Regional Workshop on Metrology and Technology Challenges
of Climate Science and Renewable Energy

ST. VINCENT AND THE GRENADINES ON A PATH OF RENEWABLE ENERGY DEVELOPMENT

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Introduction

Energy situation

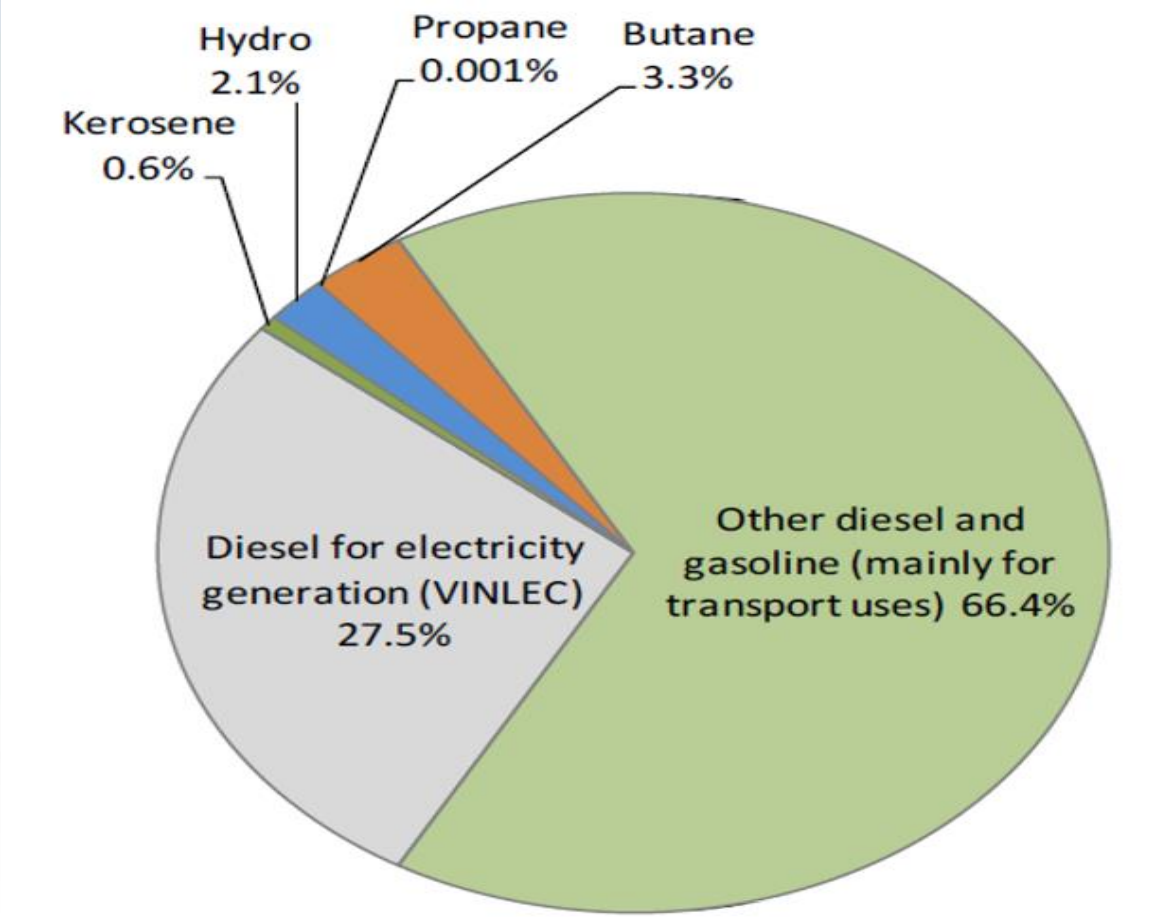
Caribbean small island states such as Saint Vincent and the Grenadines (SVG) is almost entirely dependent on fossil fuel for electricity production. This dependency has created major concerns for the sustainability of our economies and environment .

There is a thrust in SVG towards replacement of fossil fuels by the use of renewable energy sources. RE technology is used in different forms. However, there are challenges that must be overcome to expand the use of RE Technology within the country.

RENEWABLE ENERGY FRAMEWORK FOR SVG

- SVG Energy policy
- Energy Action Plan
- Standards and Regulations
- Utilisation of Renewable Energy
- Energy Awareness and Education

Breakdown of Energy used in SVG (Government of St Vincent and the Grenadines 2010)



St Vincent and the Grenadines (SVG)

- 32 islands
- 100 000 people
- Heavily dependant on fossil fuels for electricity production
- Annual energy consumption of 91 000 Toe
- Price of electricity is approximately $US0.40/kWh

ELECTRICITY GENENERATION IN ST.VINCENT AND GRENADINES

- VINLEC is given sole rights to generate and sell electric in SVG.

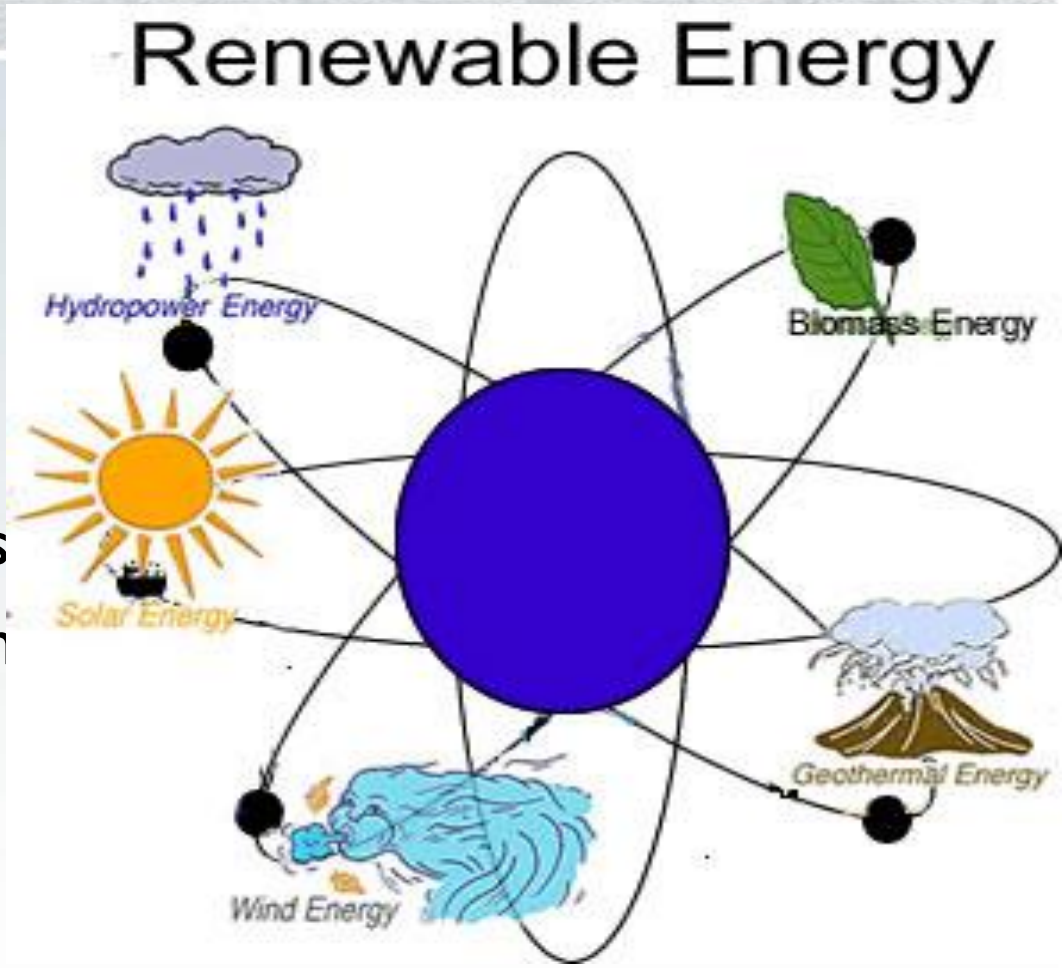
- It has nine generating plants with a capacity of 53.3MW. Three of these are hyro, with a capacity of 5.7MW(11.5%). Or 20% of peak demand.

- Local Peak demand is approx. 21MW

1. Renewable Energy Sources used/developed in SVG

Renewable energy system used to supply electricity needs:

- Small solar electric systems
- Micro-hydropower systems
- Small hybrid electric system (solar and wind).
- Small wind electric systems
- Geothermal



POWER GENERATED THROUGH THE USE OF PHOTOVOLTAICS IN SVG

Table 1: Photovoltaic Systems in St. Vincent- 2014 (source VINLEC, Dr.Vaughn Lewis, 2014)

- UP TO 2014

POWER GENERATED BY PHOTOVOLTAIC SYSTEMS IN ST.VINCENT	
VINLEC owned	187KW
Government Owned	13.3KW
Privately owned	70.8 KW
TOTAL	**271 KW**

POWER GENERATED BY PHOTOVOLTAIC SYSTEMS IN BEQUIA(largest Grenadines Island)	
Government Owned	75.9KW
Privately owned	85.0KW
TOTAL	**160.0 KW**

Further research

- Efforts are being made to expand this generating capacity base on studies carried out by GTZ. According to those studies, unused hydropower potential is in the range of 5 – 10MW from the rivers of Wallibou and Buccament

GHG EMISSIONS SAVED

- All of the solar panels installed across the country, however, are expected to reduce by more than 800 tonnes annually.

