Question:

What DG tariff will create fair and reasonable cost allocation for DG customers?

Conclusion:

DG customers are allocated more costs as compared to Non-DG customers for all classes and all rate structures. Therefore, a credit should be given to DG customers for the power they produced. DG customers should not have a special rate class but simply a credit for the services provided and savings created for the power produced and KW capacity provided.

Discussion:

Customers with solar generation not only reduce their energy usage but also create grid support, reduce transmission cost for all customers, reduce costs for the utility energy generation (especially peak energy generation), reduce utility capacity requirements, reduce outages, and increase power quality.

Since costs are allocated to the different elements of each rate structure, we analyzed each rate of each structure against the average sized customer for each rate class. This provides a significantly more accurate cost allocation analysis without having each customer usage and production set against each customer rate.

Simulations were run for the average DG customer in each class (monthly or hourly (for rates with time of use)) and compared to the non-DG customer cost (thus cost allocated). Since costs are allocated to

- Energy,
- Demand and Capacity,
- Distribution,
- System Access Charge,

each part of each rate in each class simulation determined how much the average non-DG customer cost then subtracted how much the DG customer would save by having solar in the same rate structure as compared with the same calculation using each part of each rate structure as written in the rate book. The parts analyzed are Energy (straight and time of use), Demand (straight and time of use), distribution (kWh and KW) and system access charge. The result of each analysis yielded a dollar amount which was then divided by kWh or KW to create a credit for each part.

Since each customer may have a different sized system and different usage the tariff credit should indexed against usage and saving instead of creating "one-size fits all" average annual credit which would over allocate savings to the smallest system and penalize the largest.

There are 4 parts to the DG Tariff credit that should be implemented.

Energy created and used by the DG customer should be treated much like energy efficiency and should offset their energy cost directly. Excess energy generated should be credited based upon the time of day and/or year produced, as should the energy used. The savings created through the direct reduction of fuel, labor and other costs should be allocated to the DG customers that generate those savings.

Demand charges allocate costs mostly for generating equipment. Solar systems are generating equipment and should be credited based upon the AC size of the solar system weighted for time of day and/or year of solar power produced. This is because the generated power reduces costs for the entire system and costs reduction should be allocated to the customers that generate those savings. Solar is also a complementing generating technology to wind. Wind produces more power during the night and winter. Solar produces more power during the day and summer that are peak demand times. If solar is not installed at scale with wind (EIA reported 2015 wind generated 1,660 times more power than solar) than other non-baseline generating technologies must be operated and are the most expensive to own and operate. Thus the utilities almost exclusive installation of wind to meet the RPS has created a great and expanding need for solar to offset the most expensive power generated and purchased.

Distribution costs for the utility are greatly reduced by solar because solar produces power when the grid is most stressed, reduces line losses, improves power quality and increases distribution capacity at critical times thus also reducing the need for additional investments in distribution infrastructure. Present cost allocation charge distribution for produced by DG customers. This is the complete opposite of the savings created by distributed generation. Solar power generated should be credited for distribution offsetting the rates plus the savings created above. However this presentation only recommends correcting the rate book specific distribution charge for DG generation by an offsetting distribution credit.

Service Charge for a DG customer in proportion to non-DG customers grows as usage is reduced. Average residential DG customer often generate nearly 100% of annual consumption, thus the customer charge is nearly all of their bill thus the DG customer is being overcharged for customer charges. Service charges should therefore be based upon the % of the average usage in the class.

Cost of Service Credit Computations

Result of calculations are as follows (negative numbers are credits), Energy tariff (retail rate plus credit indicated) is based upon kWh generated and is weighted averages for time of generation on each rate and Demand tariff is weighted average based upon kW size of system and service charge by average net annual savings by class:

