented here was to see if PV systems could be made more profitable without increasing GRU's financial commitment per watt to promoting PV systems. The question that needed to be answered was what form of Solar FIT would provide the maximum PV system incentive at the same level of financial contribution to GRU and its customer base per unit of energy. To answer this question PV system price data and performance characteristics were combined with engineering and financial data to evaluate a number of financial measures under various scenarios. These scenarios were then extrapolated to evaluate the over system costs that might be incurred under the new policy.

All of the modeling presented here represents fixed orientation roof mounted systems. Access to the grid is made possible through GRU's current levels of commitment to renewable energy in the form of standardized interconnection agreements.

LOCAL PV SYSTEM PRICE AND PERFORMANCE TRENDS

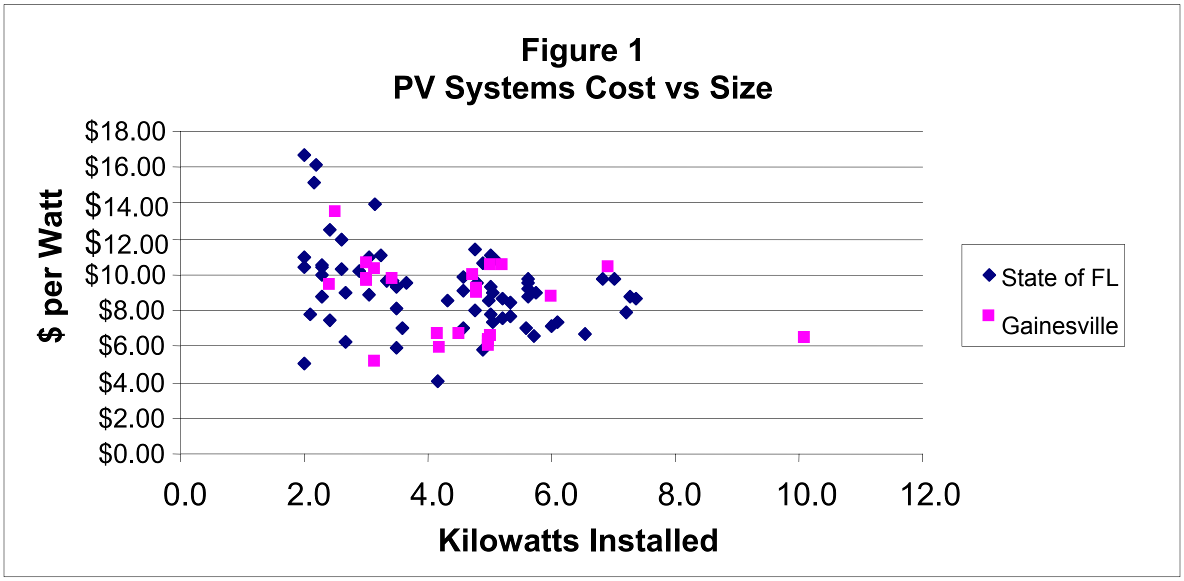
Key to modeling the financial merits of a PV system investment are costs of the systems and the amount of energy they will produce over their life time.

