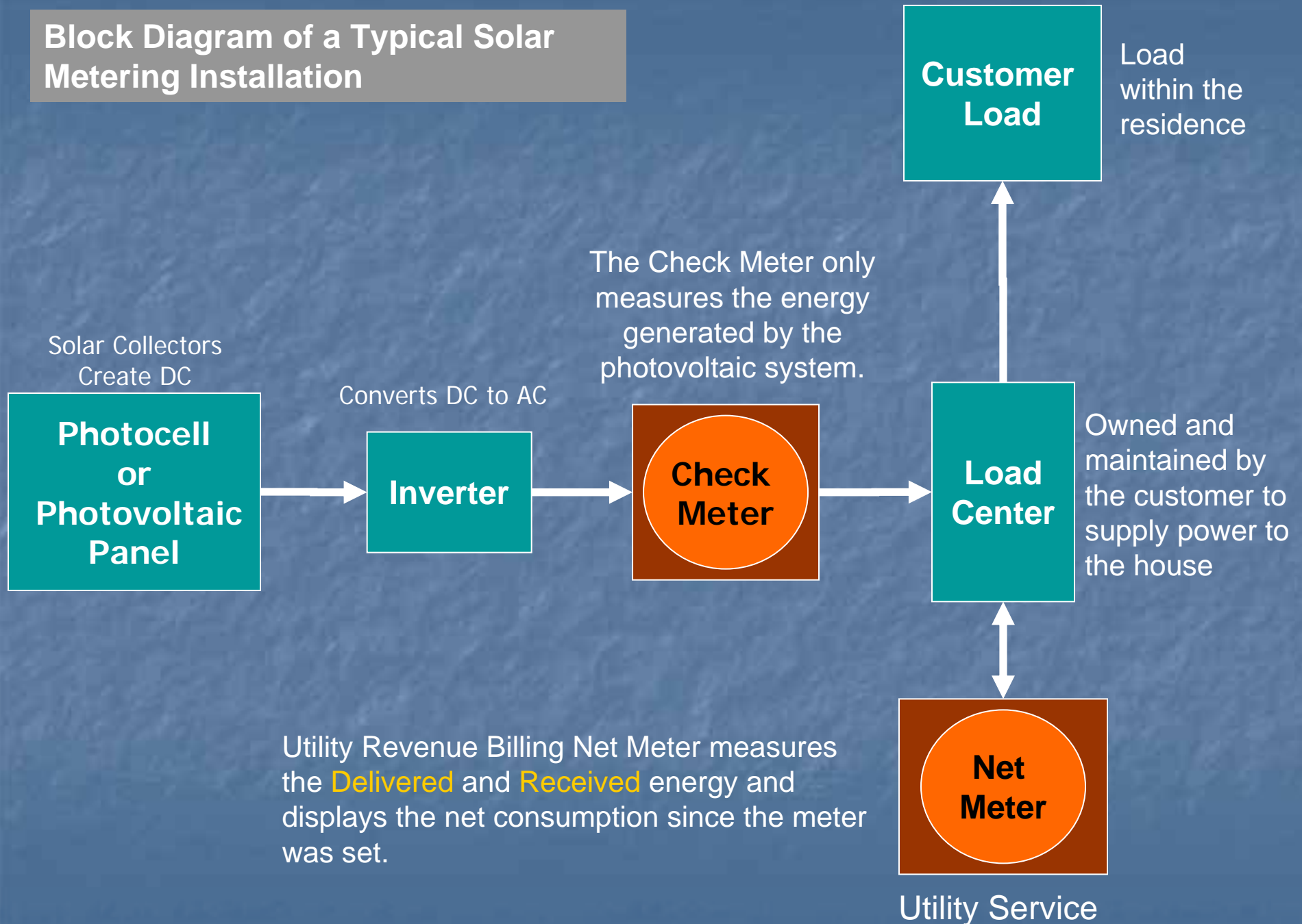


Bi-Directional (NET) Electronic Energy Measurement



Block Diagram of a Typical Solar Metering Installation



Check Meter

The **Check Meter** and **Net Meter** reads are rarely the same. The meter reads are associated with how much solar power is being generated verses customer load. The **Check Meter** measures only the energy that is generated by the photovoltaic solar system. The **Net Meter** measures power delivered by TEP, power received from the customer and shows the net difference between the two.

Example:

If the solar system generates ten (10) kWh, the read on the **Check Meter** will be **00010**.

If five (5) kWh are used for the customers load and five (5) kWh are delivered to the distribution grid, then the Received register on the **Net Meter** will have a read of **00005**.

NET Meter

What do the meter displays mean?

The symbol for the dEL register, consisting of the letters 'd', 'E', and 'L' in a stylized font, enclosed in a blue rectangular border.

dEL = Delivered = Energy delivered to the customer. This register displays the cumulative quantity since the meter was activated.