Class	Energy kWh generated	Delivery kWh generated	Demand or Capacity PV system size credit	System access charge Per customer
RS	<$0.01602/kWh>	<0.047220/kWh>		<$6.93>
RDP	<$0.13854/kWh>	<0.047220/kWh>		<$6.93>
Exp Plug-in	<$0.13927/kWh>	<0.047220/kWh>		<$6.93>
RT	<$0.03053/kWh>	<0.047220/kWh>		<$6.93>
GS	<$0.07255/kWh>	<0.042154/kWh>		<$8.60>
GSTU	<$0.08946/kWh>	<0.042154/kWh>		<$8.60>
GSD	<$0.04610/kWh>	<0.030042/kWh>	<$9.82411/KW>	<$12.90>
GP (CVL 1)	<$0.06959/kWh>	<0.047220/kWh>		<$0.40>
GP (CVL 2)	<$0.07459/kWh>	<0.047220/kWh>		<$0.40>
GP (CVL 3)	<$0.07279/kWh>	<0.047220/kWh>		<$0.40>
GDP (CVL 1)	<$0.02291/kWh>		<$20.72382/KW>	<$0.80>
GDP (CVL 2)	<$0.02791/kWh>		<$22.65348/KW>	<$0.80>
GDP (CVL 3)	<$0.02613/kWh>		<$24.66541/KW>	<$0.80>

Energy rates allocate cost based upon usage. The rate book indicates that energy rates credit power outflow at LMP. Therefore, energy outflow is over cost allocated to DG by the difference between LMP and energy rate at the time generated.

Delivery is cost allocated by kWh (except GDP where it is allocated on KW and therefore has been added to demand over allocation credit). All rates in all classes state that delivery charged for energy self generated. No delivery has taken place thus this part of the rate is over charged and thus over cost allocated. The result is that DG customers should be credited for all kWh generated (and KW size of DG system for GDP rate users).

Commercial and industrial DG customers have such small proportion of generation to usage that almost zero reduction in Demand or Capacity charges results. Solar reduces peak demand of the utility though it does not reduce Demand or Capacity charges for the DG commercial / industrial customer because commercial and industrial users have demand in hours that extend into the evening, night and early morning when no Energy is produced by Solar. Thus the positive impacts on utility costs are not reflected in these rates and Demand and Capacity size of the DG system should be credited on a weighted rate at the time generated.

System access charge should be charged in proportion to energy used. DG customers provide grid support, improve power quality, reduce outages, reduce operating and legacy environmental costs and positively impact the air and water quality. These cost savings benefit all customers but these cost savings are not allocated to DG customers. A credit against System Access Charge should be credited in proportion to the DG customer’s % of usage offset by solar generation.

Institute for Energy Innovation produced a report June 2017 that evaluated more than 40 solar studies analyzing the economic impact of solar on non-DG customers. The results indicate Net Metering does not fully compensate DG customer for the true costs and benefits generated by these customers and there should be a credit in the range of $0.0356 to $0.3360/kWh.
https://docs.wixstatic.com/ugd/371a41_1838db18923e4eb3a48712bbef91fef7.pdf

This DG tariff creates an opportunity for MPSC to finally treat solar customers fairly and to push Distributed Generation forward and decrease costs (both for customers and utilities), improve power quality, decrease pollution, and allow customers to be competitive with other companies that are more sustainable. As DG customers begin to install smart inverters, power quality will improve, as well as the stability and reliability to the grid. These factors are not included in the cost allocation but are reasons that the implementation of solar will continue to grow in importance. The credits created in this work group should be adjusted as market penetration, technologies, cost allocation and rate structures change.

This is a watershed moment for the MPSC, who has been given a rare opportunity to pave a path to a more sustainable future and not just implement the legislation handed to it.

Assumptions: Due to lack of data on usage and cost allocation from the utilities in the state, we used data gathered about Michigan by the DOE and disseminated by the EIA.

Creating a Tariff for the average DG customer for each rate is a balance between a tariff for the DG customer and an overall class average. The most accurate tariff analyzes the usage and generation against the rate class and then the costs allocated by each DG customer, but this methodology would be very difficult to implement. Cost allocation for customers with rates that include demand charges are very different than energy rate customers. Therefore, we analyzed the average DG customer usage and generation to create an average tariff for each rate in each class, thus creating a methodology for future tariff adjustments as the average DG customer changes.

Since the number, size and use profile of DG customers change over time and cost allocation will change every year with changing generation and operating cost as well as generating technology, we believe that the most “fair and reasonable” cost allocation will be adjusted annually using the methodology developed under this legislation.

Ave DG Customer system in MI in each class, derived from DOE information.

