WATER & POWER ASSOCIATES, INC.

APRIL 2021

NEWSLETTER

For a Sustainable Los Angeles

What is Behind the Great Texas Blackout of 2021

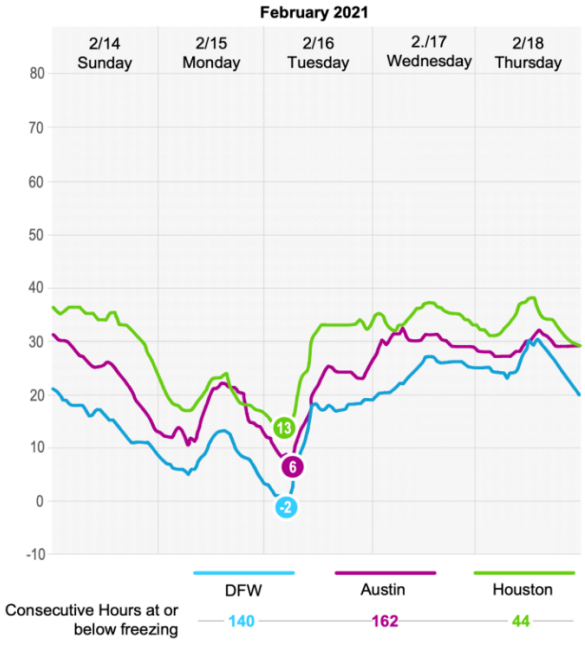
By William Barlak

This article is based on news articles published in editions of the Wall Street Journal from February 16 through March 17, and the Texas Tribune's reporting on the 2021 Winter Storm. As of this writing, news from the crisis is still developing. Details as presented in this article may change in the future as more news reports become available.

What was behind the Great Texas Blackout of 2021? First of all, it was very different from other major blackouts. A blackout usually is a wide-spread outage initiated by a single event such as equipment failure or mis-operation, or operator error, followed by the rapid cascading of other automatic protective events, or their failures, that de-energizes a large contiguous area of customers. The Northeast Blackouts of 1965 and 2003, the 1977 New York City Blackout, and the 2011 Southwest Blackout are all of this type.

The Great Texas Blackout of 2021 was caused by a sudden increase in electrical demand coupled with a sudden decrease in supply, and very cold weather. As you will see, the Texas system was not designed for these conditions, leaving the grid operator no option but to blackout a large part of Texas in order to save it.

The story begins with extremely low temperatures occurring in the early hours of Monday, February 15, 2021, in the Southern Plains of the United States, including Texas. The low temperatures lasted three days. By some estimates, 60% of Texans heat their homes with electricity rather than with natural gas. Winters are usually mild in Texas and with electricity rates normally about half of those in California, most Texans use heat pumps to stay warm in the winter and cool in the summer. This works in Texas unless the temperature drops to single digits as it did on the 15th. The electric generation infrastructure in Texas was intentionally never intended to continue production under such extremely low temperatures. Had it been, power plants and wind farms would have been able to stay online as sources in neighboring states generally did.



(Continued on page 3)

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Editor's Column

I would like to start by expressing our appreciation to Thu Pham, who developed the outstanding layout for our newsletter over the last year. She has notified us that she has commitments that will not allow her to continue in that role. She established a standard that will be difficult for us to maintain. We are looking for someone to step into that role. If you are interested in helping us, please contact me at jgewe@hotmail.com to discuss your possible role.

In order to provide the information for you to stay on top of the vital issues affecting Water and Energy in Los Angeles and Southern California, we have decided to present the information in a group of articles, rather than wait to locate someone to handle the formatting of a newsletter. I hope you will enjoy and benefit from the information presented.

This issue will focus on the energy issues as there is much currently happening in that arena. The lead article is an analysis prepared by Bill Barlak, on the recent electrical blackout affecting the State of Texas and the reasons why such a situation should not occur in the City of Los Angeles.

Also included are articles on "Are We Going Back to the All-Electric House?", "Intermountain Power Project Renewed", the National Renewal Energy Laboratory outline for a Four-Phase Framework for Energy Storage Development, and others.

We have an article on the proposed agreement between MWD and the Southern Nevada Water Authority to investigate the feasibility of working together to develop Water Recycling in Southern California to allow SNWA to access some of MWD's share of the Colorado River to assist both areas.