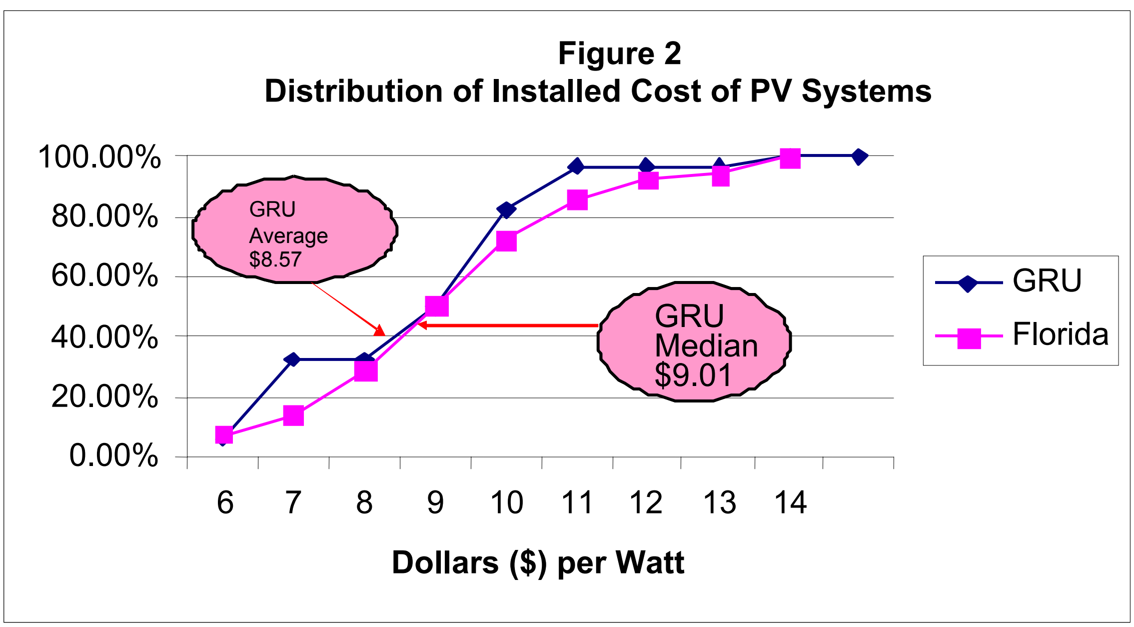
PV System Costs

To determine the system cost to be used in the model, data from actual solar installations in Gainesville and across the state were collected. The data represents the overall system cost reported as part of the rebate programs offered by GRU and the State of Florida. This includes the PV modules, the installation materials, the inverters, the electrical work and the labor charged.

Figure 1 presents the data obtained for 2007 in the form of a scattergram, plotting system size on one axis and system cost per watt on the other. Although the correlation is rough, there are more examples of expensive systems in the smaller capacity size but there is a substantial variation in cost at all system sizes represented in the data.

Figure 2 compares cumulative probability distribution curves for local and state wide data. Gainesville costs are similar to the statewide market, thus an average cost of $8.50 per watt installed was employed to represent current market conditions.





Trends in Cost

Degression is a tool used in the German FIT model to promote innovation, encourage early deployment, and mange the socialized cost of the FIT payments. The USDOE Energy Information Administration Department has periodically published studies forecasting the trends in the cost of PV systems. Figure 3 was developed from the most recent of these studies using local market conditions as a starting point. This analysis indicates that installed costs will fall at a rate of approximately 5% per year from the current average of $8.50/watt by 5% per year for 10 years, and fall at 2% a year thereafter.

Figure 3
EIA Projection of the Installed Cost of Photovoltaic Systems

PV System Degradation

PV systems become less efficient as they age, producing less energy for the same amount of incident sunlight. Empirical data from the literature suggests that after 20 years a PV system will produce about 20% less energy than it did at inception. This was modeled with a linearly decreasing output for the 20-year lifespan of the PV system.

Capacity Factor

Capacity factor is the measure of actual (or expected) energy production as a percentage of the theoretical maximum over a year. Factors incorporated in developing a capacity factor include the number of daylight hours in a year, the changing angle of the sunlight during a day, and the opacity and cloud cover of the sky. Empirical data show that the capacity factor for Gainesville ranges from 15%-19% depending on system orientation. For this analysis, capacity factor is assumed to be 17%.

O&M and Maintenance Costs

PV systems typically require periodic maintenance to assure optimal performance and roof integrity, with the single largest repair items being inverter components. O&M is linearly proportional to array size and estimated to be $25.0/kW-year for the purposes of this study. Inverter replacement was assumed to take place at year 10 at a cost of $1000/kW. This cost was included as a conservative estimate since inverters often have a shorter lifespan than a typical PV panel.

PV FINANCIAL MODEL

Model Structure and Assumptions

A model was developed to evaluate the effects of various Solar FIT rate structure designs on the financial returns to the PV system owner. The objective of the analysis was maximize the owner's first year Return on Investment (ROI) and the Owner's Internal Rate of Return (IRR) over the life of the investment without increasing the equivalent NPV levelized cost to the utility per watt over existing rebate and net metering commitments. The first year ROI is an investment figure of merit commonly in use as applied to real estate and other investments. IRR is an investment figure of merit that accommodates uneven cash flows over time and does not require an assumed discount rate or financial interest rate, and is considered by many to be a more complete figure of merit than ROI.