	Residential	Commercial	Industrial
Solar size MW	0.00728	0.02652	0.0240
Ave Usage MWh	8.08	74.57	7189.82
Est. Ave % offset	~100%	~43%	~0.4%

Background

"*Utilities are increasingly considering alternative rates structures that are designed to recover fixed utility from residential PV customers with low net electricity consumption…Demand charges resulted in an increase in utility bills of 35% or higher for PV customers in three of the five utilities evaluated…. The impact of demand–based rates on customer bills critically depended on the rate design, load profile and coincidence of PV production with load."* Ref NREL Impact of Rate Design, "Alternatives on Residential Solar Customer Bills: Increased Fixed Charges, Minimum Bills and Demand-Based Rates"

This legislation requires the commission to create a tariff that cost allocates in a "fair and reasonable" manner for DG customers. This work group should recommend to the commissioners a structure to "fair and reasonable" cost allocation. We consider this to mean equal cost allocation between DG customers and non-DG customers as "fair and reasonable." We believe their needs to be cost allocation strategies for customers with demand charges and for those who don't and not a "one size fits all" kWh credit.

DG customers will, for the foreseeable future, be a very small fraction of power generated in the utility territories. DTE's 1,109 residential net metering solar customers (cumulative total of about 4.5 MW) represent only 0.02% of DTE generating capacity. DTE installed over 50 MW in 2017 and according to their website will add 66 MW of solar by 2022. Even if solar adoption grows quickly, it will take years and years to pass 1% of generating capacity in the state while the utilities will grow their own solar (and other renewable energy) capacity much faster. Thus, cost allocated to DG customers will remain very small.

Douglas Jester of 5 Lakes Energy described very well why cost allocation for inflow should be equally credited for outflow and that even with this structure the DG customers are paying more than their fair share of the costs allocation.

Chuck Putman, Robert Ozar and Julie Baldwin presented for MPSC staff that cost allocated using inflow/outflow method of rate structure over cost allocated to residential DC customers (for DTE's 1,109 residential DG customers) by \$106/yr/customer. Thus, staff determined there should be a credit of \$0.0185 /kWh. This is very close to our analysis of Consumers residential RS rate \$126/yr/customer:
RS Credit \$0.06324/kWh (\$0.01602/kWh Energy plus \$0.047220/kWh Delivery), **RDP Credit \$0.18576/kWh** (\$0.13854/kWh plus \$0.047220/kWh Delivery), and **R Experimental Plug-in Credit \$0.18649/kWh** (\$0.13927/kWh plus \$0.047220/kWh Delivery).

Methodology

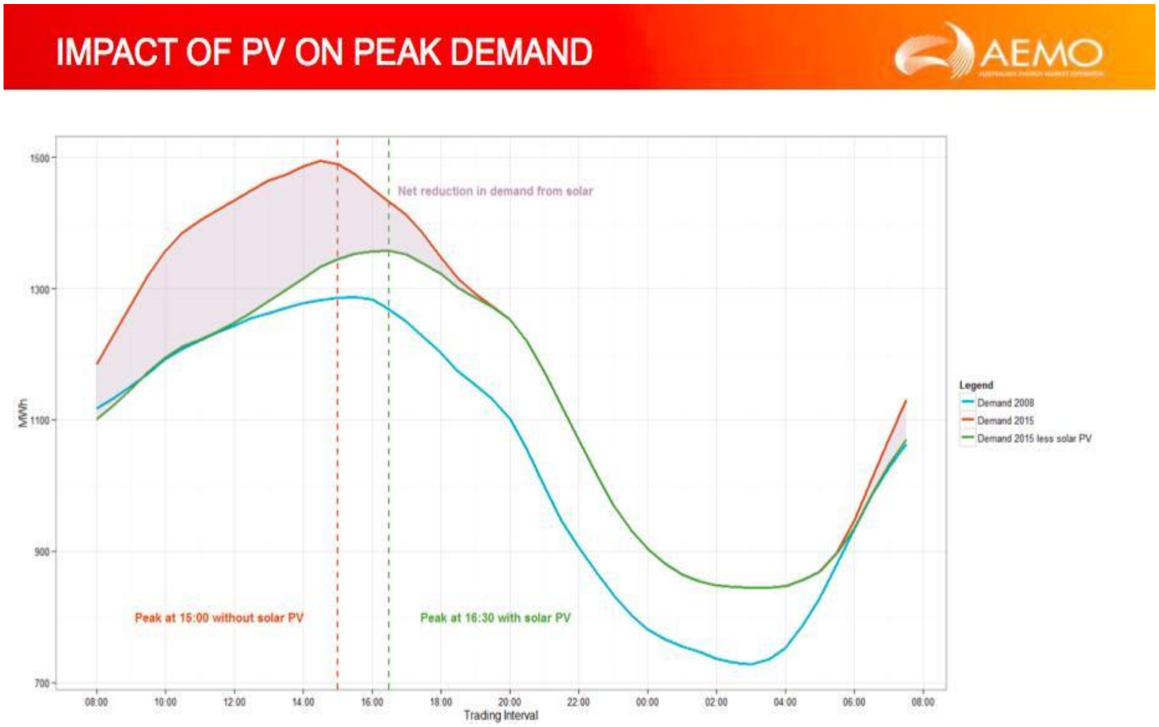
The calculation we have made take the present rate book (this analyses Consumers rate book) and determines the customer cost reduction, based upon the average DG customer in each class and the % of offset achieved, and then determined the amount each customer would actually be charged, and the difference is the overcharge thus resulting in a credit per kWh or KW for each rate structure.

