# Homer Electric Association

Considerations for Net Metering

October 8, 2024

Michael L. Jones

Homer Resident

HEA Member

# Net Metering

Intermittent renewables like wind and solar have a place in our energy portfolio.

It is fruitful to pursue adding these resources without overpaying for them with outdated Compensation methods that subsidize net metering customers at the expense of those who don't net meter.

Getting it right now, while participation is on the lower end of the scale, is the right path as existing net metering customers will likely be "grandfathered" with the existing Compensation mechanism.

We can't "un-ring the bell" if we get it wrong.

# Net Metering Flaws

This presentation demonstrates flaws associated with Net Metering Compensation for customer solar generation to facilitate discussions on the future of Net Metering.

Some argue that the impact is small and therefore can be ignored. The proper approach is to seek to understand the facts and recognize that any flaws in existence today, will only be exacerbated as more intermittent renewables are added to the Grid. We can learn from other states who are much farther down the road in this matter.

There were no fewer than 5 separate pieces of legislation in the 2023-2024 session, all (erroneously) seeking to require utilities to expand the use of intermittent renewable resources using Net Metering as the compensation mechanism.

# Net Metering Flaws: Compensation

The concept of Net Metering has two components for Energy produced and consumed:

1. Interconnection
2. Compensation

While there are important Interconnection issues to consider with Net Metering (community solar, for example), this presentation will focus on the Compensation flaws associated with Net Metering for customer solar generation. These flaws result in a direct subsidy being paid by non-solar customers to solar customers.

Other forms of intermittent renewable generation resources used in Net Metering have similar flaws.

# Net Metering Flaws: Compensation

The Net Metering Tariff has at least 4 Major Compensation Flaws:

1. **Compensation for Offsetting Use**
2. **Compensation for Excess Energy Produced**
3. **Credits for Excess Energy Don't Expire**
4. **No Additional Fees For Providing Defective Power to the Grid (Leaning on the Grid)**

We'll look at each one separately

We will not focus on the arguments advocating for or against customer solar based on environmental or other benefits, although I am willing to participate in a separate discussion on that matter at your convenience.

# Net Metering Flaws: Recommendations

Finally, I provide 10 recommendations based on a "soup to nuts" review of customer billing to identify and propose modifications that would eliminate subsidies inherent in net metering, including:

1. **Energy Charge (Price)**
2. **Energy Charge (Quantity)**
3. **Energy Charge (Quantity, Time-of-Use Mismatch)**
4. **Customer Charge**
5. **System Delivery Charge**
6. **Minimum Demand Charge**
7. **Cost of Power Adjustment**
8. **Regulatory Cost Charge**
9. **ERO Charge**
10. **Sunset legacy net metering when property changes hands**

# Net Metering Flaws: Compensation for Offsetting Use

RCA No. 32, Sheet No. 28.2, Tariff Advice No. 412-32 Effective: February 11, 2019

*Billing. For each Member participating in the Net Metering Program, the Association shall measure the net electric energy during each Billing Period.*

1) *If the Association supplied more electric energy to the Member than the Member supplied to the Association during the monthly billing period, it shall bill the Member for the number of kilowatt hours of Net Electric Energy supplied by the Association to the Member at the applicable rates contained in the Association's currently effective tariff;*

This says the **Value** of the energy products produced from a customer solar system is identical to the **Value** of the energy products received from the grid and the Member's bill is reduced one-for-one based on net kWhrs .

The **Quality and Quantity** of these two products is DEEMED to be the same, consequently the kWhr credit is grossly over valued.

# Net Metering Flaws: Deemed Quality Example

**House No. 1**

4-Bedroom, 3 Bath with running water
Radiant Floor Heating, Fully insulated
Gas, Electricity
2 car heated garage
Figuratively 4 walls, a Roof, and a Bed

**House No. 2**

1-bedroom dry cabin with Outhouse
Wood stove, No Insulation
No Gas. No Electricity
Kerosene Light
Literally 4 walls, a Roof, and a Bed

**House No. 2 is <u>Deemed equal in Quality</u> of Experience (comfort/convenience) to House No. 1**

# Net Metering Flaws: Deemed Quality and Quantity Examples

The two following slides illustrate the Deemed Quality and Quantity Flaws (Equivalent Commodity Fallacy) associated with net metering.

Equivalent Commodity Fallacy: electricity produced from customer solar is identical in both **Quality and Quantity** as other forms of electricity produced on the Grid and therefore deserves to be Compensated as such.

Example 1: Equivalent Commodity Fallacy for Water from a well

QUESTION: If I produce 1,000 Gallons of raw water from my well, should I be able to ship that water to the city of Homer for them to return 1,000 gallons of pure drinking water in return, for virtually no cost?

Example 2: Equivalent Commodity Fallacy for Net Energy Metering

# Well Water Example: Offsetting Use

Well Pump

1,000 gallons

1,000 gallons

Meter

Defective Elements:
Sediment
Iron
Sulphur
Arsenic
Lack of Storage
- Time of Production-Time of Use Mismatch
- Low Pressure

Processing to Remove Defective Elements:

Leakage

Sediment

Iron

Sulphur

Arsenic

Storage

Deemed Equivalent Quality, and Quantity

Credited as 1,000 Gallons

Meter

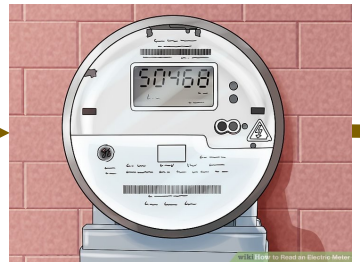
Less than 1000 gallons

The water treatment systems have processed the defective elements out

# Rooftop Solar Example: Offsetting Use

Solar Panels

1,000 kWh



1,000 kWh

Inertia

Meter

Deemed Equivalent Quality, and Quantity

Credited as 1,000 kWh to offset household use

Meter

Less than 1,000 kWh

The Grid has processed the Defective elements out

Defective Elements*:
No Inertia (flywheel effect)
Line Loss
Intermittency
Lack of Ancillary Services
- Regulation Up/Down
- Voltage/VAR, SR, DA, BS
- Time of Production-Time of Use Mismatch

* See Appendix No. 1

Storage: 80% round trip efficiency

Processing to Remove Defective Elements:

- Line Loss, and Transformation
- Intermittency
- Regulation
- Voltage/VAR
- Synchronized Reserve, Day Ahead, Black Start

# Rooftop Solar Example: The Equivalent Commodity Fallacy

Solar Panels

1,000 kWh

Defective Elements:
No Inertia (flywheel effect)
Line Loss
Intermittency
Lack of Ancillary Services
- Regulation Up/Down
- Voltage/VAR, SR, DA, BS
- Time of Production-Time of Use Mismatch

The best way to demonstrate the fallacy is to disconnect the house from the grid and observe the usefulness of the intermittent solar resource in absence of the grid.

- Is the home network "stiff" enough to support operation of motors?
- Can you depend on sufficient continuous energy to complete a load of laundry?
- Do you modify your lifestyle to fit into the limits of your electrical supply?

Can the homeowner depend on the energy supply to be sufficient to operate a **any household appliance, any time of the day or night without some other source of energy?**

**If not, the homeowner is "Leaning on the Grid" and not simply "Offsetting Use".**

# Net Metering Flaws: Compensation for Excess Energy

RCA No. 32, Sheet No. 28.2, Tariff Advice No. 412-32 Effective: February 11, 2019

*Billing. For each Member participating in the Net Metering Program, the Association shall measure the net electric energy during each Billing Period.*

2) *If the Member supplied more electric energy to the Association than the Association supplied to the Member during the monthly billing period, it shall credit that Member's account with an amount derived by multiplying the kilowatt hours of Net Electric Energy supplied by the Member to the Association by the Small Facility Power Purchase Rate (Schedule 9, Sheet 87.1), unless a different rate has been established in a Commission-approved contract;*

This says the **value** of the energy products produced from a customer solar system is identical to the **value** of the energy products produced by REAL generators connected to the grid and the member is paid the same rate that a REAL generator would be paid.

The **Quality and Price** of these two dramatically different products is DEEMED to be the same, consequently the dollar credit is grossly over valued.