We also have summaries of the presentations at our recent Director's meetings including Marty Adams, GM of LADWP, "Update on Issues Facing LADWP", Emil Abdelsheid of LADWP, "Current Efforts Regarding Power Distribution Automation" and Deven Upadhyay, AGM and COO of the Metropolitan Water District, "MWD Report on Statewide Water Issues."

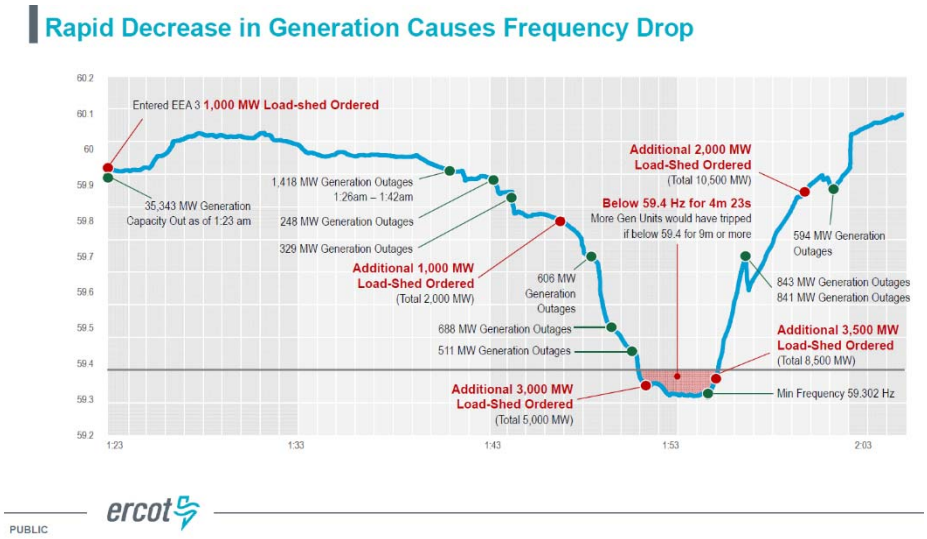
We also have our popular Mystery History feature.

Enjoy

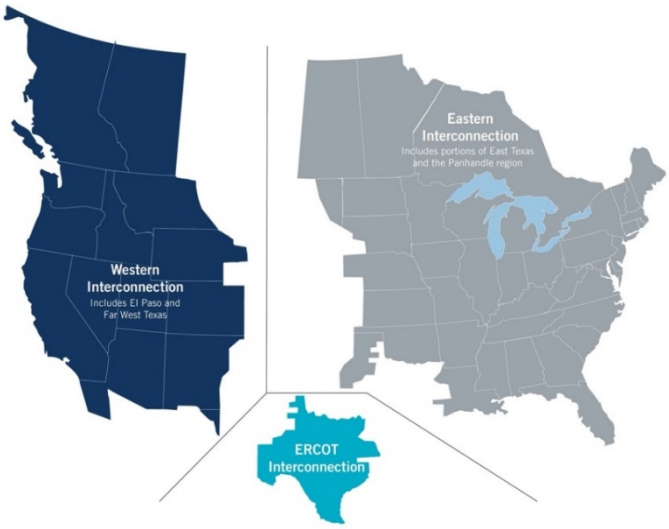
Jerry Gewe, Editor

Texas deregulated its power industry in 2002 allowing customers their choice of retail providers. The providers compete among themselves to deliver energy to their customers at the lowest price. Winterizing their assets was not a decision that made economic sense to the providers. The free-wheeling Texas energy market was supposed to encourage suppliers to harden their systems to maintain production during periods of low temperatures that promised very high prices to the providers. None of the suppliers chose to respond to that market incentive and, under the Texas deregulation scheme, they were not compelled to.

Early Monday morning, as the temperature dropped, demand spiked from 55,000 MW to 70,000 MW due to increased electric heating just as supply dropped by more than 30,000 MW as un-winterized power sources failed. The blades of wind turbines in West Texas iced up while coal-fired, gas-fired, and even nuclear generation throughout Texas tripped off-line. Some gas-fired generators remained on-line, but their gas supplies were either curtailed or cut off due to frozen gas well heads which further cut electric supply. Faced with such a severe imbalance between supply and demand and the resulting very low frequency, ERCOT, the Texas grid operator, was forced to shed as much as 30,000 MW of customer demand through rolling blackouts, affecting 4 million customers, to prevent low frequency from damaging or tripping the remaining resources. Later, ERCOT revealed the Texas grid was minutes away from total collapse when it issued the order to shed load.