CLIMATE CHANGE EFFECT. These include a trough system on Christmas Eve 2013 that claimed 12 lives, and left loss and damages of 122 million dollars, or 17 per cent of the gross domestic product, according to government estimates

VINLEC'S NEW 370 KW PHOTOVOLTAIC POWER GENERATOR AT LOWMANS BAY

CHALLENGES TO THE USE OF PHOTOVOLTAIC SYSTEMS

- Lack of awareness and Education
- Physical site limitation
- Lack of Meterological site specific data.
- Limited technical expertiste trained in systems designing - ESCO's
- Cost of PV Systems
- Lack of carbon credits and other incentives
- Limit placed by the utility company for grid connection.
- Lack of ready financing to purchase PV systems.

THE WAY FORWARD

- Awareness and Education campaign- Introduce RE Technology in the curriculum on a larger scale.
- Meterological site specific data need to be source.
- technical expertiste trained in systems designing - ESCO's
- Subsidize Cost of PV Systems
- Provide carbon credits and other incentives
- The utility company for grid connection.
- Negotiate financing to purchase PV systems. Set uip lending fund with soft loans.

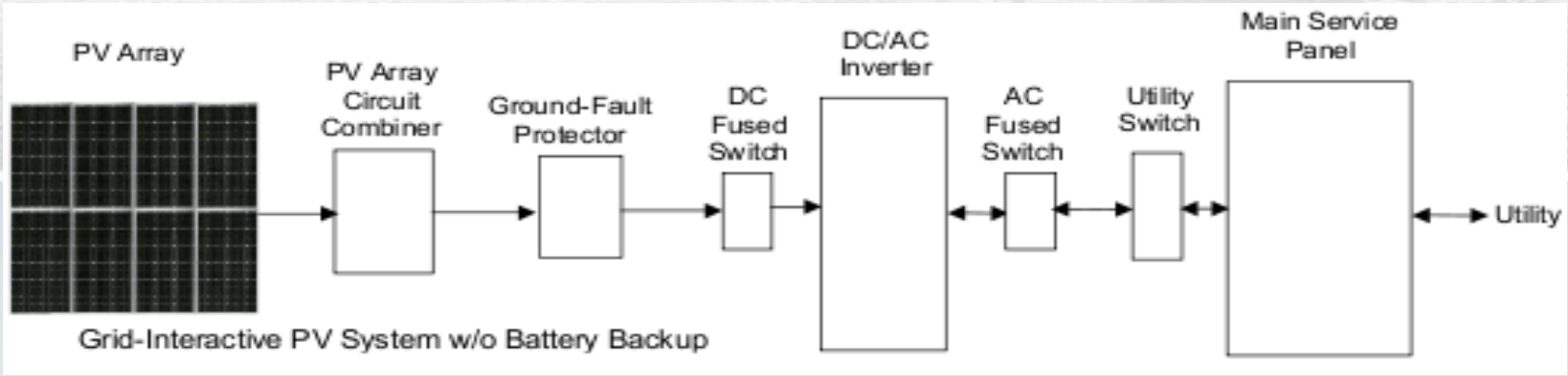
St Vincent and the Grenadines

Renewable Energy Technology

PHOTOVOLTAIC SYSTEMS

HARNESSING THE POWER OF THE SUN

2. Renewable Energy System - Solar Electric Systems



Components

- PV Array: *Photovoltaic (PV) solar panels silicon crystal layer converts sunlight to DC electricity.*

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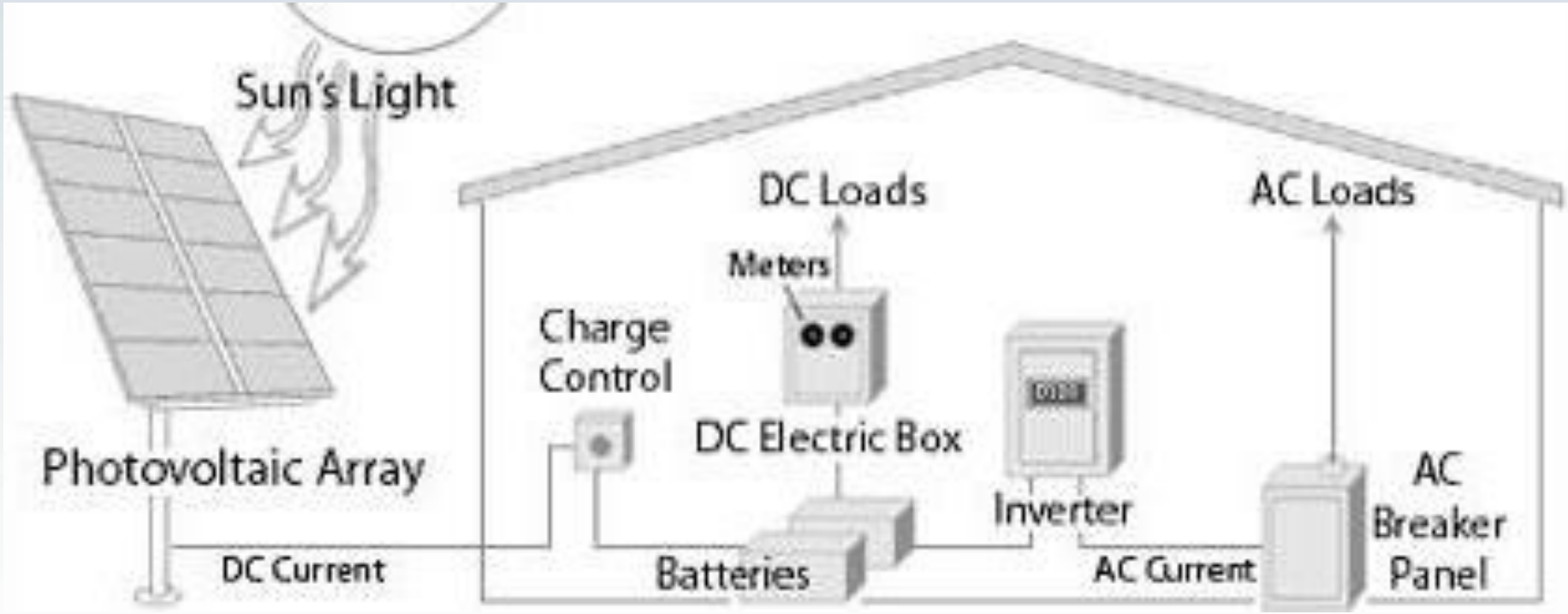
Stand-alone PV system