# Net Metering Flaws: Compensation for Excess Energy

**A core principle for co-op electricity pricing is cost-of-service ratemaking.**

A fundamental flaw in Net Metering Compensation is the **artificial pricing scheme** used to establish the price for Customer Solar delivered to the grid.

*Schedule 9 on Sheet Nos. 87 and 87.1 of the tariff details out the rate that is used for Excess Energy produced from a homeowner's solar panels. The price for this Excess Energy is "at a rate equal to the avoided cost of fuel, variable operations and maintenance, and purchased power (**SFPPR**)".*

The price paid is currently **9.819 c/kWh.**

**It's interesting to note that the rate used for compensation exceeds the COPA rate*.**

* COST OF POWER ADJUSTMENT (COPA): The COPA rate was established to recover the cost of fuel, purchased power and other fuel-related costs. This line reflects the most current COPA rate and is multiplied by the number of kilowatt hours (kWh) used at the location during the billing period. Rate fluctuations may occur on a quarterly basis predominately due to changing costs of fuel

# Net Metering Flaws: Compensation for Excess Energy

**SFPPR** originates from a decades old principle for utilities to transfer energy between each other in a fair manner.

Under cost-of-service ratemaking, a utility would typically cover all the fixed costs of production and ownership through their rate base. Consequently, the incremental cost of energy transferred from one utility to another was Fuel and Variable O&M (VOM). On the West Coast, these transfers were typically performed by oil and gas fired generating resources as they were the marginal load following resources on the grid. This construct prevented utilities from "double recovering" costs authorized under cost-of-service ratemaking.

The Net Metering compensation in the Tariff does not use cost-of-service ratemaking principles for the Customer Solar Resources.

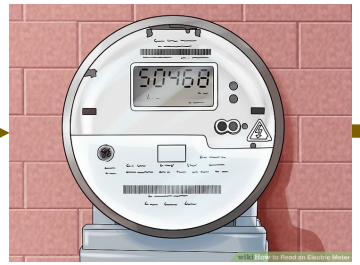
FLAW 1: The tariff DEEMS the QUALITY of the energy produced from a customer solar installation to be EQUAL to the QUALITY of the energy produced by other means.

FLAW 2: The tariff DEEMS the incremental COST of the energy produced from a customer solar installation to be EQUAL to the incremental COST of the energy produced by other means. The **actual** incremental cost for rooftop solar is **virtually ZERO**.

# Rooftop Solar Panel Example: Excess Energy

Solar Panels

500 kWh Excess Energy



Meter

500 kWh

Inertia

Defective Elements:
No Inertia (flywheel effect)
Line Loss
Intermittency
Lack of Ancillary Services
- Regulation Up/Down
- Voltage/VAR, SR, DA, BS
- Time of Production-Time of Use Mismatch

Storage: 80% round trip efficiency

Processing to Remove Defective Elements:

- Line Loss, and Transformation
- Intermittency
- Regulation
- Voltage/VAR
- Synchronized Reserve, Day Ahead, Black Start

Less than 500 kWh

Quality: Deemed to be the same as REAL generators

Price: Paid at 9.819 c/kWh

Quantity: Deemed to be 500 kWh

The Grid has processed the Defective elements out

# Net Metering Flaws: Deemed Variable Cost Example

**House No. 1**

Monthly variable cost to operate: $500

Usage charges for Gas, Electricity
Water and Sewer

**House No. 2**

Monthly variable cost to operate: $50

Kerosene for Lighting

**House No. 2 is <u>Deemed equal in Variable Cost</u> to House No. 1 and is compensated based on the cost structure of House No. 1**

# Net Metering Flaws: Billing for Offsetting Use and Excess Energy

The energy crediting process is flawed for both Offsetting Use and Excess Energy.

Fundamentally, there are two separate transactions taking place, but for convenience, they are DEEMED to be one transaction:

1. The customer **consumes** energy from HEA with all the associated charges including:
   - Energy Charge (Full Price for energy consumed like any other customer)
   - Customer Charge,
   - System Delivery Charge,
   - COPA, Regulatory Cost Charge,
   - ERO Surcharge and
   - Borough Sales Tax.

2. The customer **produces** energy for HEA which should include:
   - Energy Charge (Excess Energy Price reduced commensurate with value)
   - Incremental Customer Charge,
   - Incremental System Delivery Charge,
   - Regulatory Cost Charge,
   - ERO Surcharge
   - Borough Sales Tax , and
   - City Sales Tax (if applicable).

# Net Metering Flaws: Billing for Offsetting Use and Excess Energy

We know what the price for consumed energy is...what should the price for produced energy be?

Let's learn from California. They recently realized they have subsidized rooftop solar owners—for years.

California utilities modified their program to recognize that the energy produced from intermittent renewables is far less valuable than what they were historically paying.

They have now implemented a new rate structure that reinforces that net energy metering for rooftop solar (in particular) **needs to have energy storage in place**.

The quote on the following page acknowledges that the California utilities have historically been overpaying for their low value intermittent renewable generation by over 6 times—HEA's overpayment may be even greater due to the difference in daily and seasonal demand.

If we apply the California overpayment factor to the price paid for rooftop solar in HEA, the value is **reduced from 9.819 c/kWh to 1.637 c/kWh.**

# Net Metering Flaws: Billing for Offsetting Use and Excess Energy

The following is an excerpt from an article published by PG&E, dated December 13, 2023:

*The new Net Billing Tariff (NBT) encourages the continued growth of rooftop solar and incentivizes customers to add battery storage to solar systems to help make the state's electric grid more sustainable and reliable. The new NBT also provides a more equitable solution for non-solar customers, oftentimes lower income customers, who pay higher rates resulting from the NEM cost shift. Electricity customers in California without solar are paying over $5 billion more annually in their electric bills as a result of NEM. This cost shift will still grow under NBT, albeit by a significantly reduced amount...While the NEM 2.0 paybacks were shorter for standalone solar (as low as three years in San Diego), these were only possible by compensating solar exported onto the grid at rates over six times the value, creating a substantial* ***cost shift to non-solar customers****.*

They are admitting that their previous path of adding intermittent renewable resources like wind and solar, without storage, was overpaying for energy and taking money out of the pockets of low-income families, making the electric Grid less reliable and more expensive. **Let's learn from that.**

# Net Metering Flaws: Credits for Excess Energy Don't Expire

RCA No. 32, Sheet No. 28.2, Tariff Advice No. 412-32 Effective: February 11, 2019

*Billing. For each Member participating in the Net Metering Program, the Association shall measure the net electric energy during each Billing Period.*

3) *Dollar amounts credited to the account of a Member for furnishing electric energy to the Association under Section 4.10(b)(2) of this section will be used to reduce dollar amounts owed by the Member in subsequent monthly billing periods. The credits do not expire or otherwise revert to the Association.*

With a winter peaking energy demand, HEA values wintertime energy greater than summertime energy. This energy credit construct allows for quantities of energy produced when it is needed the LEAST to be carried over into pay periods when there is less supply and greater demand (when it is needed the MOST). Without any actual physical storage in place to store that energy for use in the high demand period, the solar customer is being compensated as if that energy was stored.

The **Value** of the excess summertime energy is DEEMED to have been stored and **Valued** the same as wintertime energy even though the energy is not produced in the winter.