Residential Customers

Energy - a customer's reduction in energy use results in reduction in energy producing or purchasing by the utility thus reducing related costs, including equipment costs (generating capacity) and displacement of peak load as well. These cost savings should be allocated to the customers that create those savings, as opposed to everyone benefiting from the solar customer's investment--or worse, the utilities not recognizing the savings in their calculations, and pocketing the savings.

An electron does not know from what source it came from, and therefore, any energy savings should be equally cost allocated by use (inflow) and generation (outflow). This factor does not require any special consideration because it is fairly and reasonably cost allocated if all electrons are treated equally and the cost allocation is equal for inflow and outflow, if the utilities have true net metering for all sized systems but they don't. The resulting credits shown in the calculation provide the appropriate credit to offset utility rate book inequalities.

Time of use rates should allocate costs at the amounts the rate structure indicates. Since all customers should be treated equally, the power generated should offset the rates indicated. It would be most accurate to analyze each customer's usage and generating profile to create the resulting cost allocation. But an easier method is to analyze the average customer in the class and calculate the resulting savings against billing described in each rate to determine the average kWh savings, indicated in the resulting calculations chart.



Until the percentage of energy generated from solar is hundreds of times more than it is at present, solar production will offset peak usage. The 0.02 % of the total generation in Michigan that comes from solar is less than the thickness of the red line in this graph.

Renewable energy, Energy Efficiency, Low-Income Assistance Surcharges
There is no surcharge on renewable energy, and this is appropriate since it is cheaper than conventional thermal generating technologies. Energy efficiency costs should be shared equally among all customers as it is now, and the same goes for low-income assistance.

Distribution - Customers with solar capacity provide the utilities with increased transmission and distribution capacity, decreased transmission and distribution losses, and other grid support such as frequency and voltage balancing from smart inverters. This results in lower distribution cost for all customers and reduced infrastructure expansion and maintenance. All of which should go against the distribution charge on customers with solar power. Solar generates more during the summer, thus the positive impact to the grid should translate to more than cost avoidance. Thus it is “fair and reasonable” to reduce distribution costs based upon the total monthly kWh reduced (generated).

System Access Charge - since it is a fixed amount for all residential customers, the system access charge overcharges customers who reduce their usage and motivates waste. As a customer reduces energy costs and/or produces energy to further reduce energy consumption, the system access charge becomes a larger and larger percentage of the customer’s bill. If all customers are cost allocated equally as part of this charge, then those efficient and/or DG customers become more and more disproportionately cost allocated as their % of their bill goes to the System Access Charge.

We recommend that the System Access Charge be eliminated and put as part of the energy and distribution charge and cost allocated in that way. If the System Access Charge remains, then the overcharge to the DG customer should be included in the credit calculated for the DG customer. We believe the fair and reasonable System Access Charge should be the customer % of renewable energy to overall usage times the System Access Charge. For DTE, the charge is $6/month x 12 months = $72 and at present the average DG / Net metering customer has savings of nearly 100% offset of annual energy usage therefore cost allocated to this cost allocator over charges DG customers.

Adopting this methodology does not penalize those who choose to reduce their energy usage and puts them on an equal cost allocation with every other customer. In fact, it makes sense even in the extreme. If a customer chooses to go to completely net zero (off grid) then their System Access Charge would be zero because they are not connected to the grid. Even further since solar provides grid support, reduced utility peak demand (thus reducing utilities' peak power needs, peak power purchases), and complementary power generation to wind (rapidly being implemented in MI).