Stand-alone PV systems



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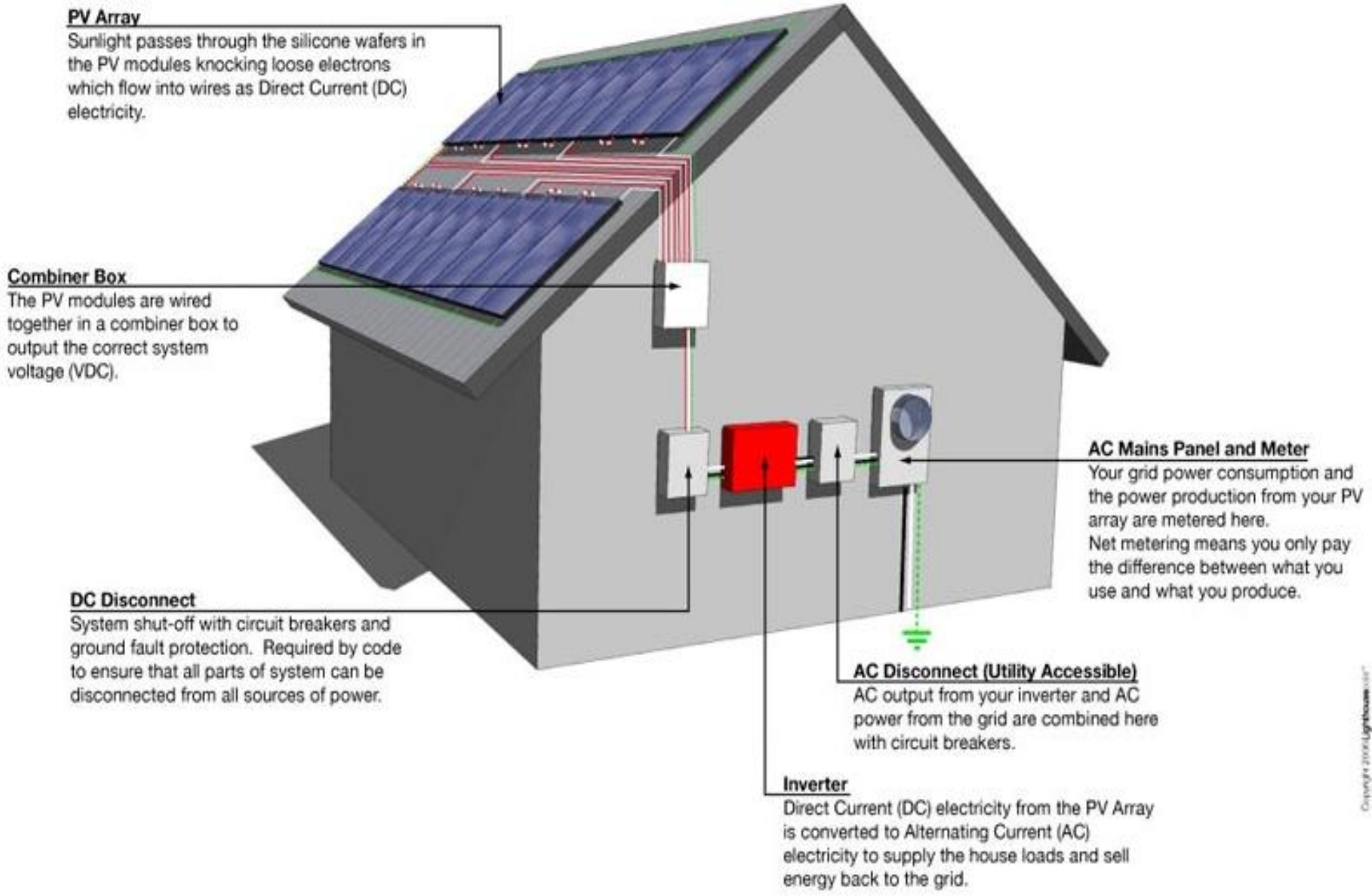
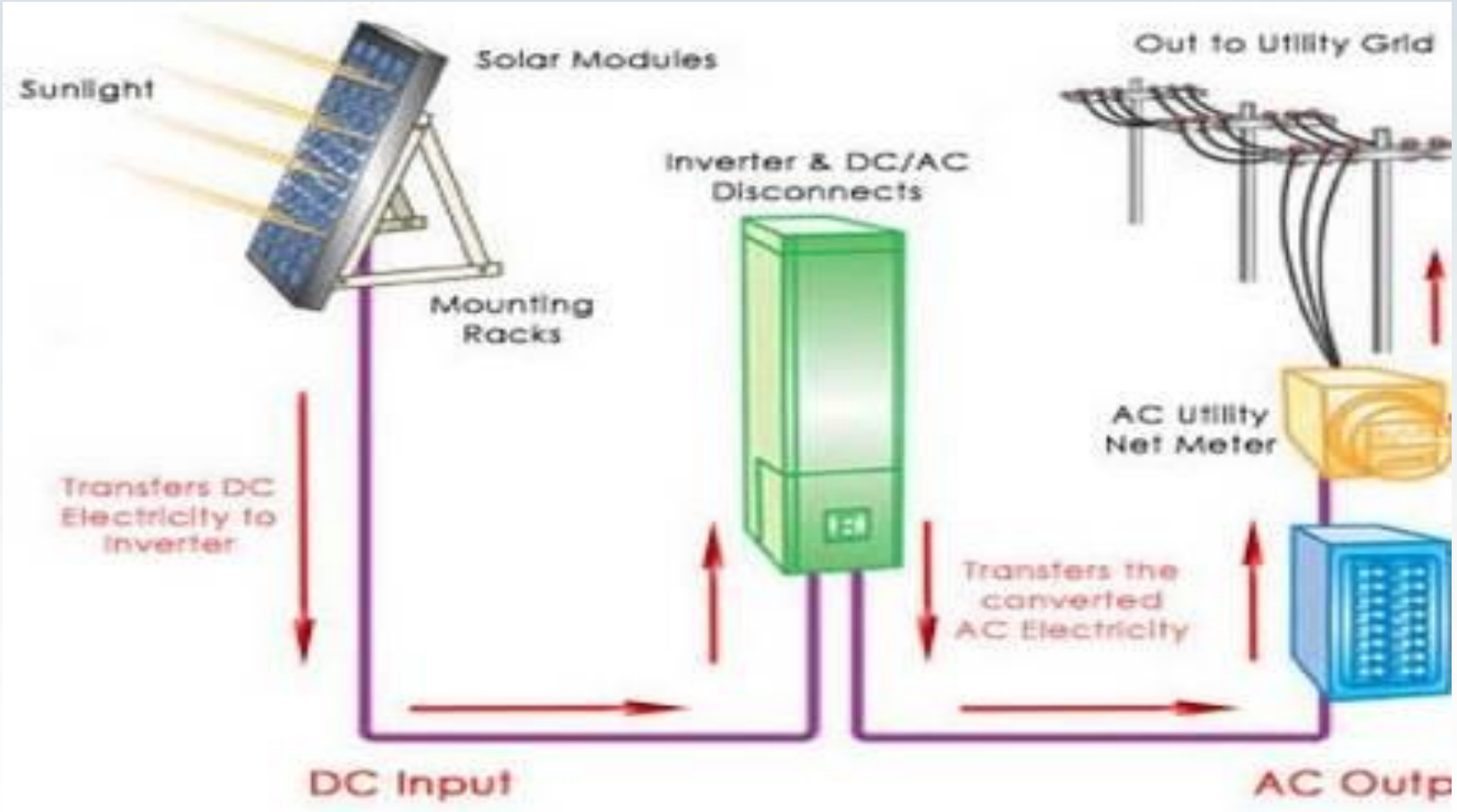
Grid-tied PV systems

2. Renewable Energy System - Solar Electric Systems

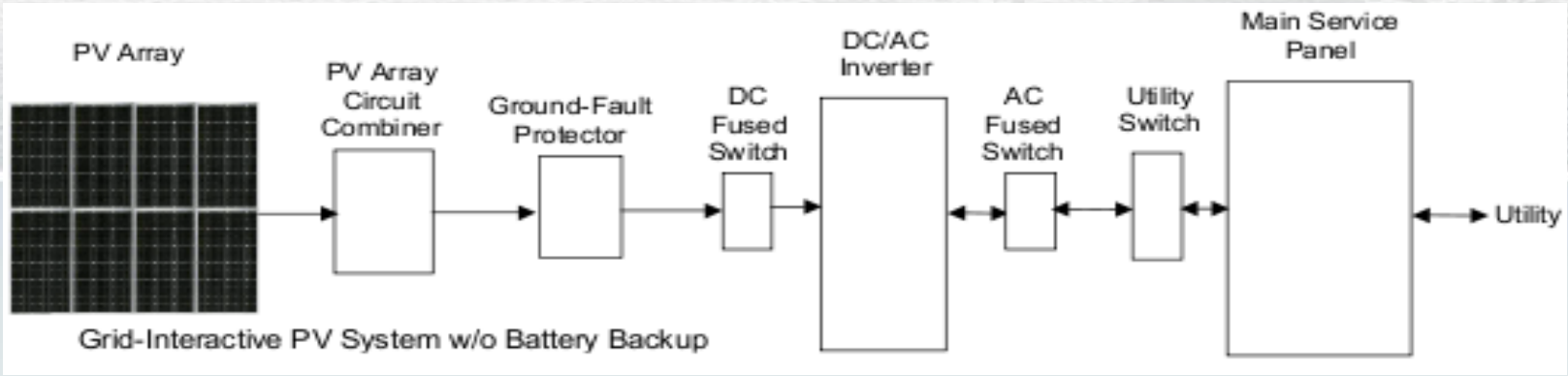


Schematic of a grid-tie system



- MERIT OF THE GRID-TIED SYSTEM

- No batteries are required as an
- Energy not generated is sent back to the grid
- Some grid-tied systems have batteries for backup
- Metering is required so the electricity sent to grid is paid for.
- The owner of the PV system can access electricity from the grid when solar is not available



- Modules or Array
- Junction box
- DC isolation switch
- Grid-tied Inverter
- Export and import meter
- Fuse box/ breaker panel
- Loads

Grid-tied inverter concepts

Who oversees international standards regarding:

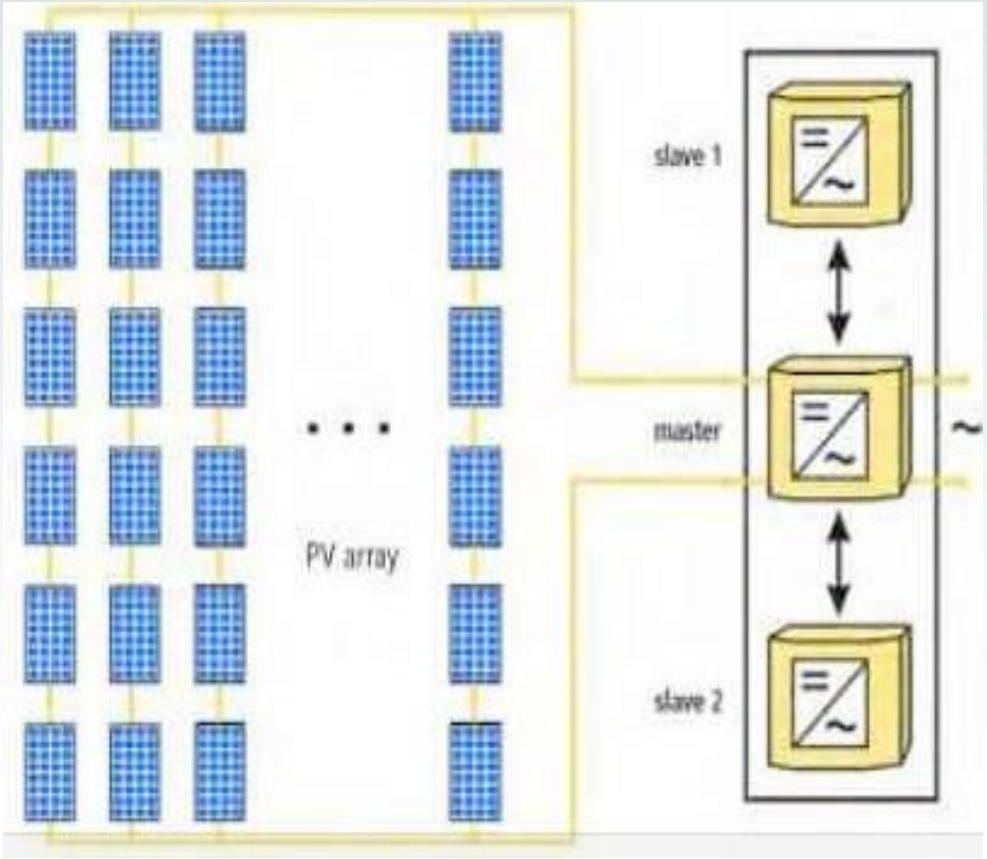
- Sine wave output
- Efficiency (AC)
- Protection against overcurrent and overvoltage
- Remote monitoring
- Visual display of array output, fault indicators etc.
- Metering