# Net Metering Flaws: No Additional Fees For Defective Power

RCA No. 32, Sheet No. 28.2, Tariff Advice No. 412-32 Effective: February 11, 2019

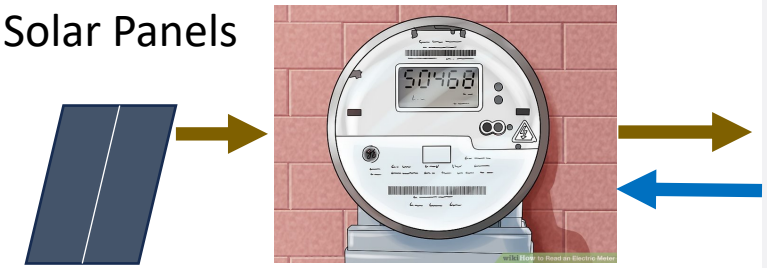
*Billing. For each Member participating in the Net Metering Program, the Association shall measure the net electric energy during each Billing Period.*

5) *The Association will not charge a Member participating in the Net Metering Program any additional fee for standby, capacity, interconnection, or other net metering expense unless approved by the Commission;*

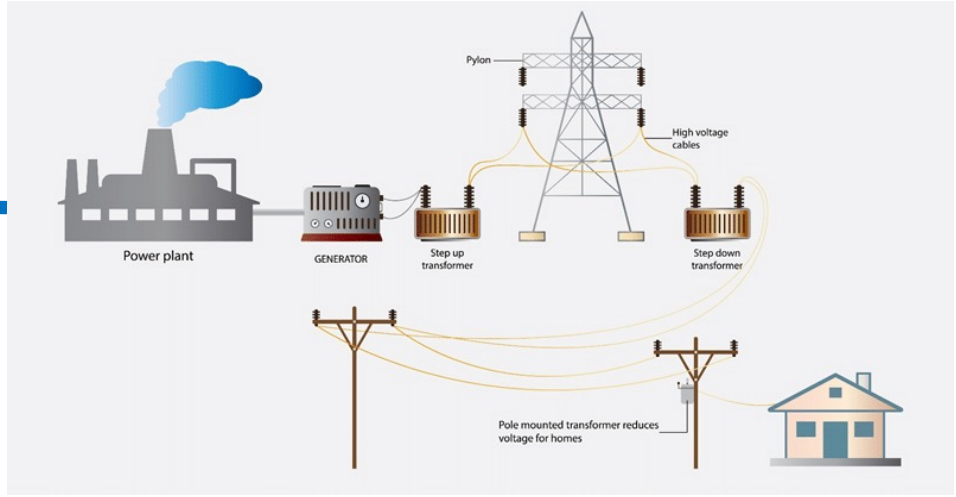
We've demonstrated previously how customer solar installations "Lean on the Grid" to financially benefit from a defective product that is DEEMED equivalent to other products. Let's look at what goes into the grid that is "being leaned on".

# Net Metering Flaws: No Additional Fees For Defective Power

Solar Panels



Meter




The ENTIRE GRID and ALL of its elements provide the processing necessary to remove the defective elements associated with Grid interconnected solar power.

Grid interconnectivity costs include the sum total of the Capital Investment, O&M, Financing, Indirect Costs, and Overheads. The Grid facilitates the interconnection of a solar system that allows that customer to receive the net metering benefit.

Said differently, BUT FOR the existence of the Grid, the solar customer would not be able "TO LEAN ON THE GRID" to clean up the defective power produced from their systems to receive the compensation they receive.

# Net Metering Flaws: No Additional Fees For Defective Power

**User Pays Principle:**

The Grid is operating to clean up the defective energy produced from customer solar systems. These are functions that no other user of the Grid demands from the Grid.

Consistent with the user pay principle, solar customers should pay for goods and services they receive as those services are fundamentally different than the goods and services a typical electric customer receives. Their defective product is made more valuable by the existence of the grid.

# Net Metering Flaws: Conclusions

We have discussed four Major Compensation Flaws in the existing Net Metering Tariff.

Intermittent renewables like wind and solar have a place in our energy portfolio.

It is fruitful to pursue adding these resources without overpaying for them with outdated Compensation methods that subsidize net metering customers at the expense of those who don't net meter.

More detailed information is provided in:

**Appendix No. 1: Defective Elements of Solar**
**Appendix No. 2: Sample HEA Bills**
**Appendix No. 3: Other Customer Solar Subsidies**

The following Recommendations will help to avoid overpaying for intermittent renewables.

# Net Metering Flaws: Recommendations

Perform a "soup to nuts" review of customer billing to identify and propose modifications that would eliminate subsidies inherent in net metering, specifically:

1. Energy Charge (Price)

   As noted previously the energy charge component of the bill needs to be reflective of a two-step transaction for net metered customers—a consumption component where they pay the energy rate all other customers pay, and a customer energy production component where they are paid a much-reduced Excess Energy Price that is commensurate with its value.

   **Action: HEA should perform an analysis to quantify a cost-of-service ratemaking Excess Energy Price for Customer Solar Net metering to eliminate this price subsidy in future net metering formulas.**

# Net Metering Flaws: Recommendations

2. Energy Charge (Quantity)
   Excess Energy produced from the solar panel is measured at the meter on a GROSS BASIS and sent to the Grid where its defective elements are resolved. However, by leaning on the Grid to resolve these defects, the energy may go through multiple stages of transformation from house voltage, to distribution voltage, to transmission voltage and the reverse path, with associated line losses. Battery system energy storage suffers a 20% round trip energy loss.

   At the end of the day, the actual energy delivered back to the house will be less (NET BASIS) than the energy produced and originally measured at the meter on a GROSS BASIS. The solar customer is being subsidized by this difference in GROSS and NET generation.

   **Action: HEA should perform an analysis to quantify the difference between Gross and Net metering to eliminate this quantity subsidy in future net metering formulas.**

# Net Metering Flaws: Recommendations

3. Energy Charge (Quantity, Time-of-Use Mismatch)

   Under Section 4.10(b)(3), the credits do not expire... This incentivizes the homeowner to install solar panels in an orientation to seek maximum production in the summer months to generate as much excess power as possible to create the largest carryover credit possible.

   **Action: HEA should perform an analysis to determine the extent and consequence of Time of Production-Time of Use Mismatch driven by the language of Section 4.10(b)(3).**

   **Features of that analysis should include:**

   **A. A comparison of the use of hourly energy values to a fixed annual price for excess energy.**

   **B. The effect of limiting the carryover of excess payments to one month.**

   **This will help the utility to understand the magnitude of this subsidy using the current approach, compared to other reconciliation intervals.**

# Net Metering Flaws: Recommendations

4. Customer Charge.

   HEA should look at all aspects of the bill. Many times, a Customer Charge doesn't reflect the total cost that the utility is trying to collect. Instead of the actual cost, a value is "chosen" to cover some of the cost but is balanced by judgement as to what other utilities charge. Likely, the true cost is greater than the $20.00 per month fee that is currently being charged.

   In the interest of transparency, it would be good to confirm the components of the charge and adjust, as necessary.

   **Action: HEA should perform an analysis to confirm there is no difference between the Customer Charge costs and the Customer Charge billed. Similarly, HEA should evaluate if there are any Incremental Customer Cost drivers associated with Net metering.**

# Net Metering Flaws: Recommendations

5. System Delivery Charge.

   Reevaluate this charge considering Customer Solar (and other intermittent renewables). Like the Customer Charge, there is a risk that the charge doesn't reflect the total cost of operating the grid and instead is balanced by judgement.

   Consistent with the user pay principle, solar customers should pay for goods and services they receive as those services are fundamentally different than the goods and services a typical electric customer receives.

   Consider if there should be two levels of System Delivery Charge—Level 1 is paid by the typical electric customer who only receives energy from the grid. Level 2 is paid by intermittent renewable customers who receive Level 1 service as well as the additional service of leaning on the grid.

   **Action: HEA should perform an analysis to determine if there should be two levels of System Delivery charge to reflect the usage difference between conventional customers and Net Metered customers.**

# Net Metering Flaws: Recommendations

6. Minimum Demand Charge.
   Rather than creating a two-level System Delivery Charge, does the Minimum Demand Charge provide a vehicle to bill intermittent renewable customers for leaning on the grid?

   **Action: HEA should perform an analysis to determine if a Minimum Demand Charge provides a vehicle to bill intermittent renewable customers for leaning on the grid.**

# Net Metering Flaws: Recommendations

7. Cost of Power Adjustment (COPA).

   The COPA rate is lower than the SFPPR which is the basis for the reimbursement for excess energy. As noted previously, the value for energy produced from customer solar is MUCH less than energy provided by REAL electric generators—the payment for excess solar should be dramatically reduced and should **NEVER** exceed the payment for energy products from a bona fide generator.

   **Action: HEA should perform an analysis to limit the SFPPR to not to exceed COPA. This may be unnecessary given the pricing work to be performed under step 1.**

# Net Metering Flaws: Recommendations

8. Regulatory Cost Charge.

   It appears that net metering customers with excess energy avoid paying this charge.