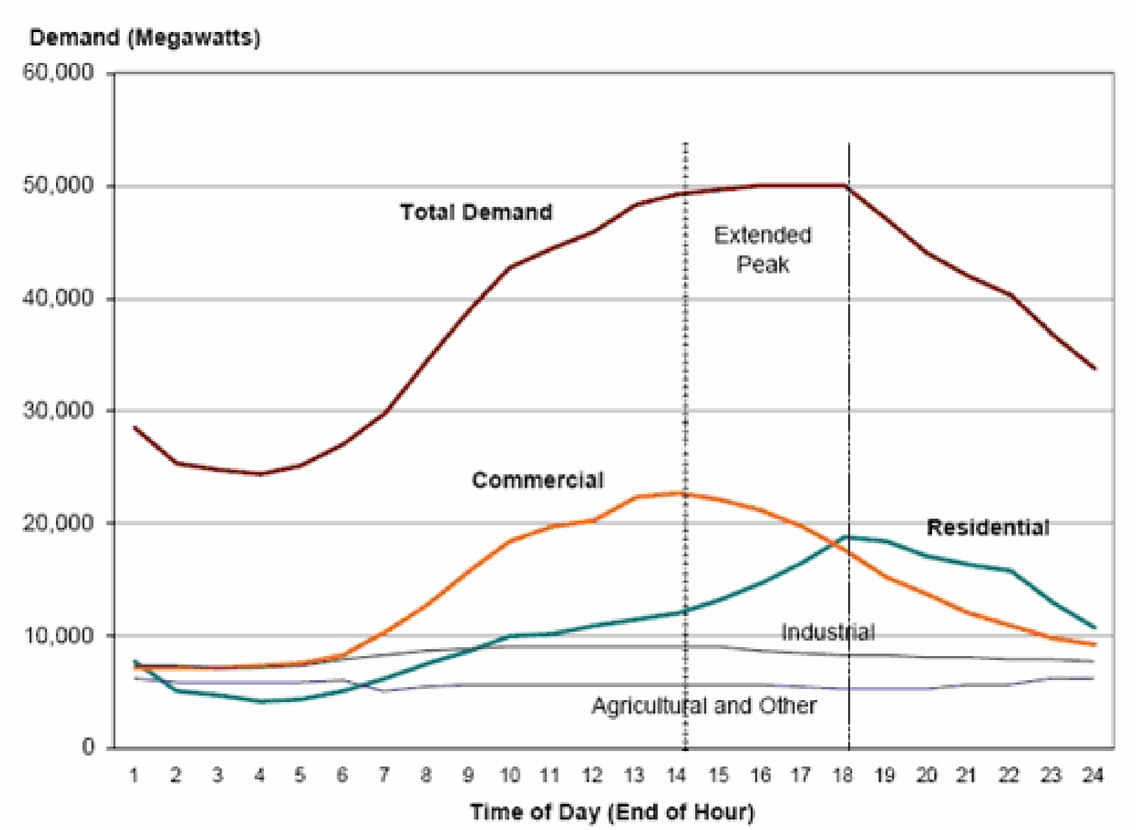
Commercial Customers

Energy – DG customer's reduction in energy use results in reduction in energy producing or purchasing, including equipment costs (generating capacity) and displacement of peak load. Time of use rates allow the utilities to recover higher energy costs at peak times. Solar should be credited for offsetting those same higher costs. Similarly to other classes, it would be most fair to analyze the generation of power and the resulting cost allocation, but this could be very challenging to implement. We recommend an annual average customer analysis against that year's cost allocation, rate structure, average customer generation profile, and resulting in a DG credit for those customers with solar.

Capacity Requirements – Utilities count DG customer generating capacity in their purchase of power. Because DG generating capacity is installed in their territory, they are able to purchase less capacity, reducing their overall purchase price of power. Therefore, solar generation capacity reduces the cost of service and should be credited for the KW size of the system.

Demand – Demand and time of use demand charges represent 60.4% of cost allocations. Thus this is the most important cost allocation. Solar generates power during peak power usage especially during the summer, closely following commercial annual and hourly usage patterns, thus reducing overall utility demand and capacity requirements. However, the measurement of peak is over a short period and ratcheted annually, thus DG customers have very little if any reduction in demand and therefore are not credited for any reduction in cost the utilities enjoy. The result is that DG customers on a rate that has a demand charge are over charged by the amount they generate.

