SOLAR ENERGY

BACKGROUND:

In 1882, Thomas Alva Edison started the Edison Electric Light Company and the first power system. It was the forerunner to today's power grid. In 1954, Bell Laboratory patented a method of making electricity directly from sunlight using silicon based solar cells.

By the mid 1960s electrical efficiency, or useful power output divided by the electrical power consumed, was nearing ten percent. Subsequent federal government provisions, upgrades, and deregulation within the solar industry was designed to stimulate market demand for renewable energy systems that met certain eligibility requirements, by offering rebates to reduce the initial cost of the system to the customer.

Solar panels provide electricity, either as stand-alone arrays or augmenting other power supplies by integration into an existing electrical grid. The Grid refers to the main or national electrical grid. The effects of solar panels are financial and environmental, and can be as easily noticeable as a reduction in power bills or as subtle as a gradual lowering of the greenhouse gases present in the Earth's atmosphere.

All energy used on our planet can be traced back to its source – the Sun.

The State of California is encouraging solar power that is connected to the electrical grid to avoid the use of toxic lead acid batteries for night time storage. Grid-tie systems are generally less expensive than off-grid systems due to the lack of additional equipment like charge controllers and batteries. However, some systems may mitigate this difference by using old car batteries that can no longer supply enough current to start a car.

REASON FOR INVESTIGATION:

The 2013 – 2014 Tulare County Grand Jury has chosen to investigate solar energy in Tulare County.

PROCEDURES FOLLOWED:

1. Toured the Southern California Edison Education Center

2. Interviewed relevant witnesses

3. Researched relevant documents

FACTS:

1. State Senate Bill 1X-2 enacts a 33% renewable portfolio standard for energy savings.

2. Solar energy comes from the rays of the Sun. As the rays of the Sun reach the earth, they can be converted into thermal energy and electricity. Thermal energy can heat water and spaces, while solar cells and solar power plants can convert solar energy into electricity.

3. Solar radiation can be absorbed only during the daytime, but the demand for the energy it generates is continuous day and night.

4. Solar energy systems use two different types of solar modules. They are as follows:
   a. Photovoltaic Cells (PV) – Converts sunlight into electricity. The cells harvest the sun's energy and convert it into electricity that can be used to power lights, appliances and other electrical devices.
   b. Concentrating Solar Thermal Plants (CSP) – Converts sunlight into electricity. The cells also harvest the sun's energy, but the highly concentrated energy generated primarily by the larger solar fields is used by large industries.

5. Environmental impacts can vary greatly depending on the technology which includes two categories: photovoltaic solar cells or concentrating solar thermal plants. The impacts are as follows:
   a. Land Use – Larger utility scale solar facilities can raise concerns about land degradation and habitat loss. Land use can vary from 3.5 to 10 acres per megawatt for photovoltaic solar cell systems or from 4 to 16.5 acres per megawatt for concentrating solar thermal plant systems.
   b. Water Use – Solar photovoltaic cells do not use water for generating electricity, but water is used to manufacture some of the components. Concentrating solar thermal plants require water for cooling. The water use depends on the plant design, location and type of cooling system and use between 600 and 650 gallons of water per megawatt-hour of electricity produced.
   c. Hazardous Materials – A solar panel is made of pure silicon, a hard metalloid with a metallic luster that is basically harmless. The manufacturing process may involve toxic chemicals, solvents, alcohol and strong acids and bases. These substances are harmless if safety contained and not released to the environment, but they may pose risk. Inhaling silicon dust can cause harm to the respiratory system and may result in silicosis, which are scars that form on lung tissue and interfere with oxygen transport. A study by the People's Union for Civil Liberties in Shakapur Village, Khambat, Gryarat in India found that nearly twenty-five people died from silicosis.

6. The process of using solar energy as a heating unit involves storing heat energy in water contained in a storage unit. The unit consists of systems engineered to store solar energy to heat water and aid in household use. Solar heat systems use solar collectors that generate chemicals that can pose risks to chemically sensitive individuals who are constantly exposed to them.