   As noted previously, the net metering billing should be broken into two transactions—consumption billing and production billing.

   At a minimum, the consumption billing should be subject to the Regulatory Cost Charge. Perhaps both transactions should be assessed the Regulatory Cost Charge.

   **Action: HEA should perform an analysis to evaluate if net metering customers who produce excess energy are not paying this charge, and if not, why not. Additionally, HEA should evaluate if this charge should be paid for both consumption billing and production billing.**

# Net Metering Flaws: Recommendations

9. ERO Charge.

   It appears that net metering customers with excess energy avoid paying this charge.

   As noted previously, the net metering billing should be broken into two transactions—consumption billing and production billing.

   At a minimum, the consumption billing should be subject to the ERO Charge. Perhaps both transactions should be assessed the ERO Charge.

   **Action: HEA should perform an analysis to evaluate if net metering customers who produce excess energy are not paying this charge, and if not, why not. Additionally, HEA should evaluate if this charge should be paid for both consumption billing and production billing.**

# Net Metering Flaws: Recommendations

10. Sunset legacy net metering when property changes hands.

    It's not clear how net metering is continued when a property changes hands.

    If a homeowner purchases a solar system under the existing rules, and the net metering rules change in the future, is that home allowed to continue to benefit from the original net metering rules to perpetuity?

    Or does the tariff end the legacy net metering agreement and replace it with an agreement that is up to date with the current rules (if the homeowner applies for net metering)?

    **Action: HEA should establish clear guidance that legacy net metering contracts will sunset on change of property ownership.**

# Appendix No. 1:  Defective Elements of Solar

# Defective Elements of Customer Solar—Lack of Inertia

There is a large volume of research reports on this matter.

A common failure for these types of reports is they lack consideration of the asymmetric risk profile of failure to deliver energy.

In Alaska, failure to deliver energy is a low probability, high consequence event. People and property are at risk if energy is not delivered in the harsh Alaskan winter.

Many of these types of reports are "tabletop" exercises—analytical studies by people who don't have grid operations experience and are not focused on the specifics of Alaska climate.

That said, one report worth reviewing for a better understanding of the technical issue of inertia is:

*Denholm, Paul, Trieu Mai, Rick Wallace Kenyon, Ben Kroposki, and Mark O'Malley. 2020. Inertia and the Power Grid: A Guide Without the Spin. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6120-73856. https://www.nrel.gov/docs/fy20osti/73856.pdf.*

# Defective Elements of Customer Solar—Lack of Inertia

An item in this report:

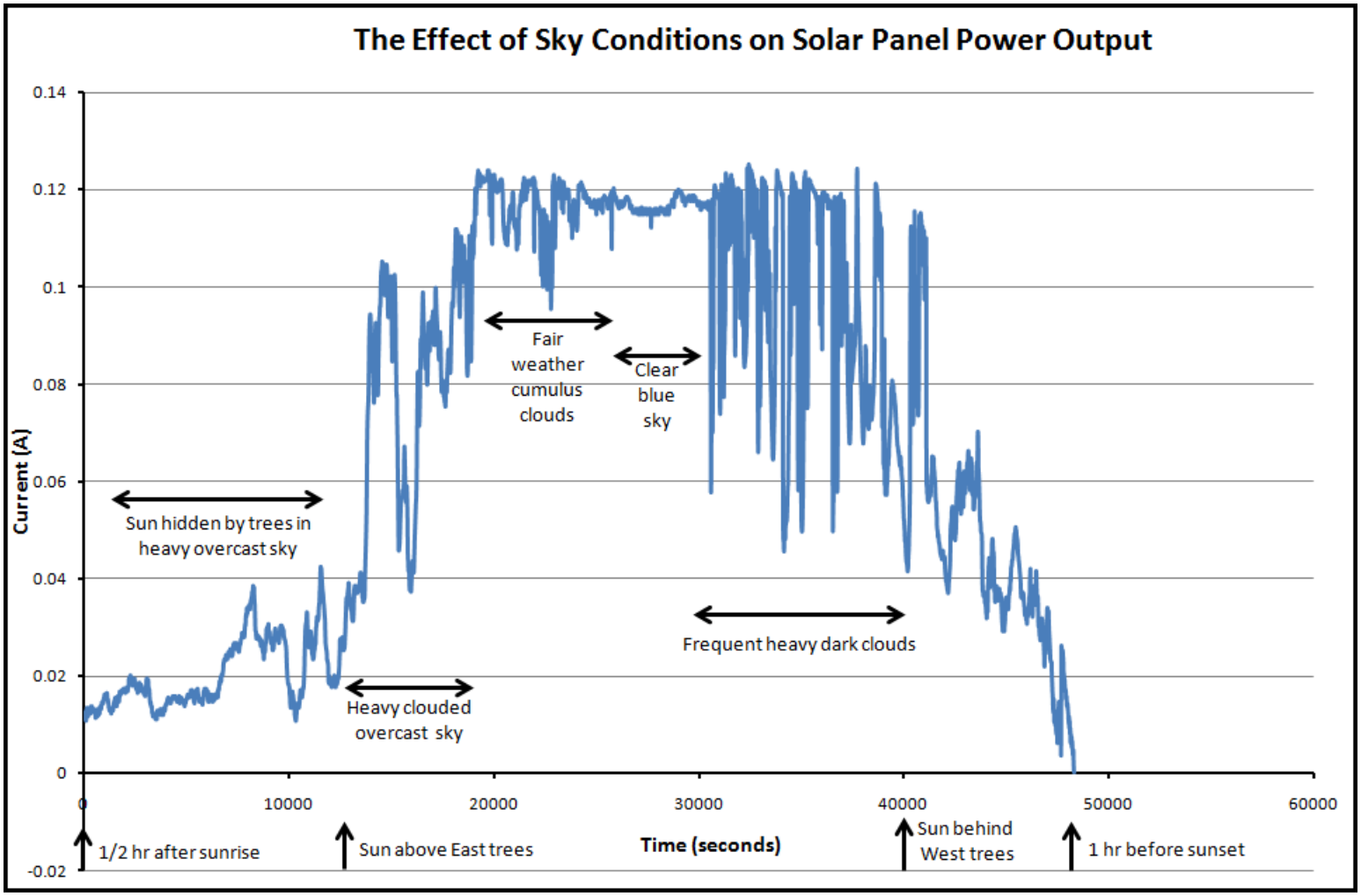
> *7.1.3 Synchronous Condensers*
>
> *There are also non-generation alternatives to provide inertia. The most commonly discussed option is the deployment of synchronous condensers, which are synchronous motors/generators that draw energy from the grid to maintain a spinning mass and can inject power into the grid in the same manner as a synchronous generator. Historically, these have been installed to solve very localized grid issues (e.g., maintaining local voltage requirements).23 However, they could also provide a brute force solution to the potential need to maintain a minimum level of inertia (Kenyon et al. 2020). Synchronous condensers could be deployed by retrofitting generators from retiring plants or by equipping renewably fueled synchronous generators with clutches that would enable them to act as synchronous condensers when not generating. The cost of this option has not been compared to that of others.24*

I have been intimately involved in the conversion of four legacy fossil generating assets to synchronous condenser operation, using three different starting methods. This area would be good to discuss prior to the retirement of any existing fossil generating facility.