Small portions of Texas that border other states are connected to either the Eastern or the Western Interconnections, but, by far, most of Texas does not connect to either Interconnection. Historically, this "go-it-alone" grid in Texas was intentional. Federal (NERC) reliability standards do not apply to states whose transmission system does not cross state boundaries. So, most of Texas avoided such interconnections to prevent Federal regulation of the state's electric energy business. Could a more interconnected Texas have survived the crisis much as interconnected utilities did that endured the same weather? Hard to say. The answer depends on how much capacity and energy would have been available in neighboring states whose supplies were also likely very stressed. Can Texas interconnect now? While interconnected operations almost always improve reliability, connecting systems that have evolved independently raises more questions. To which



regional Interconnection will Texas connect? Are there sufficient resources close to the connection interface that would be available to Texas during the next freezing cold wave? Is existing transmission on both sides of the interface strong enough to support enough power transfer to significantly reduce or eliminate future rolling blackouts? Answers to these and other questions will not come quickly, easily or cheaply.

As temperatures returned to normal, so did electrical supply and ultimately power was restored to all Texas customers. But the fallout from the event continued.

First, power was cut off to water treatment facilities, and water at these facilities froze. Water suppliers could not adequately treat water distributed to their customers. At one point in the blackout, almost half of all Texans were ordered to boil water due to lack of treatment. Also, distribution pipes burst which decreased water pressure delaying water service restoration.

Second, in order to take advantage of usually low market-driven rates resulting from supply competition, customers could choose suppliers whose rates were directly tied to the daily market price, rather than pay a higher, but constant, rate. At the depth of the crisis on Monday morning, the Texas Public Utilities Commission suspected the ERCOT computer software that matched supply and demand was not working to issue the correct market signal. The three-member PUC, all of whose members were appointed by the governor and is responsible for the reliability of the Texas grid, manually increased the market energy price from $1,200 per MW-hour to $9,000 per MW-hour in order to get more generating units on-line. The PUC made this manual change precisely when all the available units in Texas were already generating at maximum; increasing the price did not increase supply. The $9,000 price remained in effect for more than four straight days, accompanied by fees for ancillary services totaling $25,000 per MW-hour. Some market participants later complained that the PUC's manual price increases turned an electrical emergency into a financial disaster for distribution companies and customers who are subject to the artificially high market rates. Texans who were not blacked out but who originally chose to be supplied at market rates suddenly faced bills of thousands of dollars. Distribution companies who supplied customers at constant rates are also facing much higher energy bills because the cost of their supply is also directly tied to the market. Brazos Electric Power Cooperative, the largest electrical co-op in Texas, filed for bankruptcy. Brazos' general manager said, "Simply put, Brazos Electric suddenly finds itself caught in a liquidity trap that it cannot solve with its current balance sheet." CPS Energy, San Antonio's municipally-owned electric and gas utility, is suing ERCOT, alleging that the grid operator is engaged in "one of the largest illegal wealth transfers in the history of Texas." Even though an independent auditor later reported that ERCOT maintained the $9,000 energy price 33 hours longer than warranted resulting in an overcharge to customers of $16 billion, the Texas PUC chose not to reverse the overcharge. There is a continuing dispute about how to handle the $16 billion in overcharges. The Environment Subcommittee for the U.S. House Committee on Oversight and Reform stated it is investigating ERCOT's role in the crisis.

Third, many of Texas' grid officials are now gone. As of mid-March, all three members of the Texas PUC resigned leaving Texas with no one in authority to oversee the Texas electricity system. Six ERCOT board members, some of whom reside outside of Texas, including the chair- and vice-chairperson, resigned after ratepayers and politicians criticized ERCOT's leadership for failing to anticipate the crisis. The ERCOT board fired its CEO, Bill Magness, for not doing more to compel suppliers to weatherize their resources.