Inverter configurations

In very large PV system more than one inverter may be used. It will not be necessary to use all the invertors at once so if at low generation levels, i.e. lower irradiance, only one may be used.

Master/slave configuration

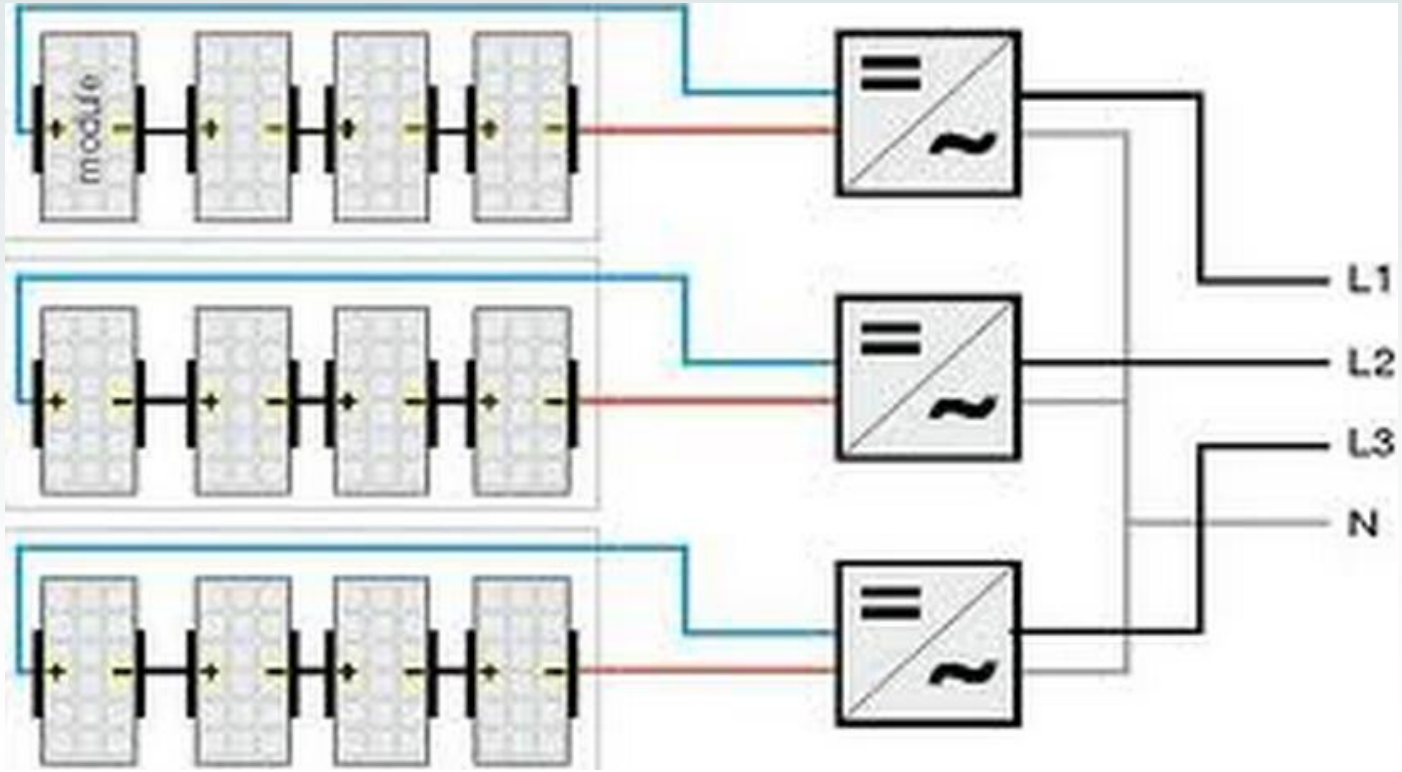
The duties of the invertor are rotated to reduce wear.



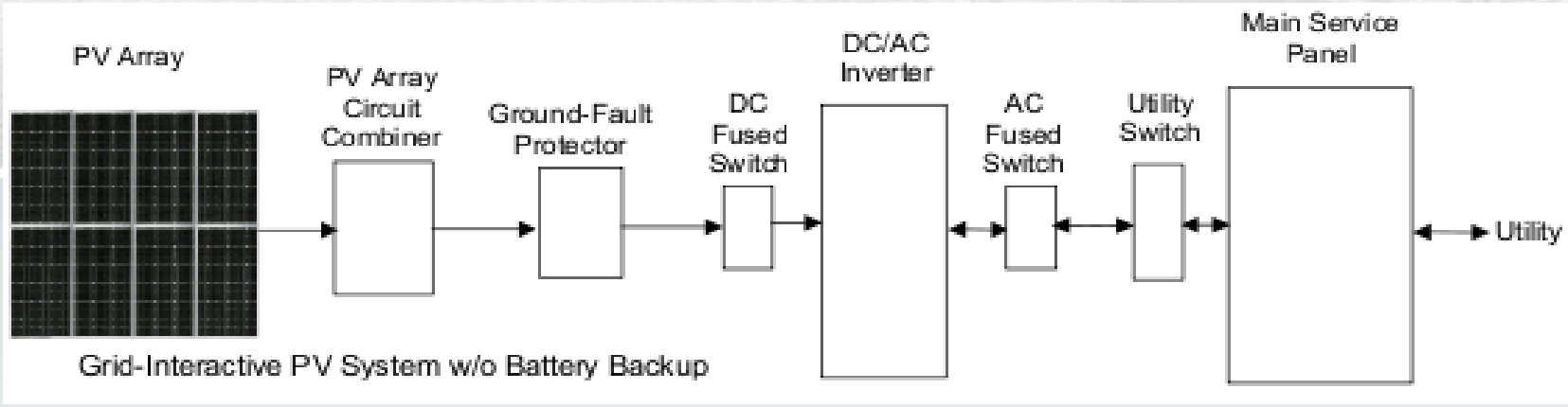
This configuration is not known to be used in the PV installations in SVG. The string configuration is dominant

String inverter configurations

- Separate invertor for each string
- If one inverter fails remainder of system OK
- Cheap, easy to install, less cabling, no junction box



2. Renewable Energy System - Solar Electric Systems



Components

- **DC/AC Inverter:** *This is the device that takes the DC power from the PV array and converts it into standard AC power used by the house appliances*