The following may also be a good resource to review regarding synchronous condensers:

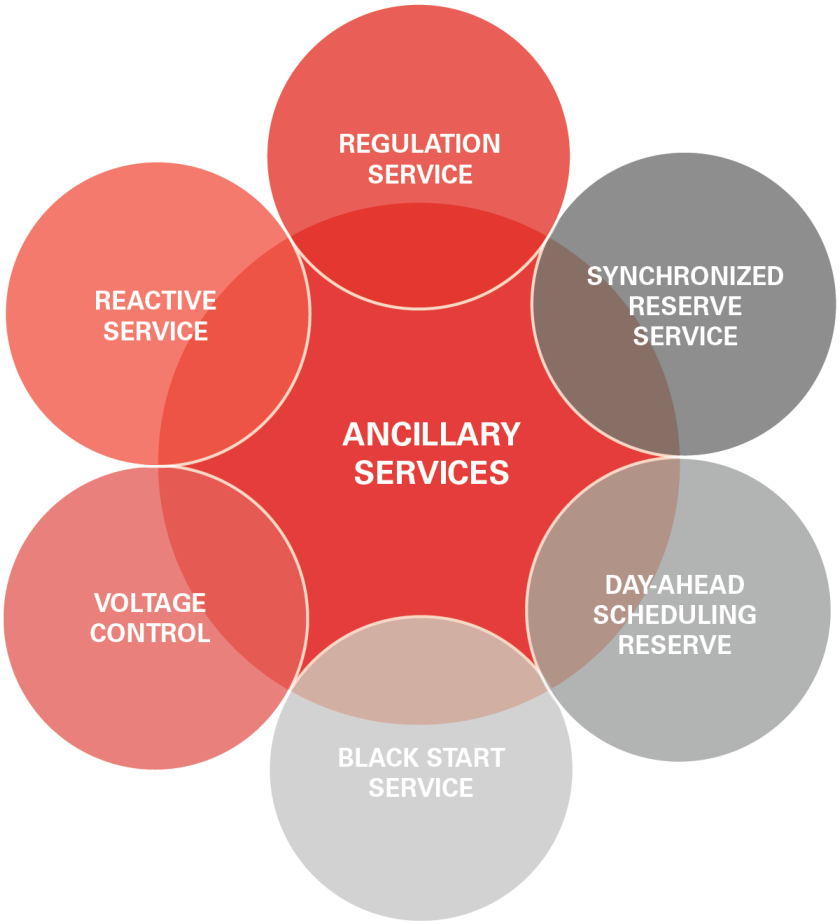
*Zhou, George, David Wang, Adham Atallah, Frank McElvain, Ram Nath, John Jontry, Christopher Bolton, Huang Lin, and Andreas Haselbauer "Synchronous Condenser Applications: Under Significant Resource Portfolio Changes." IEEE Power and Energy Magazine 17(4): 35– 46. https://doi.org/10.1109/MPE.2019.2909005.*

# Defective Elements of Customer Solar—Real time Intermittency




https://www.vernier.com/vernier-ideas/the-effect-of-sky-conditions-on-solar-panel-power-output/

# Defective Elements of Customer Solar—Lack of Ancillary Services




https://www.aepenergy.com/blog/september-2017-edition/

# Definitions for some Ancillary Services

Regulation Service:

an ancillary service provided by resources that can respond quickly to the instantaneous change in electrical demand, often represented as a regulation signal. These resources, which are typically some type of electricity generator, demand response, or sources storing and then releasing electricity, may offer this service based on constructed formulas. Some of the items impacting a resource's revenues when providing this type of service are whether it has the ability to respond quickly or slowly to a regulation signal and how well the resource can follow the regulation signal. A resource that can follow the regulation signal better than other resources will receive more revenue for this service.

https://www.aepenergy.com/blog/september-2017-edition/

# Definitions for some Ancillary Services, Continued

Synchronized Reserve Service (Spinning Reserve, or Spin):

an ancillary service designed to ensure that there is enough "headroom" or unutilized energy on resources to increase output to ensure abrupt changes in electrical supply or demand can be met.

A demand response resource, or aggregate of demand response resources, may provide this service by rapidly reducing electricity usage.

A prime example of why this service is needed is for the sudden loss of generation or a loss of transmission capability.

If a generator stops producing electricity due to a sudden operational issue, other resources must respond quickly to provide the "missing" power.

For the most part, this market product clears at zero cost due to adequate supply or "headroom" on the system. When there is high demand for electricity, the price associated with this service could increase as the grid operator has to pay resources to be in an operating position to provide this service.

https://www.aepenergy.com/blog/september-2017-edition/

# Definitions for some Ancillary Services, Continued

(Non-Synchronized Reserve Service—(Non-Spinning Reserve, or Non-Spin):

provides this function from generating assets that can be started quickly, usually within 10 minutes, to fill the generation shortfall—MLJ)

Day-Ahead Scheduling Reserve (DASR):

cleared a day prior (day-ahead) to the actual need of the ancillary service and is utilized to ensure a sufficient quantity of resources, including demand response, are in the operational position of being available to provide 30-minute reserve service in the real-time market.

https://www.aepenergy.com/blog/september-2017-edition/

# Definitions for some Ancillary Services, Continued

Black Start Service:

an ancillary service that is paid to certain generating resources that can begin providing electricity to the grid without first utilizing outside power from the grid to initially start power generating stations.

Black start is necessary if there are large black outs on the power system. The power output from these resources is utilized to start other power stations, provide electricity to nuclear stations, and provide critical-needs services.

The compensation for resources providing this service is an annual FERC-approved, cost-of-service rate. As new black start resources begin operation, or as existing black start resources retire, significant changes to this charge can occur.

https://www.aepenergy.com/blog/september-2017-edition/

# Definitions for some Ancillary Services, Continued

## Voltage Control and Reactive Service:

a FERC-approved rate that provides basic compensation for a generator to provide incremental voltage or to absorb voltage on the transmission system.

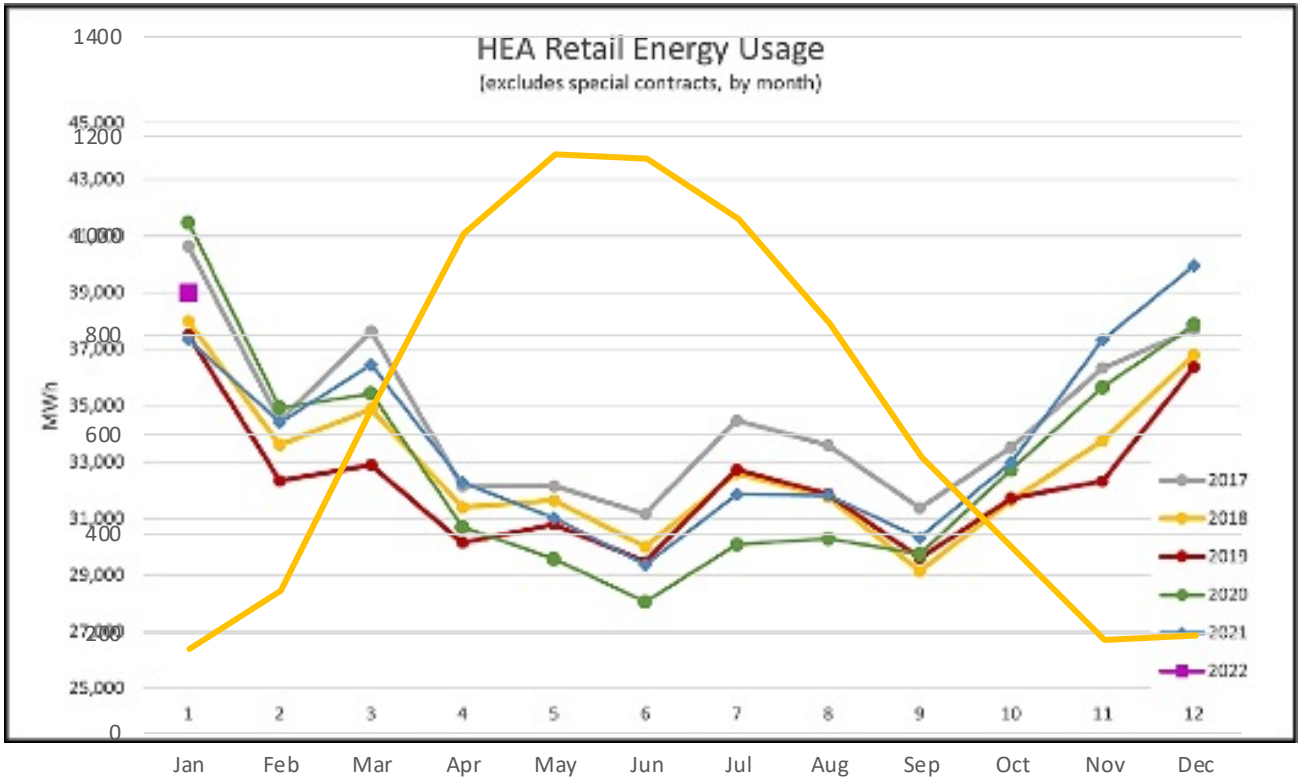
This type of service is local in nature. In other words, you may have portions of the electrical grid with both normal and abnormal conditions depending on the configuration of generators, loads, and the transmission system.