7. Health risks associated with using solar energy as a thermal energy system are connected to the storage units, where allergenic molds and fungi may thrive if the materials used for the storage units are not ideal for the purpose.

8. The United States Energy Information Administration states that large solar thermal power plants could harm the environment and ecology if they are not managed properly. Animals such as insects and birds may die if they fly over an area that contains a concentrated beam of sunlight coming from a solar power tower.

9. The goal of solar power procurement and use is to protect against rising energy costs and increased demands on the grid. Other reasons are as follows:
   a. It's clean – Solar energy has no negative impact on the global climate; whereas, energy generated by conventional power plants produce carbon dioxide emissions that scientists state are serious threats to the planet.
   b. It's renewable – Wherever there is sunlight, electricity can be generated. Nonrenewable energy resources such as oil, gas and coal are increasingly scarce.
   c. It's self reliant – The more sunlight that is captured, the less electricity is needed from the grid.

10. There are two primary types of solar systems:
    a. Grid-tied Photovoltaic Cells Systems – Excess electricity produced by solar systems can be fed back to the grid through a process known as net-metering. When electricity from the grid is used the meter spins forward. The less electricity used from the grid, the slower the meter spins. When feeding electricity back to the grid, the meter spins backwards.
    b. Stand alone Photovoltaic Cell Systems – This is also called an "off the grid" or "off-grid" system, and it operates independently from the utility grid, providing all of the electricity needed at the site.

11. Going off-grid (no use of electricity) can be done for environmental reasons. It is often done to residential buildings only occasionally occupied, such as vacation cabins. Returning to the grid is usually more expensive because of inefficiencies of the components.

12. The top two of seven reasons for going off-grid according to Nick Rosen's book "How to Live Off-Grid" are saving money and reducing the carbon footprint.

AGRICULTURE
PART I

FACTS:

1. Farming and ranching are energy intensive practices. A majority of the operating costs go to electricity.

2. Having a stable energy source is necessary in agribusiness.

3. The following number of applications have been approved for agricultural solar construction permits:
    a. 2011 – Six fruit and nut agriculture companies
    b. 2012 – One fruit agriculture company
    c. 2013 – Six fruit and nut agriculture companies
    d. January through March 2014 – Five fruit and nut agriculture companies

4. One of the oldest applications of solar energy in agriculture is using the sun to dry crops and grains. Solar drying equipment can dry crops faster and more evenly than leaving them in the field after harvest. A solar dryer can consist of an enclosure or shed, screened drying trays or racks, and a solar collector, i.e., a south window to let the sun shine into a shed.

5. Commercial greenhouses rely on the sun for lighting and rely on gas or oil heaters to maintain constant temperatures. A solar greenhouse generally faces south, while its northern side is well insulated, with few or no windows.

6. Solar water heaters can provide hot water for dairy operations such as cleaning equipment and pens and for warming and stimulating cows' udders for milk production.

7. Solar use at a farm located in Tulare County:
    a. In the summer of 2013, an established farm, installed a one megawatt solar tracking system.
    b. The unit is capable of producing two million kilowatt hours, the equivalent of powering 186 average homes annually.
    c. The solar unit is projected to provide ninety-five percent of the electricity required at the dairy.
    d. The three reasons for installing the solar unit were reductions in energy costs, cost of installation and reduced taxes.

8. Solar use at a vineyard located in Tulare County:
   a. In January 2014, an established vineyard broke ground for a 1.13 megawatt solar system.
   b. They have projected to produce 1.7 million kilowatt hours annually, offsetting ninety-one percent of the company's energy needs for the cold storage facility.
   c. Over the next twenty-five years, the system is projected to save the facility $5.7 million in electricity costs.
   d. The use of solar energy at the vineyard is equivalent to preserving 24,000 acres of forests and removing 30,000 metric tons of carbon dioxide from the atmosphere.