The model is an Excel spreadsheet and a screen shot is provided in Appendix A. It is based on the following inputs and assumptions (some of which were described in more detail in the previous section):

PV System and Usage

- System size (kW)
- Installed cost ($/watt)
- Capacity factor (the percentage of the year that the panels produce energy)
- Panel degradation factor
- O&M and repair costs

Financial Incentives (Adjustments)

- State rebate ($/watt)
- GRU rebate ($/watt)
- Federal tax rate
- Federal investment tax credit rate
- Maximum incentive levels ($)

Financial and Energy Rates

- Discount rate
- Renewable energy payment ($/kWh)
- Renewable energy payment escalation factor (%)
- GSN energy rate
- GSN escalation rate

Other Assumptions

- All levelized values are net present valued (NPV) over 20 years with a 6% discount rate
- Owner has sufficient tax liabilities to take advantage of IRS 179 depreciation
- Electrical price escalation rate of 3.0% per year
- All escalation takes place linearly over the 20-year life of the program
- State rebate is not considered and assumed to be zero throughout the analysis
- Federal Investment Tax Credit rate of 30%
- IRS income tax rate assumed to be 35% throughout this analysis
- Federal Production Tax Credits of $0.02/kWh (only available five years)
- PV system life of only 20 years (a conservative estimate)

Scenarios for Analysis

The five scenarios presented in this report for comparison are summarized in Table 3. The first and second "Current" scenarios assume GRU's current program of PV system incentives and further assumes that the net metering rate applicable to each rate class will escalate uniformly at 3.0% per year. The "Current 100% Excess" scenario assumes that the PV system is a stand alone system not associated with a utility account. Accordingly the system owner does not enjoy the benefits of avoiding local and state taxes. The "Current No Excess" scenario with no excess energy assumes that the PV system is sized to be small enough to avoid ever producing more energy than needed at any time for that utility customer. Accordingly the system owner enjoys the maximum benefit per kWh possible. Taxes are assumed to escalate at the same rate as the price of electricity.

Table 3
Scenarios for Analysis

Parameter	Scenario				
	Current 100% Excess	Current No Excess	Flat Solar FIT	Escalating Solar FIT	Front Loaded Solar FIT
Rebate Amount- $/Watt	$1.50	$1.50	$0.0	$0.0	$0.0
Initial Solar FIT ($/kWh)	Net Metering Rate	Net Metering Rate	.2644	.2100	.3600
Solar FIT Escalation Rate (%/Year)	3.0	3.0	0.0	3.0	-5.61 for 11 years
Additional Value From Avoided Taxes	None	For 100% of Output	None	None	None

The third scenario, “Flat Solar FIT” closely follows the German FIT model. The value of .2644 is the levelized cost per kWh that is equal on a NPV basis to the “Current” scenario applied to the GSND rate class. This levelized value integrates the rebate, net metering, and future escalation and brings the benefits of future escalation forward. Applying this equally across all rate classes addresses the inequalities inherent in the current net metering program demonstrated in Table 1 and both anticipates and eliminates any gamesmanship and limitations involved in investors selecting sites for PV systems.

The fourth scenario, “Escalating Solar FIT” was developed to address the concern that a levelized Solar FIT prevents the PV system owner from capturing the upside benefits from escalation rates higher than the 3.0% assumed here. The levelized cost per kWh under this scenario is the same as for the “Flat Solar FIT” when 3.0% is assumed to be the escalation rate, but the starting value was smaller. Scenarios under which escalation is higher or lower were tested as well.

The fifth and final scenario, “Front Loaded Solar FIT” was selected in anticipation that this form of design might be suggested by potential PV system investors. The initial Solar FIT for this scenario was set at $0.10 higher than the levelized equivalent cost used in the “Flat Solar FIT” scenario, then de-escalated to the net metering rate. The de-escalation rate was set to make the levelized cost per kWh under this scenario the same as for the “Flat Solar FIT” when 3.0% is assumed to be the escalation rate for electrical prices.

