

Activity 6 - Water and Power True and False (9th -12th grades)

Introduction

The electric power industry is a complex and dynamic environment. It is made up of a diverse range of organizations and involves billions of dollars in capital. Central Arizona Project plays an important role in this industry. CAP not only buys electric power to operate its canal system, but also, indirectly, sells wholesale electric power.

CAP's involvement in the power market is directly related to our organization's primary objectives: reliable delivery of Arizona's share of Colorado River water and repayment of costs related to CAP's construction.

Electric Power

Over the years, many types of generation technologies have been developed employing a range of energy sources. The primary methods in use today include coal, natural gas, nuclear, hydroelectric, and fuel oil. Of those, coal and natural gas fuel the largest share of U.S. power production. Other technologies contribute to electricity generation by taking advantage of certain renewable energy sources. These include wind, solar, landfill gas and geothermal energy. While showing promise for the future, these sources are responsible for only a small fraction of the total electrical energy currently produced in this country. An important characteristic of electricity is that it cannot be stored or saved for future use. It must be used in real time and, therefore, is generated to meet demand.

Since we need to put this newly generated power to work immediately, let's take a look at the next step in the process: transporting the power from the points of generation to points of local distribution. The term "transmission," in the context of this discussion, refers to the bulk transfer of electrical power from one location to another. It involves the transporting of electricity from the generating facilities to the distant substations near the end-user customer.

Before newly generated power is sent across transmission lines, its voltage is increased through the use of step-up transformers. This is done in order to achieve greater transmission efficiency. The electricity then travels to the substation by way of the power transmission network, or "grid." The grid is made up of high-voltage bulk power transmission lines, cables, circuit breakers, switches and transformers. Typically, the greater part of this journey is made on over head power transmission lines that can be hundreds of miles in length. This is especially true here in the West.

Once high voltage electricity reaches the substation, the voltage is reduced through the use of step-down transformers. Lower voltages are required for compatibility with local distribution lines that carry the electricity from the substation to industries, businesses and residential customers. Depending on the location, these distribution lines can be wires atop utility poles or power cables buried underground.

Control of a utility system takes place at the substations where load and generation must be continually balanced to ensure the quality of the electricity product. Poor control can result in voltage dips, frequency deviations, power interruptions and even power outages. Operators must maintain awareness of three things in order to properly control their systems. First, they must know what is happening on their system right now in real-time. This means understanding how the system's load is being balanced by available generation. Secondly, they need to know what the load forecast and supply plan is for tomorrow. And thirdly, they need to know the load forecast and supply plan for the balance of the month, quarter, year, etc.

Utility system operators are responsible for certain specific territories. These territories include both retail and

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wholesale customers. As a given area grows, more residential, commercial and industrial customers come on line. As a result, more power lines, substations and power plants must be added to meet the demands for power.

Traditionally, the electric utility industry in the U.S. has been made up of three types of players whose major activity is selling retail power to end-users. They are investor owned utilities, public power utilities and rural electric cooperatives. In addition, there are power providers that sell at the wholesale level. These utilities deliver power to other utilities that, in turn, deliver it to the end user. Some utilities combine both functions, selling to other utilities at wholesale and to end-users at retail. Not all electricity producers and sellers are utilities. Several non-utility types have emerged over the past few decades as a result of congressional action.

The 1978 Public Utility Regulatory Policies Act (PURPA) paved the way for qualifying facilities or QFs. PURPA requires utilities to purchase power from them under certain circumstances. Examples of QFs include independent power producers, cogenerators and exempt wholesale generators. Some industry participants do not own any utility infrastructure at all. These power marketers buy and sell electric power, transmission and distribution services to both utilities and end users. They are essentially electric power services brokers.

CAP's Power Situation

The Arizona Power Authority has a contract with the Western Area Power Administration, or "Western" for Arizona's entire share of Hoover Dam power generation. In turn, Central Arizona Project has a contract with the Arizona Power Authority for a small portion of Arizona's allocation of Hoover Dam power. CAP also has its own hydroelectric power generation facility, namely, the New Waddell plant located at the Lake Pleasant Reservoir near Phoenix. Seasonal power generated by this facility contributes to CAP's electricity portfolio.