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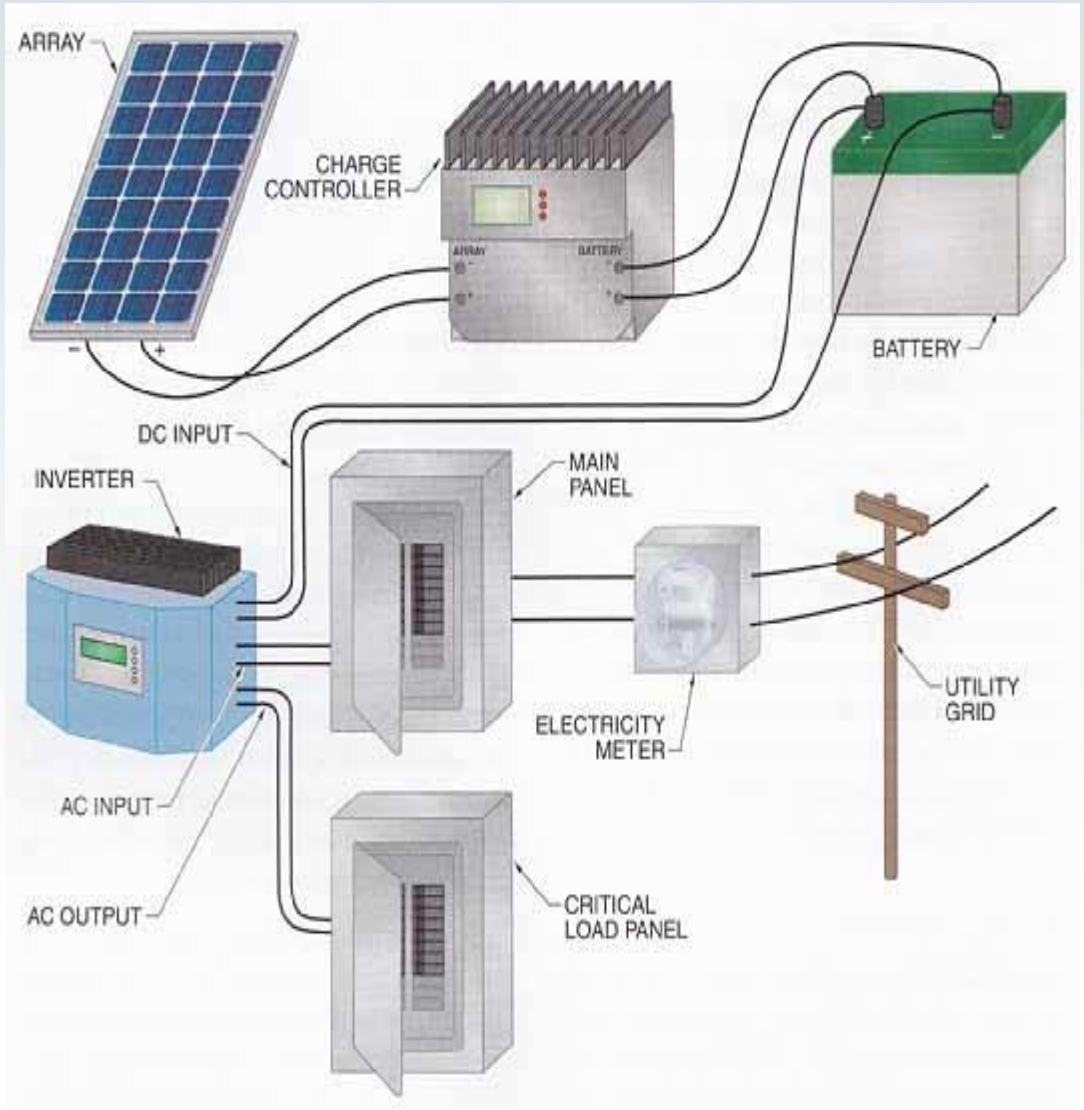
Bimodal and Hybrid Systems

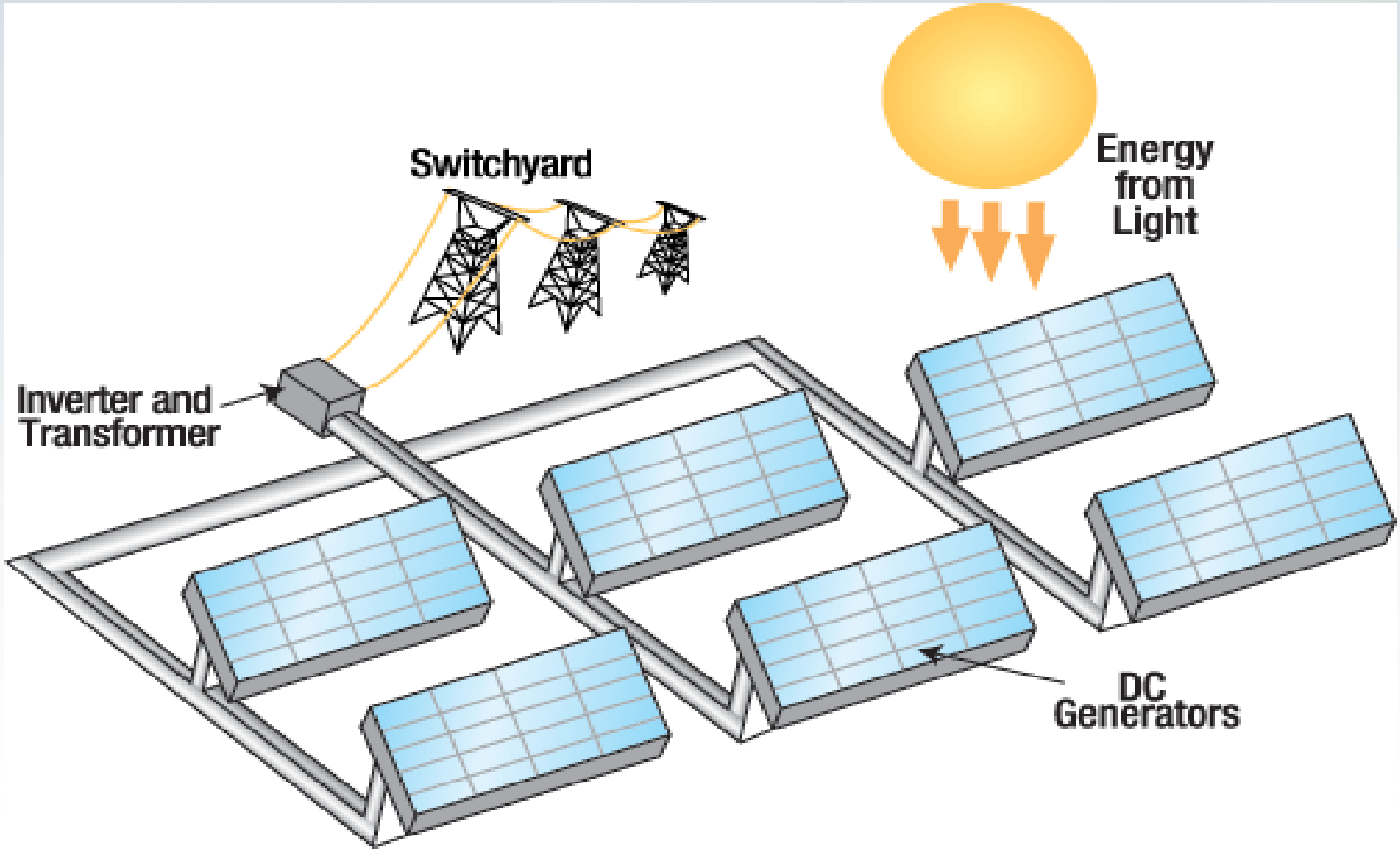
Bimodal systems

- The inverter draws DC power from the battery system instead of the array
- The array simply acts as a charging source for the battery system.
- In SVG this is utilized in a few cases to power off-grid systems

Schematic of a bimodal system



System uses a transformer to step up from say 220V to 11KV

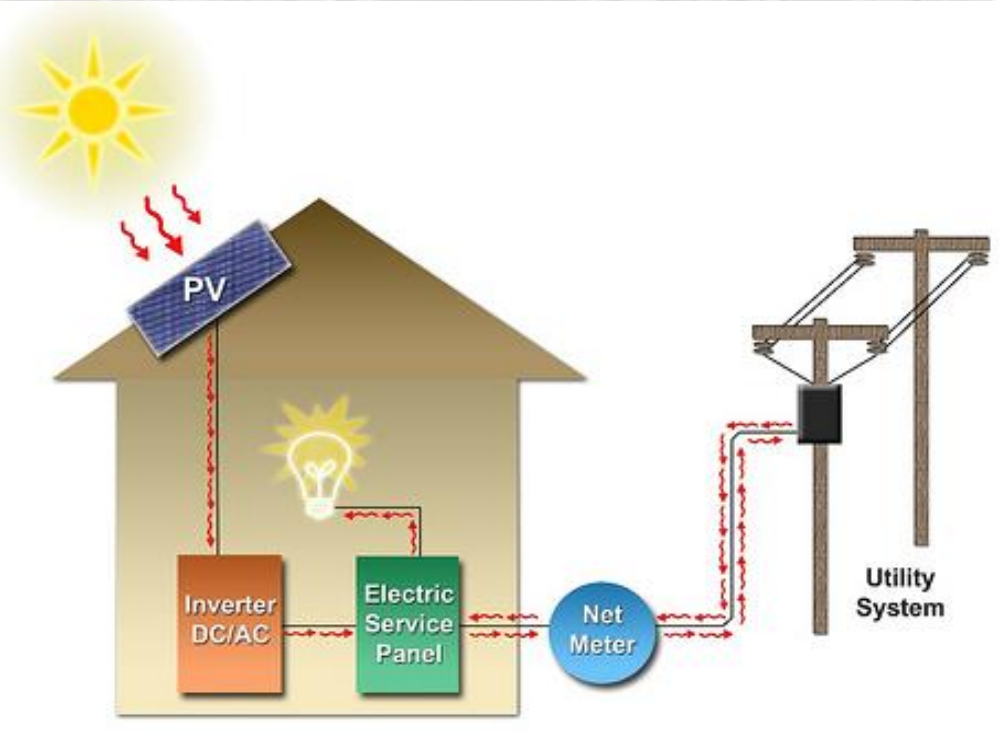


3. Net Metering Arrangement (old system)

Net metering allows customers to generate and use power simultaneously.

If either an individual net metered customer use more electricity than is generated, the customer will pay the utility only for the difference.