RESULTS

Table 4 summarizes the results from evaluating all the scenarios for each of GRU’s retail customer rate categories. Some key observations from this data are:

Table 4
Results for All Scenarios
For All Rate Classes
(3.0% Electrical Price Escalation)

Rate Class	Scenario				
	Current 100% Excess	Current No Excess	Flat Solar FIT	Escalating Solar FIT	Front Loaded Solar FIT
First Year ROI Results (%/Year)					
Residential	3.84	4.12	6.65	5.29	9.04
Gen. Serv. Non-Demand	7.46	8.52	11.56	9.19	15.72
Gen. Service-Demand	5.09	5.75	11.56	9.19	15.72
Large Power	5.03	5.68	11.56	9.19	15.72
IRR Results (%)					
Residential	-3.32	-2.56	0.02	0.64	-0.68
Gen. Serv. Non-Demand	2.86	4.73	6.43	6.39	6.51
Gen. Service-Demand	-2.21	-0.64	6.43	6.39	6.51
Large Power	-2.35	-0.79	6.43	6.39	6.51

1. All of the Solar FIT scenarios provided a better investment yield than GRU's current program, even including the value of avoided taxes.

2. The front loaded Solar FIT had the best ROI and a slightly enhanced IRR. However, upon careful inspection of the detailed case, these figures of merit are misleading since this scenario resulted in ROI values lower than any other Solar FIT case after the initial six years, which is problematic, as will be discussed.

Table 5 compares the effects of varying the escalation rate on the "Escalating Solar FIT" scenario. The escalation rate has no effect on the ROI because only the first year ROI is shown and the escalation is not assumed to affect rates until year 2. A 100% increase in escalation improves the IRR by 52%, and reducing the escalation rate 50% reduces the IRR by 27%.

Table 5
Effects of Escalation Assumptions
On the Escalating Solar FIT Scenario

Escalation Rate	ROI	IRR
1.5%	9.19%	4.65%
3.0%	9.19%	6.39%
6.0%	9.19%	9.71%

POTENTIAL RATE AND ENERGY CONSERVATION IMPACTS

While the forgoing analysis held GRU's financial commitment to current levels, it must be expected that improving the performance and reducing the risks associated with PV systems is likely to achieve the desired outcome. This outcome is to accelerate the deployment of PV systems in GRU's service territory. On one hand, this will put upward pressure on rates (probably through the fuel adjustment, since the Solar FIT payments are to purchase power). At the same time it will also contribute powerfully towards GRU's energy efficiency and renewable energy efforts. Since it is impossible to predict the degree to which the market will accelerate, a range of sensitivities will be presented to provide insight into the magnitude of the possible effects.

Effect on Fuel Adjustment

The baseline fuel adjustment was projected using native load fuel cost projections per kWh from GRU's 2008 Ten Year Site Plan (TYSP). Since this data is only projected out ten years, the ensuing ten years were linearly projected using the average escalation over the TYSP timeframe. This credits the Solar FIT payments for the cost of the fuel avoided by using solar energy. Solar FIT payments in excess of this savings were then converted to their equivalent incremental effect on the fuel adjustment. A degression rate of 5% was used in the analysis.

A fairly aggressive range for the hypothetical rate of installed PV capacity was applied in the analysis, ranging from 250 kW to 1000 kW per year. To put this in perspective, there is currently a total of 301 kW of solar PV systems currently installed in GRU's entire service area. The results are provided in Table 6. Even at the most aggressive rate of installation, the Solar FIT program (assuming the "Flat Solar FIT" scenario is adopted), only adds 2.42 mills to the fuel adjustment after 20 years. If escalation is a steady 3%, this will represent less than a 1% overall increase in the total cost per kWh of electricity. Table 7 contains estimates of how much solar PV deployment with contribute to GRU's energy efficiency goals. At a deployment rate of 1,000 kilowatts per year, the solar FIT program could contribute about 11% of GRU's energy efficiency goals.

Table 6
Increase In Fuel Adjustment (Mills) Due To
Solar Fit Costs Net Of Avoided Fuel Costs

Installed Capacity per year

Year	250 kW	500 kW	750 kW	1 MW
1	0.05	0.10	0.15	0.21
2	0.10	0.20	0.30	0.40
3	0.14	0.29	0.43	0.58
4	0.19	0.37	0.56	0.75
5	0.23	0.45	0.68	0.91
6	0.26	0.53	0.79	1.05
7	0.30	0.60	0.90	1.19
8	0.33	0.66	0.99	1.32
9	0.36	0.72	1.08	1.44
10	0.39	0.78	1.16	1.55
11	0.41	0.83	1.24	1.66
12	0.44	0.88	1.32	1.76
13	0.46	0.93	1.39	1.86
14	0.49	0.97	1.46	1.95
15	0.51	1.02	1.53	2.04
16	0.53	1.06	1.59	2.12
17	0.55	1.10	1.65	2.20
18	0.57	1.14	1.71	2.28
19	0.59	1.18	1.77	2.35
20	0.61	1.21	1.82	2.42