A major source of energy for CAP is its entitlement to a portion of the power generated at the coal fired Navajo Generating Station near Page, Arizona. Navajo is a non-federal generating facility owned by a partnership of several companies and governmental agencies. The Department of the Interior's Bureau of Reclamation is the largest stakeholder. Section 107 of the Hoover Power Plant Act of 1984 requires that a power-marketing plan be developed to handle any surplus power from the Navajo plant that CAP does not consume. This plan is called the Navajo Power Marketing Plan and surplus power is resold under its provisions.

Western, working closely with Reclamation and Central Arizona Project, is the marketing entity responsible for the sale and exchange of surplus Navajo power in accordance with applicable Federal law. The proceeds from these sales contribute to the timely repayment of construction costs of authorized features of the Central Arizona Project. The Bureau of Reclamation prepares Navajo Power Marketing Plans. They are subsequently adopted by the Secretary of the Interior in consultation with the Secretary of Energy, Western, the State of Arizona, and CAP.

Under the existing four-party agreement, Salt River Project has operational responsibility for CAP's power and transmission resources. SRP supplies CAP with energy for operations through the use of both SRP's and CAP's resources. Energy is provided at a price that is based on costs to generate power at Navajo Generating Station and on costs to transmit the power to the two primary substations used to supply CAP. Beyond this threshold, CAP has options as to how it meets its remaining power requirements. Conversely, any surplus power generated at Navajo - power beyond that required by CAP for operations – is resold to SRP under provisions contained in the agreement.

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The current four-party agreement is set to expire on September 30, 2011. The process of drafting the new Navajo Power Marketing Plan is well underway. The concerned parties have already engaged in discussions and a final draft of the amended plan has been authored. This draft is currently under review and could have far reaching impacts as decisions are made on how and to whom surplus Navajo Power will be marketed.

Conclusion

As you have seen, Central Arizona Project is both a leader and partner in Arizona's water and power arenas. We take these responsibilities seriously while focusing on our two primary objectives: the reliable delivery of Arizona's full share of Colorado River water to our customers in central and southern Arizona and our obligation to repay costs related to the construction of Central Arizona Project infrastructure. Our active participation in the wholesale power marketplace offers an outstanding opportunity for continued achievement of these very important goals.

Circle true or false for each statement.

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|-------------|--------------|---|
| TRUE | FALSE | The primary power generation methods in use today include coal, natural gas, nuclear, hydroelectric, and fuel oil. |
| TRUE | FALSE | Before newly generated power is sent across transmission lines, its voltage is decreased through the use of step-down transformers. |
| TRUE | FALSE | As electricity travels through the substation the greater part of this journey is made on under water power transmission lines that can be hundreds of miles in length. |
| TRUE | FALSE | CAP not only buys electric power to operate its canal system, but also, indirectly, sells wholesale electric power. |
| TRUE | FALSE | Utility system operators are responsible for certain specific territories. These territories include both retail and wholesale customers. |
| TRUE | FALSE | All electricity producers and sellers are utilities. |
| TRUE | FALSE | Some power industry participants do not own any utility infrastructure at all. |
| TRUE | FALSE | The 1978 Public Utility Regulatory Policies Act (PURPA) paved the way for qualifying facilities or QFs. PURPA requires utilities to purchase power from them under certain circumstances. |
| TRUE | FALSE | The proceeds from the sale and exchange of surplus Navajo power contribute to the timely repayment of construction costs of authorized features of the Central Arizona Project. |
| TRUE | FALSE | The Arizona Power Authority has a contract with the Western Area Power Administration, or "Western" for Arizona's entire share of Hoover Dam power generation. |
| TRUE | FALSE | A major source of energy for CAP is its entitlement to a portion of the power generated at the coal fired Salt River Project near Page, Arizona. |
| TRUE | FALSE | CAP has its own hydroelectric power generation facility, namely, the New Waddell plant located at the Lake Pleasant Reservoir near Phoenix. |
| TRUE | FALSE | SRP supplies CAP with energy for operations through the use of both SRP's and CAP's resources. |
| TRUE | FALSE | Central Arizona Project is both a leader and partner in Arizona's water and power arenas. |
| TRUE | FALSE | Any surplus power generated at Navajo - power beyond that required by CAP for operations – is saved for future use. |
| TRUE | FALSE | CAP has two primary objectives: the reliable delivery of Arizona's full share of Colorado River water to our customers in central and southern Arizona and our obligation to repay costs related to the construction of Central Arizona Project infrastructure. |