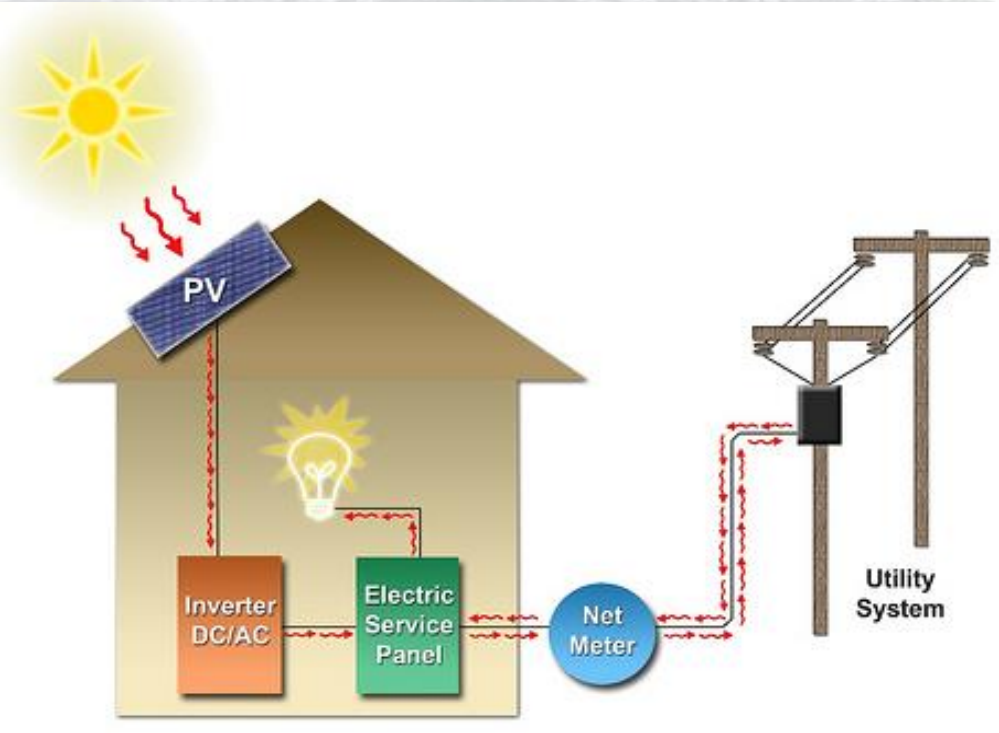
If the system generates more electricity than the customer used in a month, the utility records a credit for the excess kilowatt hours towards the customer's next bill.



3. Net Metering Arrangement (old system)

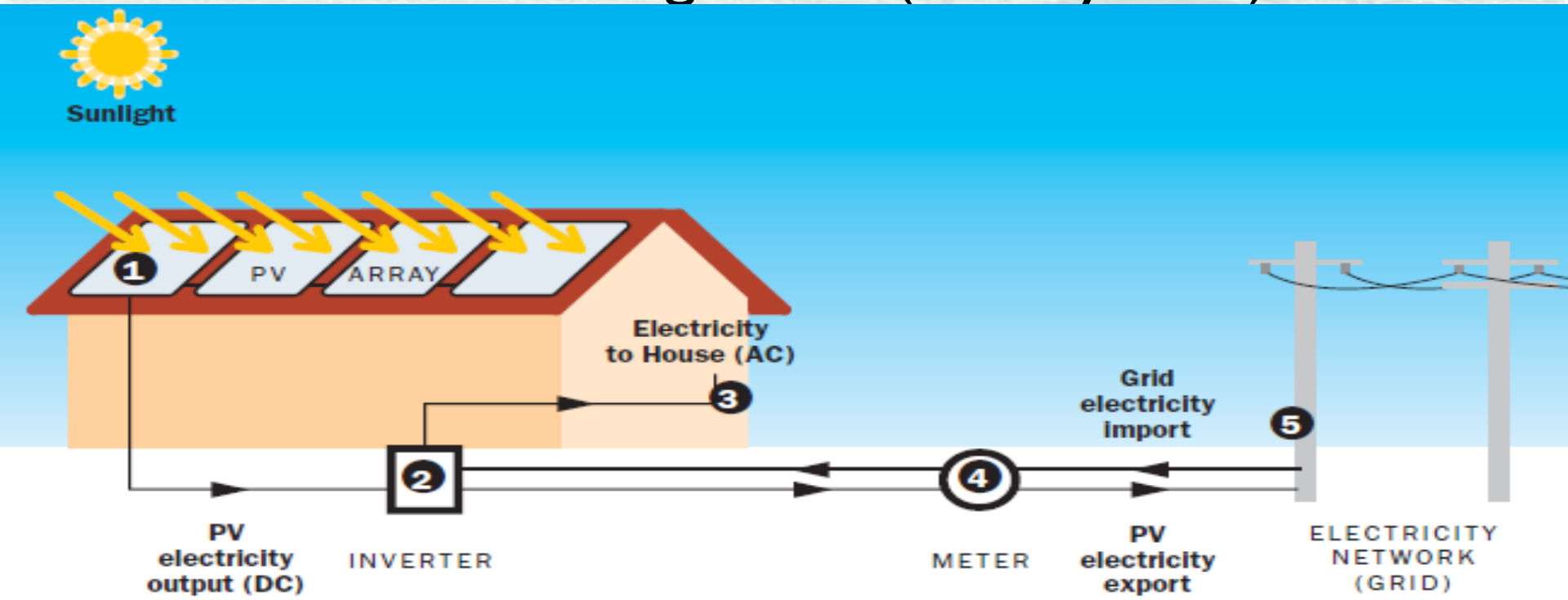
During the day when the sun is shining and the PV system is generating electricity, any power that is not directly used is transmitted back to the utility grid and the electric meter literally spins backwards.

As the meter spins backwards the customer accumulate "credits" with the utility company which is use in the evening when the PV system is not generating power.



Basically, the customer only pay for the electricity they use that they are not able to produce by their renewable energy system.

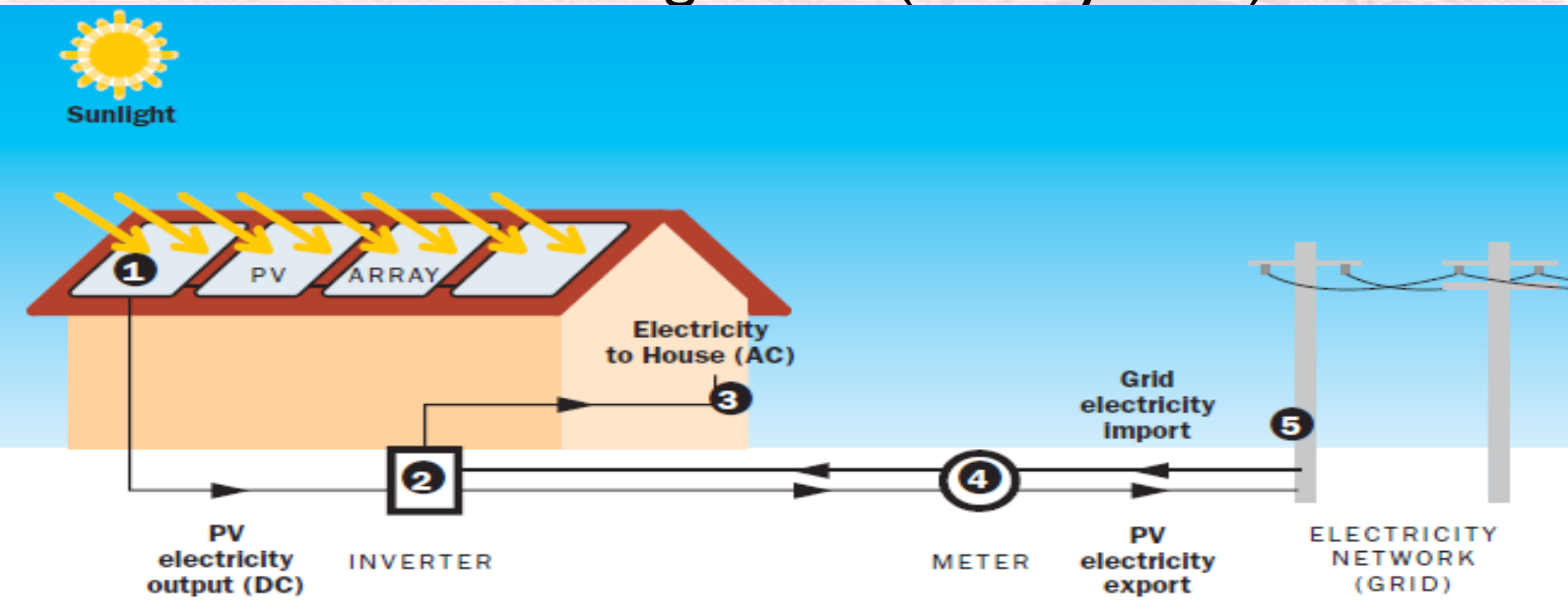
4. Feed-in-Tariff Arrangement (new system)



Feed-in Tariff* (FIT) Principle:** A renewable energy policy that typically offers a guarantee of:

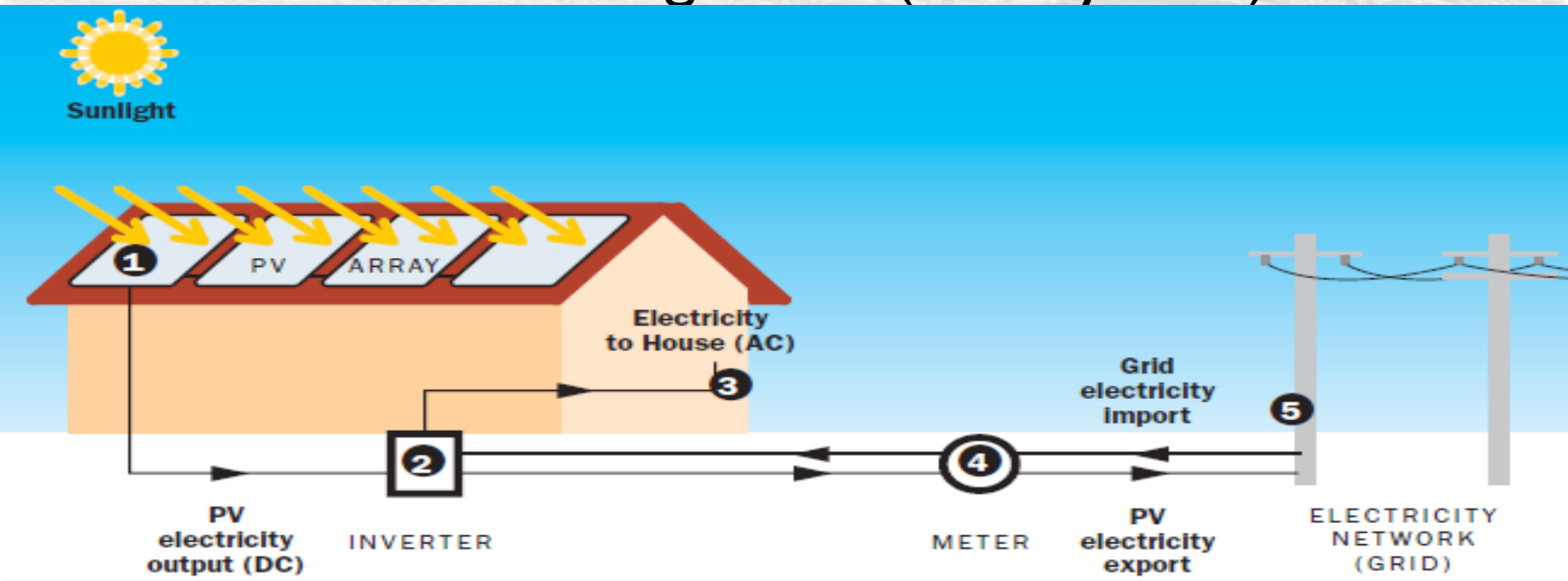
- Payments to project owners for total kWh of renewable electricity produced;
- Access to the grid; *and at times a*
- *Stable, long-term contracts (15-20 years)*

4. Feed-in-Tariff Arrangement (new system)



VINLEC Feed-in Tariff (FIT): St. Vincent Electricity Services Ltd (VINLEC) has establish a utility-level feed-in-tariffs (FITs) programme voluntarily for residential and commercial customers to encourage the deployment of renewable electricity technologies (e.g. solar photovoltaic (PV) generators).

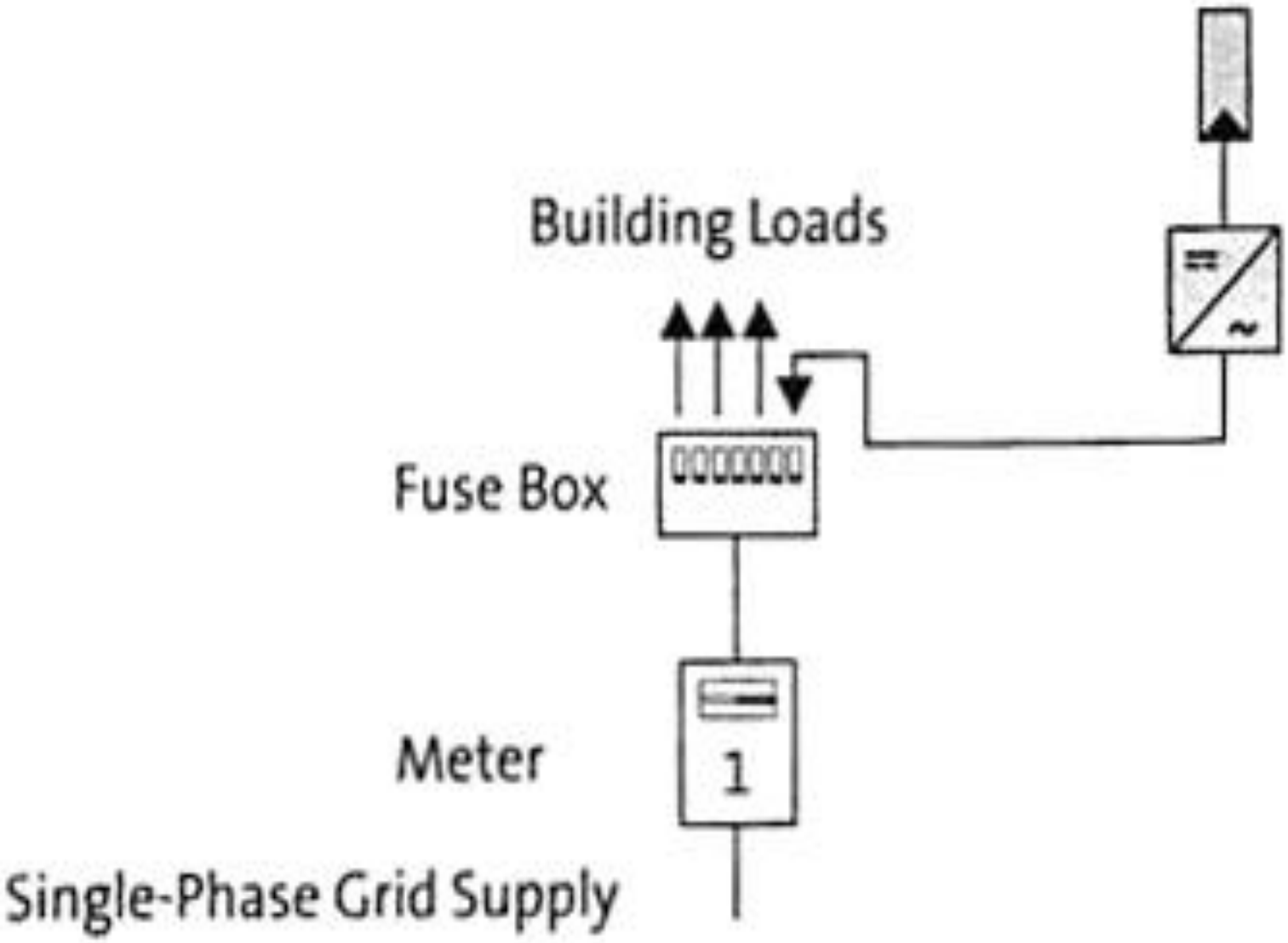
4. Feed-in-Tariff Arrangement (new system)



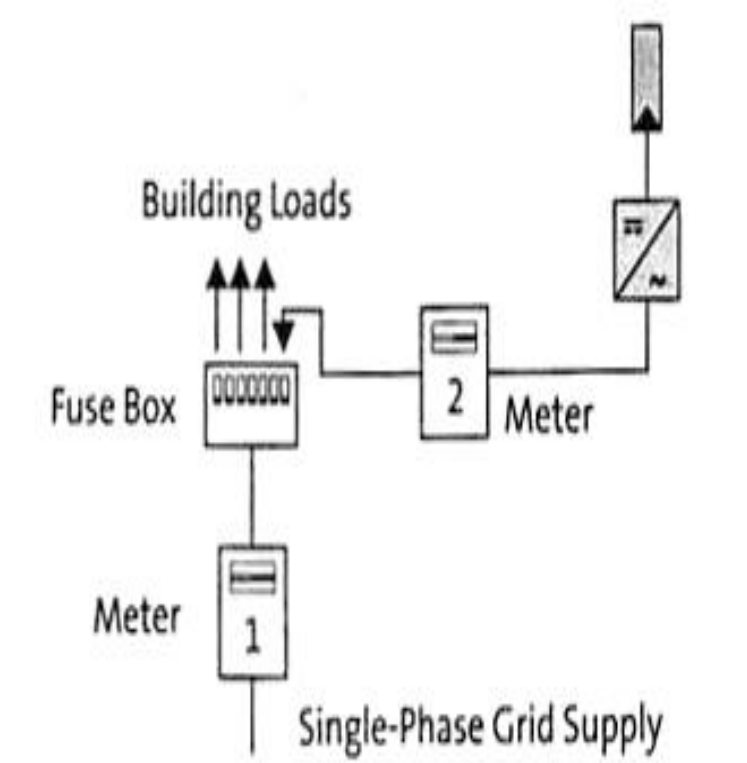
VINLEC Feed-in Tariff (FIT) (con't): The residential and commercial participants will receive 45 cents per kilowatt-hour (kWh) for all renewable electricity provided to the grid i.e. energy received (exported), and