Table 7
Solar Capacity as Percentage of Overall Energy Efficiency Goals

Year	DSM Projected GWh	Annual Rollout Rates (capacity per year) 250 kW	500 kW	750 kW	1000 kW
2009	21	1.8%	3.5%	5.3%	7.1%
2010	31	2.4%	4.8%	7.2%	9.6%
2011	45	2.5%	5.0%	7.5%	9.9%
2012	61	2.4%	4.9%	7.3%	9.8%
2013	80	2.3%	4.7%	7.0%	9.3%
2014	100	2.2%	4.5%	6.7%	8.9%
2015	121	2.2%	4.3%	6.5%	8.6%
2016	143	2.1%	4.2%	6.3%	8.3%
2017	160	2.1%	4.2%	6.3%	8.4%
2018	177	2.1%	4.2%	6.3%	8.4%
2019	194	2.1%	4.2%	6.3%	8.4%
2020	210	2.1%	4.3%	6.4%	8.5%
2021	227	2.1%	4.3%	6.4%	8.5%
2022	233	2.2%	4.5%	6.7%	9.0%
2023	238	2.3%	4.7%	7.0%	9.4%
2024	243	2.5%	4.9%	7.4%	9.8%
2025	249	2.5%	5.1%	7.6%	10.2%
2026	254	2.6%	5.3%	7.9%	10.6%

DISCUSSION

In this analysis several rate structures were examined to determine their relative merits relative to GRU's existing program of solar PV incentives. Compared to other alternatives evaluated, two scenarios had the best overall performance measures, the "Flat Solar FIT" and the "Front Loaded Solar Fit". Although very close in terms of the overall IRR, the "Front Loaded Solar FIT" first year ROI is misleading. Inspection of the detailed results found that, as would be expected, once the "Front Load" was gone, the ROI dropped to as low as 7.0% and had a lower ROI over twenty years than the "Flat Solar FIT". This trend toward lower revenues from the PV system would work against the incentive to maintain the system over the long term. The "Front Loaded FIT" also has negative cash flow implications for GRU. It would also be much more difficult to track and administer, and would provide an additional level of complexity for the potential PV system owner. For these reasons, the "Flat Solar FIT was determined to have the best overall ability to successfully accelerate the deployment of solar PV systems in Gainesville.

The "Flat Solar FIT" consists of a fixed payment of 0.260 $/kWh over 20 years. Depending on the specific rate category being compared, the fixed Solar FIT program nearly doubles the first year ROI and yields an IRR comparable to other investments on the market today, instead of one that is either nearly zero or worse, negative. If designed similar to the manner applied in the German FIT model, the fixed Solar FIT payment will also help to mitigate the technical, institutional, and financial obstacles presented by the existing program of rebates and net metering. At the very least, applying the Solar FIT across all the rate categories would constitute a significant improvement in the range of sites upon which solar systems might profitably be installed.

Thus far this report has focused on the benefits of a Solar FIT from the PV system owner's perspective. There are some significant advantages from GRU's and other stakeholder perspectives as well. These include:

- Accelerated achievement of energy efficiency goals
- Less upfront commitment of capital from GRU
- "Pay for performance" reduces GRU's risk
- Equity across rate categories
- Ease of administration
- Ability to leverage and maximize federal incentives
- Less erosion of utility tax revenue for the City and County
- Increased incentive for PV system maintenance by the owner
- Provides a hedge against greenhouse gas regulations
- Maximizes GRU's renewable energy credits.

The German model of applying degression to the Solar FIT, depending on the year in which the system is installed, provides additional benefits. It has been shown to promote innovation, encourage early deployment, and manage the socialized cost of the FIT. Delaying the start of degression for a few years will give the community time to adapt to the new Solar FIT program.

While the fixed Solar FIT is beneficial to all rate categories, members of the staff and the private sector involved in the solar industry believe that residential customers may prefer the rebate model. For many residential PV system owners, the system is less of an economic investment than an ideological choice. For many, the initial cost is more of an impediment than the expected financial return. However, GRU believes that a Solar FIT for residential customers might promote some innovative third party financial schemes.