The symbol for the rEC register, consisting of the letters 'r', 'E', and 'C' in a stylized font, enclosed in a blue rectangular border.

rEC = Received = Energy received from the customer. This register displays the cumulative quantity since the meter was activated. This value will be shown on the monthly bill as KBH.

The symbol for the nEt register, consisting of the letters 'n', 'E', and 't' in a stylized font, enclosed in a blue rectangular border.

nEt = Net = Total difference between delivered and received quantities. This register displays the cumulative quantity since the meter was activated. If more power is received than delivered and goes past 00000 the meter will count backwards from 99999.

Net Meter Load Emulator

The purpose of the load emulator is to show the direction of energy flow into or out of the meter. This is an electronic version of the disk on the old electromechanical meters. The arrow shows the instantaneous flow of energy. As the meter scrolls between energy values, the emulator continues to show the direction of flow that is occurring at that time.



Energy Delivered:

When the emulator is pointing left to right it is indicating that power is being **delivered** to the customer from the utility.



Energy Received:

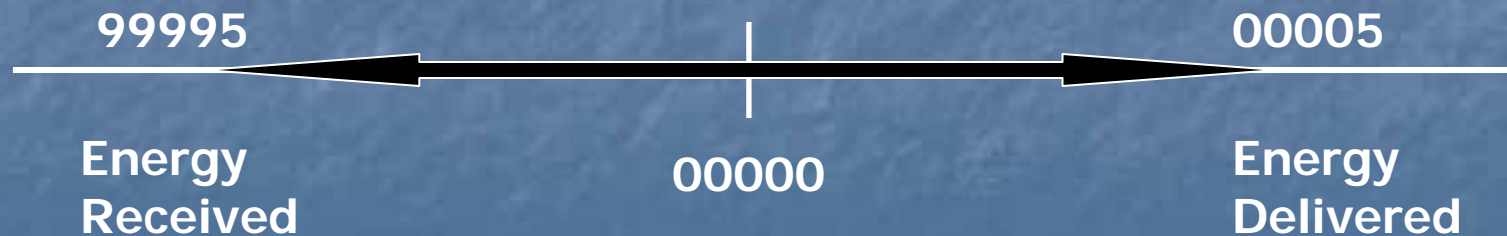
When the emulator is pointing right to left it is indicating that power is being **received** from the customer's solar installation to the utility's distribution system.

Energy Measurement on the Net Register

The **Net Register** is cumulative. It records the net consumption of energy since the meter was installed.

The Net Register can seesaw back and forth around zero, such as 99995 and 00005.

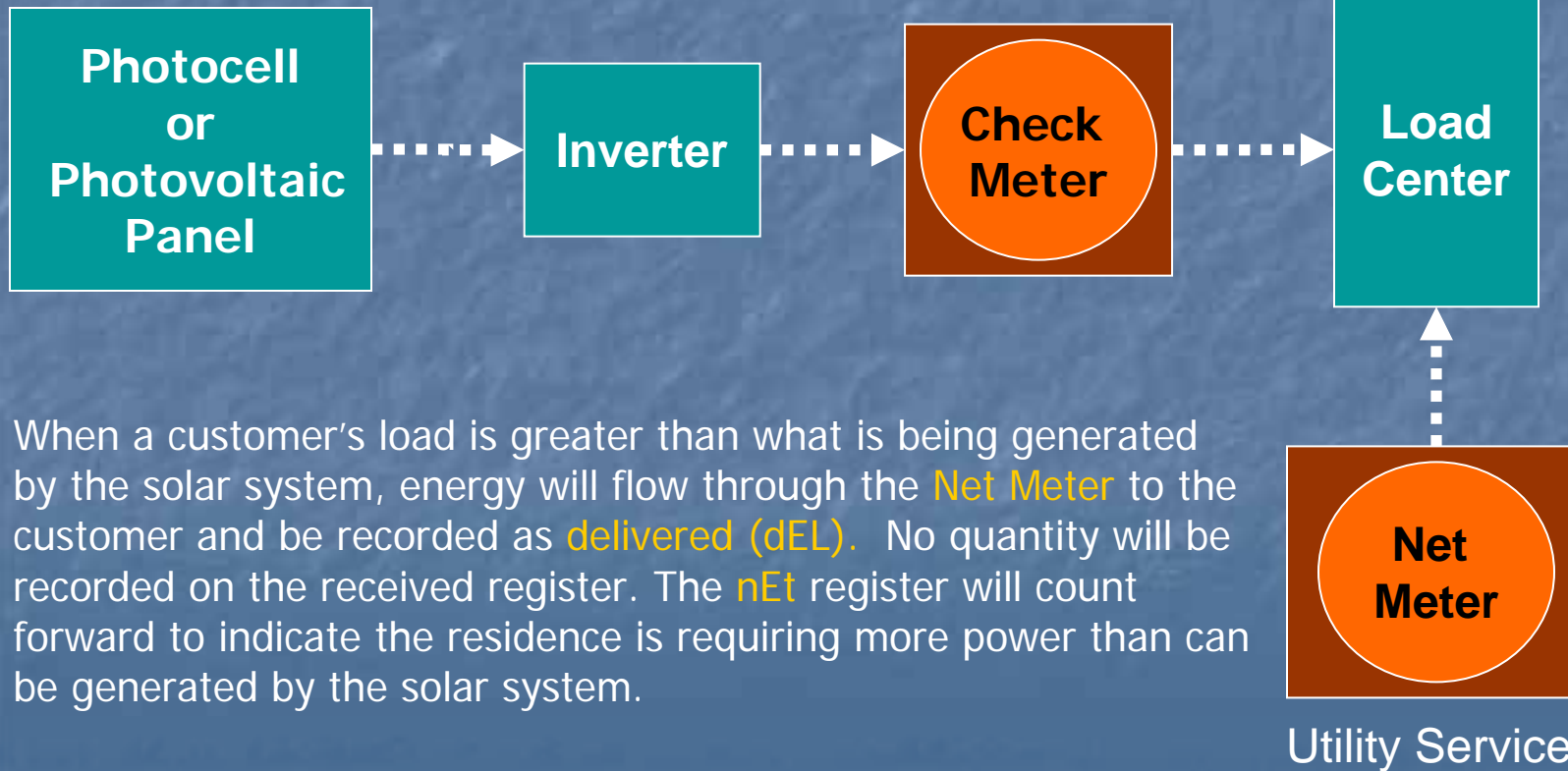
The Net Register displays the difference between what the customer consumes and what the customer generates. This can also be calculated by taking the dEL- rEC registers. Negative results are subtracted from 99999 to obtain the meter nEt register value.