For this reason, we believe that the DG customers should be credited for the generating capacity (KW) of the system. This should be credited against their demand charges.



Source: Lawrence Berkeley National Laboratory Aggregate (Community) Electricity Consumption Summer 1999 California.

As shown in this chart the commercial demand curve follows the solar very nicely and since the commercial nearly equals residential usage the overall power demand of the utilities are smoothed out considerably, creating an extended peak. Solar generates power over that extended peak.

Renewable energy, Energy Efficiency, low-income assistance Surcharges – There is no surcharge on renewable energy and this is appropriate since it is cheaper than conventional thermal generating technologies. Energy efficiency costs should be shared equally amounts all customers as it is now and the same goes for low-income assistance.

Distribution - Customers with solar capacity provide the utilities with increased transmission and distribution capacity, decreased transmission and distribution losses, and other grid support such as frequency and voltage balancing from smart inverters. This results in lower distribution cost for all customers and reduced infrastructure expansion and maintenance. All of which should go against the distribution charge on customers with solar power. Solar generates more during the summer thus the positive impact to the grid should translate to a greater than cost avoidance. Thus it is “fair and reasonable” to reduce distribution costs based upon the total monthly kWh reduced (generated).

System Access Charge - since it is a fixed amount for all commercial customers, the System Access Charge overcharges customers who reduce their usage and motivates waste. The System Access Charge should be reduced by the % of reduction in energy created by the solar because they use less of the costs allocated to this charge.

Industrial Customers

Energy – DG customer’s reduction in energy use results in reduction in energy producing or purchasing, including equipment costs (generating capacity) and displacement of peak load. Time of use rates allow the utilities to recover higher energy costs at peak times. Solar should be credited for offsetting those same higher costs. Similarly to other classes, it would be most fair to analyze the generation of power and the resulting cost allocation but this could be very challenging to implement. We recommend an annual average customer analysis against that year’s cost allocation, rate structure, average customer generation profile and resulting in a DG credit for those customers with solar.

Peak Demand Charge - Solar energy only impacts usage during daylight hours (first shift), but industrial energy usage is relatively uniform throughout the entire day (first, second, and third shifts), therefore costs allocated through demand charges are disproportionately higher on DG customers than non-DG customers. Industrial customers have very uniform usage throughout the day and year. Since solar only produces power during daylight hours max peak power measurement is not shaved at all because the max peak measurement can be at any hour there is not solar production.

Peak is the instantaneous maximum usage during a period (month or year), we have found that demand charges are rarely if ever lowered by solar even though solar provides power during on-peak periods, thus reducing peak power purchases, peak power generation, peak capacity requirements, and grid losses. Therefore, a customer with solar is being overcharged for demand-allocated costs--which equates to a solar tax. In reality, the value that solar customers add to the grid outweighs the costs of providing utility service to them, so they should be credited and not charged.

As stated before, the reduced costs the utility benefits from should be allocated to the customer that produces them. Thus peak power cost allocation should credit customers based on the size of their solar array.

Renewable energy, Energy Efficiency, low-income assistance Surcharges – There is no surcharge on renewable energy and this is appropriate since it is cheaper than conventional thermal generating technologies. Energy efficiency costs should be shared equally amounts all customers as it is now and the same goes for low-income assistance.

Distribution - Customers with solar capacity provide the utilities with increased transmission and distribution capacity, decreased transmission and distribution losses, and other grid support such as frequency and voltage balancing from smart inverters. This results in lower distribution cost for all customers and reduced infrastructure expansion and maintenance. All of which should go against the distribution charge on customers with solar power. Solar generates more during the summer thus the positive impact to the grid should translate to a greater than cost avoidance. Thus it is “fair and reasonable” to reduce distribution costs based upon the total monthly kWh reduced (generated).

System Access Charge – since it is a fixed amount for all industrial customers, the System Access Charge overcharges customers who reduce their usage and motivates waste. The System Access Charge should be reduced by the % of reduction in energy created by the solar because they use less of the costs allocated to this charge. The average Industrial solar customer offsets only 0.04% of the usage thus the System Access Charge reduction should be very small.

Solar investments are made in order to reduce electricity costs, but existing rate structures pass a portion of the savings on to the utility instead of the DG customers who make the solar investments. Current cost allocation does not take into account the value that solar adds to the grid, and therefore, overcharges DG customers. These overcharges, together with caps on system size, are limiting the implementation of a technology that benefits everyone.

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