Finally, those customers already enlisted in the net metering program have already obtained and spent their rebates, and should not be eligible for the Solar FIT program. Accordingly, it would be advisable to grandfather these customers in and continue the net metering program for them.

RECOMMENDATIONS

If the following recommendations are something the City Commission wishes to discuss further, staff will come back to the Commission with specific ordinance changes and a schedule for implementing the Solar FIT program.

1. Adopt a Solar FIT payment program for GRU's service area with all retail rate categories being eligible. In exchange for the renewable and environmental emission credits associated with PV energy, the Solar FIT rate will be fixed for at least twenty years at a price depending on the year of installation.

2. Set the Solar FIT rate for the first year of the program at GRU's current equivalent NPV cost per watt of PV system (rounded to $0.260/kWh). For subsequent years, perform a program assessment and adjust the rate downward accordingly until grid parity is reached. Table 7 shows one possible rate structure assuming a 5% degression each year.

Table 7
Proposed Renewable Energy Payment
Rate Schedule For PV Energy
($/kWh Delivered)

If PV System is Installed in Calendar Year...	Solar FIT Shall be…	And Applied Uniformly From the Date of installation through Dec. 31,
2009	0.260	2029
2010	0.247	2030
2011	0.234	2031
2012	0.223	2032
2013	0.212	2033
2014	0.201	2034
2015	0.191	2035
	Grid Parity	

3. Limit PV rebates to residential customers and allow only residential customers to enlist in GRU's net metering program.

4. Grandfather all customers and PV systems currently enlisted in GRU's net metering program.

5. Discontinue PV rebates and net metering for all customer rate categories other than residential.

Appendix A

Below is a screenshot of the excel spreadsheet for the reference case:

Solar Worksheet

COSTS		
System Size (kW)	1	
Installed Cost/Watt	$8.50	
System Installed Cost		$8,500.00
ADJUSTMENTS		
State Rebate/W		
State Rebate Total		
GRU Rebate/W	$1.50	
GRU Rebate Total		$1,500.00
Total Install less rebates		$7,000.00
Federal ITC Rate	30.00%	
Federal ITC Total		$2,100.00
IRS Tax Rate	35.00%	
IRS 179 Depreciation		$2,082.50
Net Installed Cost		$2,817.50
RATES		
GRU Discount Rate	6.00%	
Base Energy Rate/kW	$0.14	
Annual Energy Rate escalation	3.00%	
Internal Rate of Return (10)	#NUM!	
Internal Rate of Return (20)	2.86%	
ROI	7.46%	
Base Capacity Factor	17.00% (PV Watts reference 15.5-19.5)	
Annual Degradation	0.80% (from California PUC and EIA)	

PAYBACK SCHEDULE

YEAR	Energy Rate	GRU Payment	KWH	Capital + O&M Cost	Production Tax Credit	Annual Net
0				-2,817.50		-2817.5
1	0.140	$1,708.49	1489.20	-25.00	$26.81	$1,710.29
2	0.144	$213.02	1477.29	-25.00	$26.59	$214.62
3	0.149	$217.66	1465.47	-25.00	$26.38	$219.04
4	0.153	$222.40	1453.74	-25.00	$26.17	$223.56
5	0.158	$227.24	1442.11	-25.00	$25.96	$228.19
6	0.162	$232.18	1430.58	-25.00		$207.18
7	0.167	$237.23	1419.13	-25.00		$212.23
8	0.172	$242.39	1407.78	-25.00		$217.39
9	0.177	$247.67	1396.52	-25.00		$222.67
10	0.183	$253.06	1385.35	-1,000.00		-$746.94
11	0.188	$258.57	1374.26	-25.00		$233.57
12	0.194	$264.19	1363.27	-25.00		$239.19
13	0.200	$269.94	1352.36	-25.00		$244.94
14	0.206	$275.81	1341.54	-25.00		$250.81
15	0.212	$281.82	1330.81	-25.00		$256.82
16	0.218	$287.95	1320.16	-25.00		$262.95
17	0.225	$294.21	1309.60	-25.00		$269.21
18	0.231	$300.62	1299.13	-25.00		$275.62
19	0.238	$307.16	1288.73	-25.00		$282.16
20	0.245	$313.84	1278.42	-25.00		$288.84
TOTAL			27625.47			$2,494.85
NPV		$4,252.47	16084.86	-3,442.15		$674.55