Fourth, in 2011, almost 10 years to the day before the 2021 crisis, Texas suffered through another few days of very cold weather, accompanied by increased demand, a decrease in non-weatherized supply and rolling blackouts that blacked out 1 million Texans. After reviewing the 2011 event, the Federal government recommended Texas take action to avoid a future occurrence by winterizing supply. Texas chose not to take the recommended action. After the 2021 crisis, Rick Perry, the former Texas governor and former Secretary of Energy in the Trump administration was quoted as saying "Texans would be without electricity for longer than three days to keep the federal government out of their business."

Fifth, due to cheap wholesale electric rates resulting from deregulation, most of the natural gas suppliers in West Texas chose to power gas compressors at the wells with electricity rather than with natural gas from the local wells which is customary. When ERCOT ordered rolling blackouts, the gas suppliers' compressors were de-energized along with other customers, stopping them from sending gas to power plants. This "vicious downward spiral" occurred simply because gas suppliers had not filed forms with their local utilities designating their electrical supply as "critical" and not to be interrupted. One expert characterized this fatal lack of coordination between gas and electric industries as "a failure of regulation; that's all it is. It's relatively simple."

How was LADWP affected by the Great Texas Blackout of 2021? Spot market gas prices and wholesale energy prices in Southern California dramatically surged, but LADWP was protected from these high prices by:

- Maintaining resource diversity—capacity, energy, fuel type, geographic location and renewables;
- Robust gas hedging program securing a firm gas supply at known costs;
- Managing generation around the amount of hedged gas;
- Greater use of non-gas resources to fill in the gaps;
- Self-supplied resources—and not relying on markets to provide energy reliability.

Could the Great Texas Blackout of 2021 happen in Southern California, and in LADWP in particular? Since extremely low temperature was the trigger, we start by asking "what is the lowest temperature ever recorded in Los Angeles?" The answer is 28 degrees in downtown on three separate occasions dating back to 1883, which is a long way from the 4 degrees suffered by Texans. Since most Southern Californians and Angelenos currently use natural gas as space heat, very low temperatures do not necessarily mean a dramatically increased electric demand. But it would likely mean loss of some local supply that is probably not meant to ride through single digit temperatures that, so far, have never occurred in Southern California. Depending on how widespread the extremely low temperatures were, any loss of local supply could likely be mitigated by LADWP's ability to replace it with external resources available over its far-flung transmission system reaching all the way to the Northwest, Arizona, Nevada, and Utah. So, very low temperatures in Southern California would probably not result in the same crisis faced by Texas.

Moreover, there are a number of structural differences that position LADWP differently than Texas and reduce the likelihood of a similar event at LADWP resulting in multiple day outages for significant portions of its customers. DWP has designed its system to have layers of redundancy, and has undertaken a program to modernize its distribution system. Clearly climate change is the most significant issue facing the global environment. As experienced in California last summer and more recently in Texas—these extreme weather events are becoming more frequent and severe, impacting large geographic regions and tightening supply and availability of resources. It will be important to

ensure modeling, planning and system designs are modernized to factor these in appropriately as the system decarbonizes. Due to a variety of great decisions and efforts by many prior LADWP staff and regulators, LADWP has remained vertically integrated with control over its own transmission and generation resources. With LADWP's vast transmission resources, LADWP has access to a diversity of resources in the western interconnect that will assist with any energy shortfalls or contingencies. But it's important to recognize that LADWP's system is dependent on other systems, some outside of its control—natural gas, water and communications-- that can also impact electric system reliability.

Finally, DWP's LA100 study is a comprehensive, industry leading, detailed analysis of how LADWP's power system can evolve to a clean energy future while maintaining reliability for LA customers. The study will be finalized in March, and information gleaned from LA100 will flow into the Strategic Long Term Resource Planning process that will ultimately provide a dynamic roadmap to get there.

Update on IPP Renewed

By Bill Engels

The Intermountain Generating Station (aka the Intermountain Power Project (IPP)), the coal-burning generating station located in west central Utah, which has been the electric generating backbone of the LADWP Power System for more than 30 years, continues on its path to being converted to burn natural gas and renewable energy-derived hydrogen fuel. Such a conversion of this critical piece of LADWP's generation portfolio will be a major step toward Los Angeles meeting its goals of reducing greenhouse gas emissions over the next few decades.