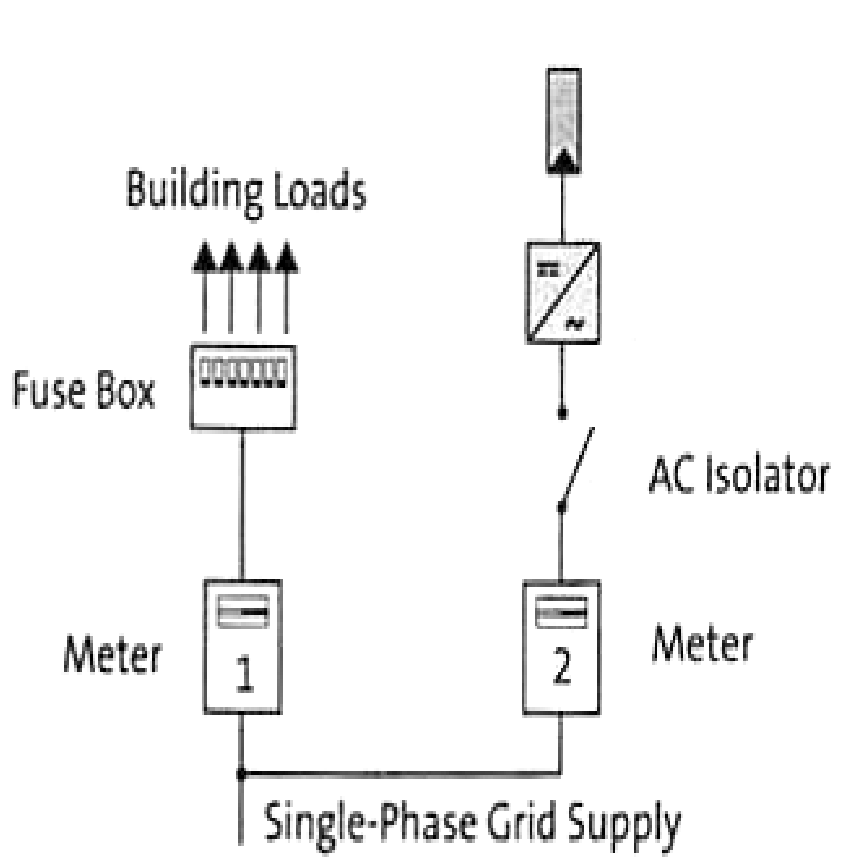
- will continue to pay the 'retail rate' for all electricity that they consume. i.e. energy delivered (imported).

METERING- USING ONE METER

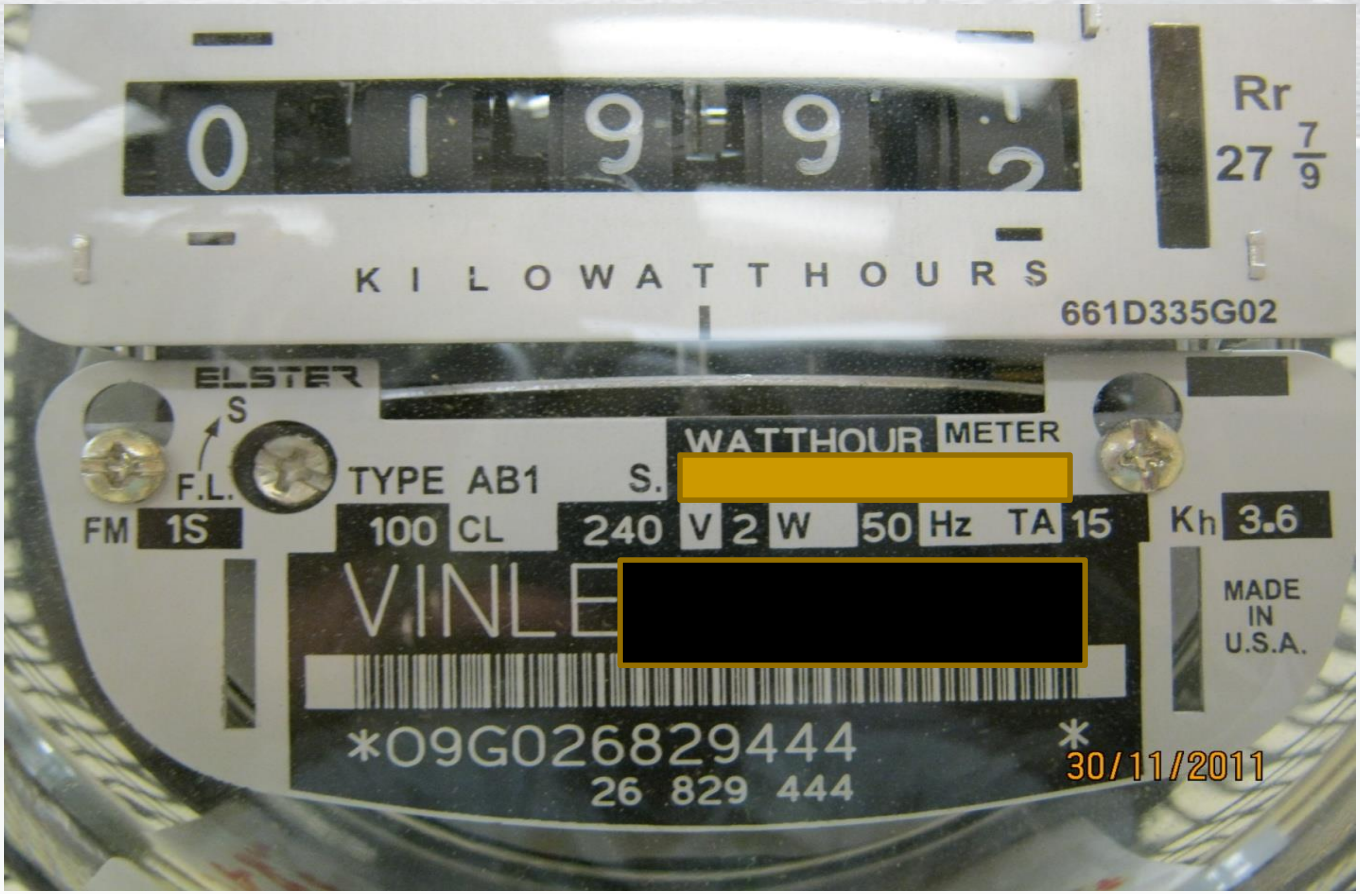


METERING – using two meters





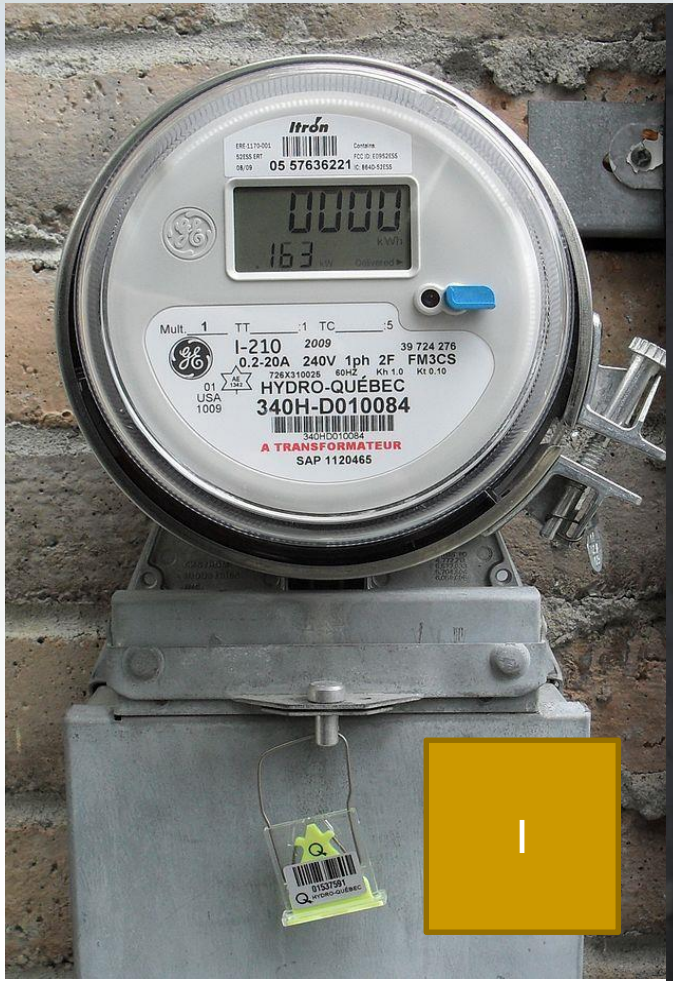
5. Electric Revenue Meters



Meter Display & Operation:

- Single display register
- Rolls forward (increase) & backwards (increase)

Electric Revenue Meters



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5. Electric Revenue Meters

Meter 1- Display & Operation:

- Single register display
- Energy deliver **ONLY**
- **Non-programmable**

Meter 2 - Display & Operation:

- Multiple register display
- Energy (kWh) delivered
- Energy (kWh) received
- **Programmable**

MONITORING OF SYSTEMS

A high percentage of the PV systems in SVG are not remotely monitored although many of the inverters carry remote monitoring capabilities.

Possible reasons:

1. Additional cost for sensors and data logging equipment and software.
2. Unfamilarity with the technology.

THANK YOU