These charges can grow beyond FERC-approved charges if the grid operator must turn on or off a generator or substantially modify the output of a generating resource to provide this service thus inhibiting the resource's ability to participate within the economic energy dispatch of the grid.

https://www.aepenergy.com/blog/september-2017-edition/

# Defective Elements of Customer Solar-Time of Production-Time of Use Mismatch

Solar Output PVWatts, 8 kW dc System

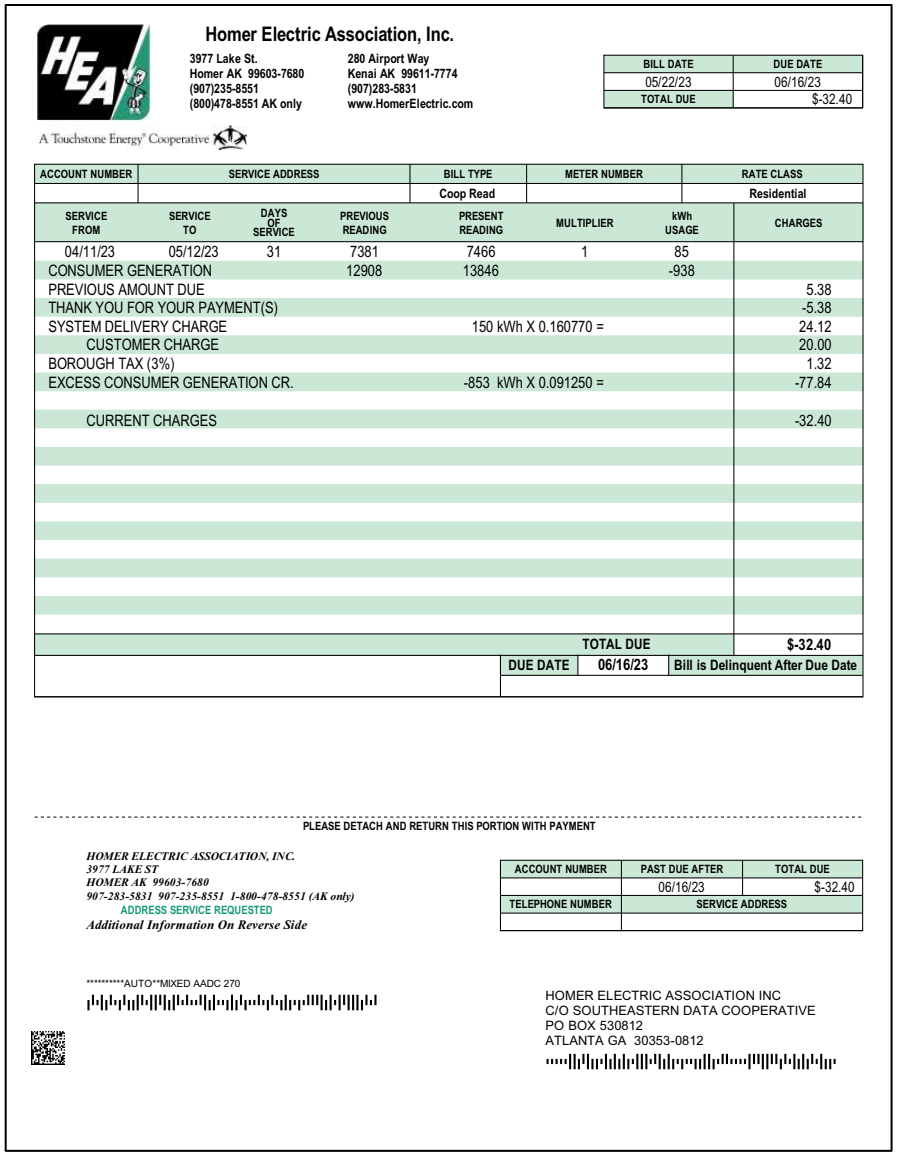



PVWatts can be found at the National Renewable Energy Laboratory website at https://pvwatts.nrel.gov

This 8 kW system, optimized for maximum energy delivered produces electricity at a 10% capacity factor (ignoring losses due to snow covering the array). Demonstrates that solar energy produced in the summer is virtually worthless unless it can be stored for delivery 5 to 7 months later when it is needed the most.

# Appendix No. 2:  Sample HEA Bills

# Sample HEA Bills



**Homer Electric Association, Inc.**

3977 Lake St.
Homer AK 99603-7680
(907)235-8551
(800)478-8551 AK only

280 Airport Way
Kenai AK 99611-7774
(907)283-5831
www.HomerElectric.com

A Touchstone Energy® Cooperative

| BILL DATE | DUE DATE |
|---|---|
| 05/22/23 | 06/16/23 |
| TOTAL DUE | $-32.40 |

| ACCOUNT NUMBER | SERVICE ADDRESS | BILL TYPE | METER NUMBER | RATE CLASS |
|---|---|---|---|---|
| | | Coop Read | | Residential |

| SERVICE FROM | SERVICE TO | DAYS OF SERVICE | PREVIOUS READING | PRESENT READING | MULTIPLIER | kWh USAGE | CHARGES |
|---|---|---|---|---|---|---|---|
| 04/11/23 | 05/12/23 | 31 | 7381 | 7466 | 1 | 85 | |
| CONSUMER GENERATION | | | 12908 | 13846 | | -938 | |
| PREVIOUS AMOUNT DUE | | | | | | | 5.38 |
| THANK YOU FOR YOUR PAYMENT(S) | | | | | | | -5.38 |
| SYSTEM DELIVERY CHARGE | | | | 150 kWh X 0.160770 = | | | 24.12 |
| CUSTOMER CHARGE | | | | | | | 20.00 |
| BOROUGH TAX (3%) | | | | | | | 1.32 |
| EXCESS CONSUMER GENERATION CR. | | | | -853 kWh X 0.091250 = | | | -77.84 |
| CURRENT CHARGES | | | | | | | -32.40 |
| | | | | | TOTAL DUE | | $-32.40 |

| DUE DATE | 06/16/23 | Bill is Delinquent After Due Date |
|---|---|---|

PLEASE DETACH AND RETURN THIS PORTION WITH PAYMENT

*HOMER ELECTRIC ASSOCIATION, INC.*
*3977 LAKE ST*
*HOMER AK 99603-7680*
*907-283-5831 907-235-8551 1-800-478-8551 (AK only)*
ADDRESS SERVICE REQUESTED
*Additional Information On Reverse Side*