Block Diagram of a Solar Metering Installation Not Producing Enough Power for the Residence Load.

The **Check Meter** will record the amount of Power that the solar system generates.

Load within the residence is greater than what the solar system is generating.



When a customer's load is greater than what is being generated by the solar system, energy will flow through the **Net Meter** to the customer and be recorded as **delivered (dEL)**. No quantity will be recorded on the received register. The **nEt** register will count forward to indicate the residence is requiring more power than can be generated by the solar system.

Energy Measurement Example

The load emulator in this example indicates that the utility is delivering energy. The customer was using more power than they were producing at the time of the pictures.



8 kilowatt-hours (kWh) have been **delivered** to the customer.

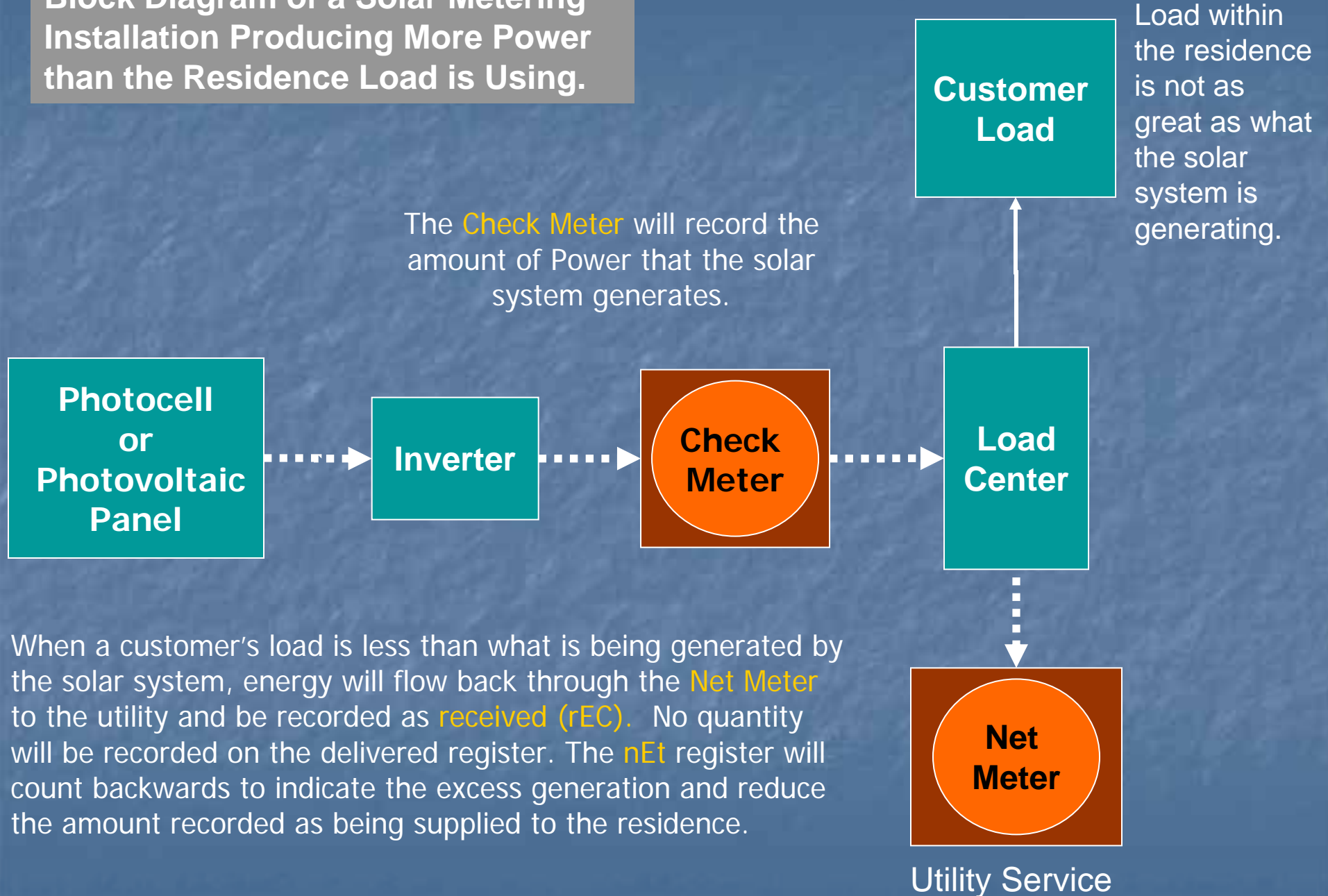


3 kilowatt-hours (kWh) have been **received** from the customer.



net difference of 5 kWh =
8 kWh delivered – 3 kWh received

Block Diagram of a Solar Metering Installation Producing More Power than the Residence Load is Using.

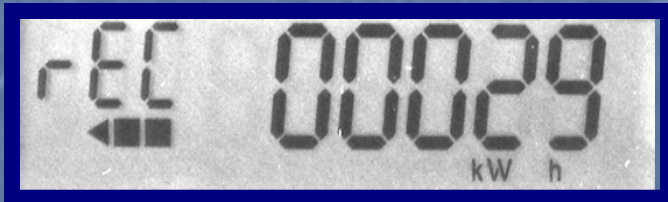


Energy Measurement Example

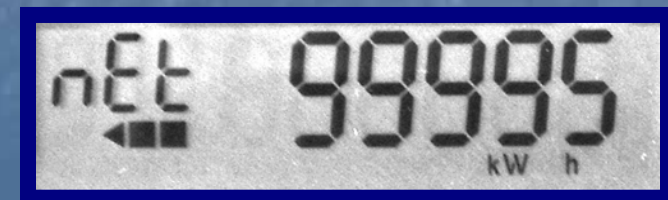
The load emulator in this example indicates that the utility is receiving energy. The customer was producing more power than they were using at the time of the pictures.



24 kilowatt-hours (kWh) have been **delivered** to the customer.