9. Solar use at an established dairy located in Tulare County:
   a. An established family owned dairy operates with 3,200 head of dairy cows. With the drop in milk prices and rise in operation costs, a solar power system was the right solution to provide stability and energy security for the dairy today and for generations to come.
   b. A contractor installed a 719 kilowatt, $2.9 million solar system on three and a half acres of land that could not be used for feed production or to house animals. This solar system is among the largest of a handful of dairy solar units in the United States.
   c. The solar tracking system is ground mounted and automatically follows the sun through the course of the day, improving solar production by twenty-five percent.
   d. The solar tracking system supplies a minimum of 85% of the dairy's electricity needs with an annual savings of $145,000.
   e. The solar power system produces over 1.4 million kilowatt hours annually, providing energy during peak hours of the day, when electricity loads and prices are the highest.
   f. The system will reduce greenhouse gas emissions by 27,000 tons which is equivalent to permanently removing 192 gasoline powered cars.
   g. The solar facility produces enough electricity to power up to 130 homes annually.
   h. The solar installation not only reduces daily operating costs, but it also provides a long-term hedge against rising electricity costs and a strategy toward sustainable energy production.
   i. In December 2013, the dairy was selected as a Pacific Southwest Region 2013 Environmental Champion, recognition from the Environmental Protection Agency acknowledging the dairy's significant contribution to protect the environment and support communities.
   j. This particular dairy was the only agribusiness awarded the 'Environmental Protection Agency Environmental Champion.' The Environmental Protection Agency recognized six other projects in California, Arizona, Nevada and Hawaii.

SCHOOLS
PART II

FACTS:

1. Visalia Unified School District will be installing solar panels on newly constructed shade structures over playgrounds and carports. There will be no roof mounted solar panels due to permitting and structural roof challenges at the following schools:
   a. Crowley Elementary School
   b. Fairview Elementary School
   c. Green Acres Middle School
   d. Highland Elementary School
   e. Houston Elementary School
   f. Ivanhoe Elementary School

g. Linwood Elementary School
h. Pinkham Elementary School
i. Redwood High School
j. Veva Blunt Elementary School
k. Willow Glen Elementary School

2. Visalia Unified School District will realize cost savings the first year of operation.

3. Visalia Unified School District projects an average savings per year of $454,141 and a twenty-five year lifetime total cost savings of $11,353,530 with total estimated project costs of $10,735,610.

4. Of the 3,316,146 kilowatts to be used by the Visalia Unified School District 3,150,329 kilowatts will be provided by solar energy.

5. The solar facilities will be designed and sized such that the District's energy bills are reduced, but excess power will occur through a process called Net Energy Metering.

6. The Visalia Unified School District will own the solar facilities. However, the District will contract with the solar provider for maintenance and service of the solar facilities with the assistance of District maintenance staff.

7. The District will receive $2,152,233 in solar rebates paid over five years by the California Solar Initiative.

8. The following school districts within the Tulare County Office of Education either have solar facilities or have plans in the future for solar facilities:
   a. Buena Vista School District – existing solar project built in 2004 and no plans for expansion
   b. Burton School District – in the bid process
   c. Farmersville Unified School District – existing solar farm with no plans for expansion
   d. Liberty School District – exploring future solar projects
   e. Pixley Union School District – conducting inquiries for the elementary and middle school sites
   f. Pleasant View School District – in planning stages at either Pleasant View West or Pleasant View Elementary School
   g. Porterville Unified School District – existing solar facilities at six sites and under contract for ten additional sites
   h. Richgrove School District – existing solar facilities and no plans for expansion
   i. Sundale Union School District – in planning stages
   j. Tipton School District – in process of implementation of solar project
   k. Tulare City School District – working on implementing solar project at fourteen of fifteen sites
   l. Waukena Joint Union School District – in planning stages
   m. Woodlake Unified School District – existing solar facilities with no plans for expansion

FINDINGS:

1. There are many benefits to solar energy such as lower energy costs, environmental, renewal resources and clean energy.

2. The schools are doing their part to become more energy efficient.

RECOMMENDATIONS:

None

REQUIRED RESPONSES:

None