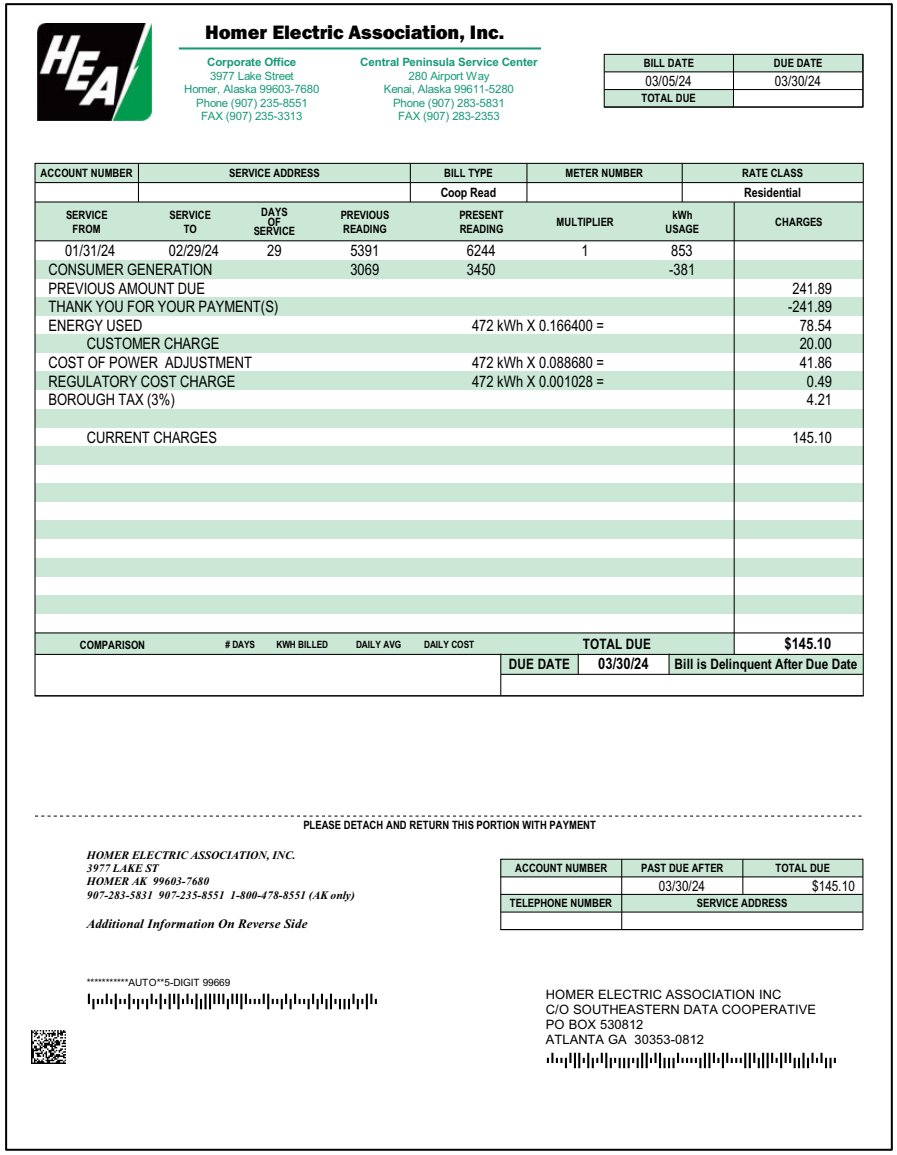
| ACCOUNT NUMBER | PAST DUE AFTER | TOTAL DUE |
|---|---|---|
| | 06/16/23 | $-32.40 |
| TELEPHONE NUMBER | SERVICE ADDRESS | |
| | | |

**********AUTO**MIXED AADC 270

HOMER ELECTRIC ASSOCIATION INC
C/O SOUTHEASTERN DATA COOPERATIVE
PO BOX 530812
ATLANTA GA 30353-0812

Customer produces **Substantially** more energy than receives from HEA

# Sample HEA Bills



**Homer Electric Association, Inc.**

**Corporate Office**
3977 Lake Street
Homer, Alaska 99603-7680
Phone (907) 235-8551
FAX (907) 235-3313

**Central Peninsula Service Center**
280 Airport Way
Kenai, Alaska 99611-5280
Phone (907) 283-5831
FAX (907) 283-2353

| BILL DATE | DUE DATE |
|---|---|
| 03/05/24 | 03/30/24 |
| TOTAL DUE | |

| ACCOUNT NUMBER | SERVICE ADDRESS | BILL TYPE | METER NUMBER | RATE CLASS |
|---|---|---|---|---|
| | | Coop Read | | Residential |

| SERVICE FROM | SERVICE TO | DAYS OF SERVICE | PREVIOUS READING | PRESENT READING | MULTIPLIER | kWh USAGE | CHARGES |
|---|---|---|---|---|---|---|---|
| 01/31/24 | 02/29/24 | 29 | 5391 | 6244 | 1 | 853 | |
| CONSUMER GENERATION | | | 3069 | 3450 | | -381 | |
| PREVIOUS AMOUNT DUE | | | | | | | 241.89 |
| THANK YOU FOR YOUR PAYMENT(S) | | | | | | | -241.89 |
| ENERGY USED | | | | 472 kWh X 0.166400 = | | | 78.54 |
| CUSTOMER CHARGE | | | | | | | 20.00 |
| COST OF POWER ADJUSTMENT | | | | 472 kWh X 0.088680 = | | | 41.86 |
| REGULATORY COST CHARGE | | | | 472 kWh X 0.001028 = | | | 0.49 |
| BOROUGH TAX (3%) | | | | | | | 4.21 |
| CURRENT CHARGES | | | | | | | 145.10 |

| COMPARISON | # DAYS | KWH BILLED | DAILY AVG | DAILY COST | TOTAL DUE | $145.10 |
|---|---|---|---|---|---|---|

| DUE DATE | 03/30/24 | Bill is Delinquent After Due Date |
|---|---|---|

PLEASE DETACH AND RETURN THIS PORTION WITH PAYMENT

*HOMER ELECTRIC ASSOCIATION, INC.*
*3977 LAKE ST*
*HOMER AK 99603-7680*
*907-283-5831 907-235-8551 1-800-478-8551 (AK only)*

*Additional Information On Reverse Side*

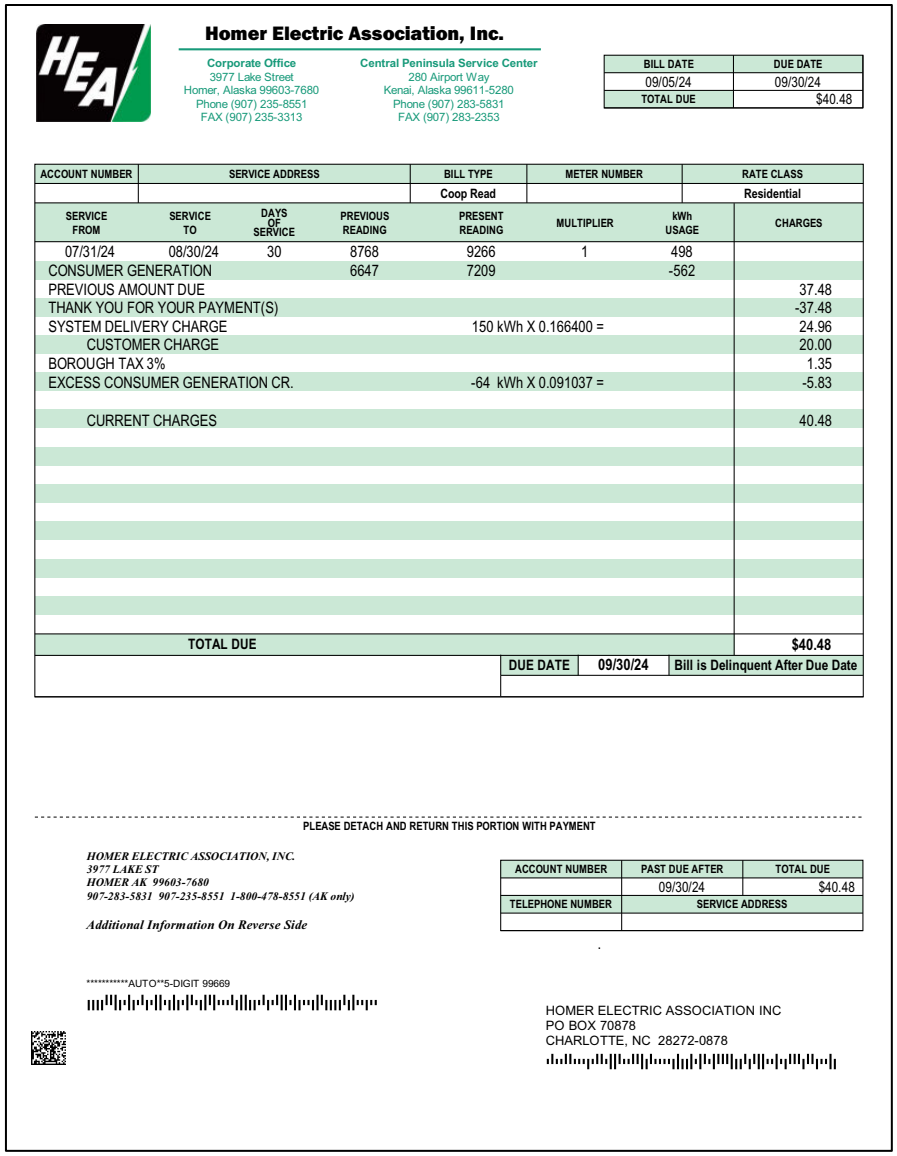
| ACCOUNT NUMBER | PAST DUE AFTER | TOTAL DUE |
|---|---|---|
| | 03/30/24 | $145.10 |
| TELEPHONE NUMBER | SERVICE ADDRESS | |
| | | |