29 kilowatt-hours (kWh) have been **received** from the customer.



In cases where the utility receives more energy than it delivers (the Net total of 5 kWh), the **Net** register of the meter will count backwards past the zero mark.

The **Net** difference of 5 kWh causes the register to display 99995.

Monthly Reads

	First month	Second month	Third month
Delivered		With 20 kWh delivered	No kWh delivered
	00010 kWh	00030 kWh	00030 kWh
Received		With 10 kWh received	30 kWh received
	00005 kWh	00015 kWh	00045 kWh
Net	Net Difference between the Delivered and Received		
	00005 kWh	00015 kWh	99985 kWh
Billing amount for consumption	5 kWh bill	10 kWh bill	30 kWh credit

Customer Load

- The customer's total load since the meter was set can be calculated by adding the meter reads from the Check and Net Meters as follows:

$$\text{Check} + \text{Net dEL} - \text{Net rEC}$$

- A monthly value for customer load can be calculated by using two different months of meter reads from the Check and Net Meters as follows:

$$(\text{Month 2 Check} - \text{Month 1 Check}) + (\text{Month 2 dEL} - \text{Month 1 dEL}) - (\text{Month 2 rEC} - \text{Month 1 rEC})$$

Solar Production

- The production of the solar system can be obtained from the read on the Check Meter. The number displayed shows the amount of production that has occurred since the meter was installed.
- The monthly production can be calculated as follows:
Month 2 Check Meter read – Month 1 Check Meter read