Inverter replacement at 10 years; $1 per watt

Levelized Energy Payout Including Rebates	$0.26 per kWh

Appendix B

Below is a screenshot of the excel spreadsheet for the flat Solar FIT case

Solar Worksheet

COSTS		
System Size (kW)	1	
Installed Cost/Watt	$8.50	
System Installed Cost		$8,500.00
ADJUSTMENTS		
State Rebate/W		
State Rebate Total		
GRU Rebate/W	$0.00	
GRU Rebate Total		$0.00
Total Install less rebates		$8,500.00
Federal ITC Rate	30.00%	
Federal ITC Total		$2,550.00
IRS Tax Rate	35.00%	
IRS 179 Depreciation		$2,528.75
Net Installed Cost		$3,421.25
RATES		
GRU Discount Rate	6.00%	
Base Energy Rate/kW	$0.2644	
Annual Energy Rate escalation	0.00%	
Internal Rate of Return (20)	6.43%	
ROI	11.56%	
Base Capacity Factor	17.00% (PV Watts reference 15.5-19.5)	
Annual Degradation	0.80% (from California PUC and EIA)	

PAYBACK SCHEDULE

YEAR	Energy Rate	GRU Payment	KWH	Capital + O&M Cost	Production Tax Credit	Annual Net
0				-3,421.25		-3,421.25
1	0.2644	$393.74	1489.20	-25.00	$26.81	$395.55
2	0.2644	$390.59	1477.29	-25.00	$26.59	$392.19
3	0.2644	$387.47	1465.47	-25.00	$26.38	$388.85
4	0.2644	$384.37	1453.74	-25.00	$26.17	$385.54
5	0.2644	$381.30	1442.11	-25.00	$25.96	$382.25
6	0.2644	$378.24	1430.58	-25.00		$353.24
7	0.2644	$375.22	1419.13	-25.00		$350.22
8	0.2644	$372.22	1407.78	-25.00		$347.22
9	0.2644	$369.24	1396.52	-25.00		$344.24
10	0.2644	$366.29	1385.35	-1,000.00		-$633.71
11	0.2644	$363.36	1374.26	-25.00		$338.36
12	0.2644	$360.45	1363.27	-25.00		$335.45
13	0.2644	$357.56	1352.36	-25.00		$332.56
14	0.2644	$354.70	1341.54	-25.00		$329.70
15	0.2644	$351.87	1330.81	-25.00		$326.87
16	0.2644	$349.05	1320.16	-25.00		$324.05
17	0.2644	$346.26	1309.60	-25.00		$321.26
18	0.2644	$343.49	1299.13	-25.00		$318.49
19	0.2644	$340.74	1288.73	-25.00		$315.74
20	0.2644	$338.02	1278.42	-25.00		$313.02
TOTAL		$7,304.17	27625.47			$2,539.82
NPV		$4,252.84	16084.86	-3,442.15		$105.31

Inverter replacement at 10 years; $1 per watt

Levelized Energy Payout Including Rebates	$0.26 per kWh

Definitions

Degression
The reduction of the Solar FIT applicable in a given year to reflect anticipated improvement in PV system costs and to promote innovation and early adoption.

Equivalent Levelized Cost (LC) of Energy
The net present value (cost) per kilowatt-hour of energy over the entire course of the program, including solar rebates, the tariff value of net metering payments (for the GSN customer category), and an assumed escalation rate for the net metering payment.

General Service, Non-Demand (GSN) tariff
The standard non-demand rate at which most (relatively small) business-class customers purchase energy from GRU.

Grid Parity
The point in time at which a FIT becomes equal to the average retail rate.

Net Metering Payment ($/kWh)
A tariff for excess solar production delivered to GRU. This tariff is based on the average retail non-fuel base energy rate for each customer class, plus the monthly fuel adjustment.

Rebate
An upfront cash subsidy based on the size of the installed capacity without respect to energy produced.

Solar Feed in Tariff (Solar FIT)
An energy-based rate structure under which all energy produced by the solar panel installation (PV system) is purchased by GRU (as in a purchase-power agreement). Unlike net metering, under this tariff the PV system provides power directly to GRU and is not associated with a host utility account.