**********AUTO**5-DIGIT 99669

HOMER ELECTRIC ASSOCIATION INC
C/O SOUTHEASTERN DATA COOPERATIVE
PO BOX 530812
ATLANTA GA 30353-0812

Customer receives more energy from HEA than is produced

# Sample HEA Bills



**Homer Electric Association, Inc.**

**Corporate Office**
3977 Lake Street
Homer, Alaska 99603-7680
Phone (907) 235-8551
FAX (907) 235-3313

**Central Peninsula Service Center**
280 Airport Way
Kenai, Alaska 99611-5280
Phone (907) 283-5831
FAX (907) 283-2353

| BILL DATE | DUE DATE |
|---|---|
| 09/05/24 | 09/30/24 |
| TOTAL DUE | $40.48 |

| ACCOUNT NUMBER | SERVICE ADDRESS | BILL TYPE | METER NUMBER | RATE CLASS |
|---|---|---|---|---|
| | | Coop Read | | Residential |

| SERVICE FROM | SERVICE TO | DAYS OF SERVICE | PREVIOUS READING | PRESENT READING | MULTIPLIER | kWh USAGE | CHARGES |
|---|---|---|---|---|---|---|---|
| 07/31/24 | 08/30/24 | 30 | 8768 | 9266 | 1 | 498 | |
| CONSUMER GENERATION | | | 6647 | 7209 | | -562 | |
| PREVIOUS AMOUNT DUE | | | | | | | 37.48 |
| THANK YOU FOR YOUR PAYMENT(S) | | | | | | | -37.48 |
| SYSTEM DELIVERY CHARGE | | | | 150 kWh X 0.166400 = | | | 24.96 |
| CUSTOMER CHARGE | | | | | | | 20.00 |
| BOROUGH TAX 3% | | | | | | | 1.35 |
| EXCESS CONSUMER GENERATION CR. | | | | -64 kWh X 0.091037 = | | | -5.83 |
| CURRENT CHARGES | | | | | | | 40.48 |
| TOTAL DUE | | | | | | | $40.48 |

| DUE DATE | 09/30/24 | Bill is Delinquent After Due Date |
|---|---|---|

PLEASE DETACH AND RETURN THIS PORTION WITH PAYMENT

*HOMER ELECTRIC ASSOCIATION, INC.*
*3977 LAKE ST*
*HOMER AK 99603-7680*
*907-283-5831 907-235-8551 1-800-478-8551 (AK only)*

*Additional Information On Reverse Side*

| ACCOUNT NUMBER | PAST DUE AFTER | TOTAL DUE |
|---|---|---|
| | 09/30/24 | $40.48 |
| TELEPHONE NUMBER | SERVICE ADDRESS | |
| | | |

**********AUTO**5-DIGIT 99669

HOMER ELECTRIC ASSOCIATION INC
PO BOX 70878
CHARLOTTE, NC 28272-0878

Customer produces **Slightly** more energy than receives from HEA

# Appendix No. 3:  Other Customer Solar Subsidies

# Other Customer Solar Subsidies

**In addition to the Price, Quality, and Quantity subsidies shown in this presentation, this appendix highlights other subsidies that owners of customer solar systems enjoy.**

Why worry about subsidies for customer solar?

In contrast to a competitively bid or a proposed solar energy project, the tax subsidies granted to a customer solar homeowner do not reduce the cost of power paid by the utility. The subsidies only benefit the homeowner.

A utility owned system under cost-of-service rate making, or independent power producer under contract to a utility, can reflect the subsidies in a lower cost of production thus passing on savings to ALL utility customers.

# Other Customer Solar Subsidies: Federal Tax Credits

**Federal Tax Credits**

"The residential clean energy credit is one of the best incentives available to taxpayers who own their solar panels or other clean energy equipment. This incentive is a dollar-for-dollar income tax credit of up to 30% of the cost of installing your home system. That means you could reduce what you owe in federal income taxes by thousands of dollars..."[1]

**Who pays for this tax credit?**
**Federal tax paying citizens subsidize the individual homeowner directly.**

[1] The Homeowner's Guide to Solar Tax Credits and Incentives, March 19, 2024. https://www.sunnova.com/watts-up/federal-solar-tax-credit

# Other Customer Solar Subsidies: KPB Property Tax

**Kenai Peninsula Borough Property Tax:**

*5.12.101. - Real property tax Exemptions Residential renewable energy systems.*
*A. Residential renewable energy systems that are used to develop means of energy production using energy sources other than fossil or nuclear fuel, including, but not limited to windmills and water and* ***solar energy devices located in the borough are exempt from taxation under this chapter.***

The value of the property is increased by the installation of a rooftop solar system (because of the offsetting electricity costs), yet the assessed value and associated property tax does not reflect that increase in value.

Would the well water pump in the example above be exempt from taxation? No, quite the opposite. The property is determined to be more valuable by virtue of having a water supply and the assessed value and associated property tax are INCREASED.

**Who pays for this tax exception?**
**KPB property tax paying citizens subsidize the individual homeowner directly.**

# Other Customer Solar Subsidies: Who Benefits?

**How are Customer Solar tax subsidies different from other energy subsidies like oil and gas?**

Similar to the distinction between customer solar homeowner systems and a utility owned or independent power producer system, subsidies granted for oil and gas exploration can be reflected in increased production and reduced energy costs for **ALL** users of that form of energy.

The important distinction in each of these cases is:

Does the benefit of the subsidy flow to the individual homeowner or to the broader customer base who use the energy?

**Customer solar subsidy schemes flow solely to the homeowner.**

# Other Customer Solar Subsidies: RECs

## Even More Subsidies: Renewable Energy Certificates (RECs)

Key Takeaways[1]

- Renewable energy certificates (RECs) show their holders own one megawatt-hour (MWh) of renewable energy.
- RECs can be sold for profit to those looking to offset their carbon emissions or speculators betting on the value of energy credits.
- Many U.S. states require using RECs as part of their renewable portfolio standards (RPS), which call for electricity providers to include a certain amount of renewable energy in their electricity sales.
- Because these RPS standards differ from state to state, there's a market for REC swaps or arbitrage, which consists of trading them to profit from the difference in price across markets.

[1] Renewable Energy Certificate (REC): Definition, Types, July 31, 2024. https://www.investopedia.com/terms/r/rec.asp

# Other Customer Solar Subsidies: RECs continued

**How RECs Work[1]**

RECs are a way to track solar, wind, and other green energies as they flow into the power grid. Since electricity generated from renewable energy sources is indistinguishable from what's produced by different sources, some form of tracking is required. Companies use them to offset their carbon emissions.

**Can I Keep the Electricity My Solar Panels Produce If I Sell RECs?[1]**

Yes, because you're not selling the electricity, but its attributes that make it clean power. If you have solar panels on your home, you produce electricity and can receive RECs for the power produced. You may still use the electricity and have it cut the amount of your electric bill while selling the REC. Selling the REC is not about electricity as such. Instead, it is selling a legal instrument that allows the buyer to claim the environmental benefits of the electricity produced.

**Who receives the value of these REC's? The homeowner.**
**Are these REC's used to offset the price for power paid? No.**

[1] Renewable Energy Certificate (REC): Definition, Types, July 31, 2024. https://www.investopedia.com/terms/r/rec.asp

# Other Customer Solar Subsidies: Economic Questions

**Economic Questions to consider**

Do all these subsidies serve to keep the cost of solar systems artificially high?

Considering a large percentage of solar panels come from China, do they have monopoly pricing capability and price their product way above cost but just low enough to make economic sense with all the tax subsidies and price/quantity subsidies in play?

Is there a ratemaking or regulatory construct that would allow for some of these subsidies to flow to utility customers rather than the individual homeowner?

Or, is it simpler to reduce the value of the Excess Energy rate in the Net Metering Tariff to coincide with the True Value of the defective energy product as opposed to the Deemed Value?