Known as "IPP Renewed", the conversion effort took a major step forward in 2020 when Mitsubishi Power Americas was awarded a contract for two advanced class combined cycle M501JAC generating units. The 2 X 420-megawatt capacity generating units, currently in the detailed design stage, are scheduled to come online in 2025, when coal-fueled electricity generation at the site will cease. Current plans are to initially utilize 30% hydrogen and 70% natural gas, before gradually converting to 100% hydrogen by 2045. The hydrogen will be derived utilizing an electrolysis process powered by nearby renewable energy resources, primarily wind and solar.

The fuel mixtures will immediately reduce carbon emissions by more than 75% compared to the retiring coal-fueled technology. Between 2025 and 2045, as hydrogen utilization is systematically increased to 100%, carbon emissions will correspondingly decrease until carbon-free utility-scale power generation is achieved.

In addition to being located in an area rich with renewable energy resources, the generating station is fortunately sited above a naturally-occurring salt dome formation, which can be hydraulically mined to create a large sealed void, in which the renewable energy-generated hydrogen can be compressed and stored. The hydrogen can then be mixed with natural gas as prescribed to fuel the generating units.

In 2020, a multi-stage Request for Proposals was advertised for the production and storage of the renewable energy-derived hydrogen, and Stage One responses have been received and evaluated. Stage Two, scheduled to be advertised in June 2021, will involve a deeper dive into the required technical and commercial arrangements, including identifying the renewable energy resources, transportation and storage, and needed commercial structures. The anticipated award of the hydrogen production and storage project is December 2022.

In 2021, an Engineering, Procurement and Construction (EPC) contractor will be selected who will begin overall project construction activities in Q2 2022.

The IPP Renewed project has recently teamed up with Siemens Energy to perform a conceptual design study on integrating the underground hydrogen storage system into the power generating facility. The joint effort was awarded a $200,000 grant from the U.S. Department of Energy in late 2020 to advance hydrogen applications in the U.S. power generation sector.

The goal of this study is to analyze the overall efficiency and reliability of a CO2-free power supply involving large-scale production and storage of hydrogen. In addition, the study will analyze aspects of integrating the system into an existing generating station and transmission grid, including the interaction with subsystems, sizing and costs. The study will be designed around Siemens Energy's Silyzer electrolysis technology, which it has developed to generate hydrogen. The scope of the research will include hydrogen compression, storage and intelligent plant controls.

As it is a ground-breaking endeavor for the power industry, the IPP Renewed project has garnered worldwide attention from news media as diverse as Bloomberg, S&P Global, Axios, and POWER Magazine, thus demonstrating once again how LADWP, as it has done many times in the past, is pioneering monumental changes for both power-producing technology and an improved environment.

If you want more information, but didn't catch it, an article about the IPP Renewed project appeared in a 2020 issue of LADWP's Intake Magazine, which can be reached at the below hyperlink.

http://www.ladwpintake.com/the-future-of-ipp-is-green/

WATER & POWER ASSOCIATES, INC.

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Interested in becoming a member? You can join via our website, waterandpower.org, or by returning the application on page 20.

The Los Angeles Water and Power Associates, Inc. is a nonprofit, independent, private organization, incorporated in 1971 to inform and educate its members, public officials and the general public on critical water and energy issues affecting the citizens of Los Angeles, Southern California and the State of California. Our secondary mission is to preserve the regional history of water and electricity and show its role in the development and growth of the City of Los Angeles. Also, to disseminate knowledge of the rich and diverse multicultural history of the greater Los Angeles area; to serve as a resource of historical information; and to assist in the preservation of the City's historic records.

NREL Outlines Four-Phase Framework for Energy Storage Development

Excerpted from APPA by William Glauz

With energy storage deployments growing, Department of Energy researchers have developed a four-phase framework to help utilities and others understand the technology's possible evolution on the grid.

The National Renewable Energy Laboratory researchers expect their report — The Four Phases of Storage Deployment: A Framework for the Expanding Role of Storage in the U.S. Power System — will help utilities, regulators and other stakeholders evaluate different pathways for storage and other sources of grid flexibility.

The report released late in January is the first publication to come out of NREL's multi-year Storage Futures Study, which will explore energy storage technologies across a range of potential future cost and performance scenarios through 2050.

There are about 24,000 megawatts of energy storage on the U.S. grid, mainly in the form of hydroelectric pumped storage facilities. Looking ahead, the NREL researchers expect energy storage to develop in four phases:

1. Energy storage with no more than one-hour duration that can provide operating reserves;
2. Energy storage with two to six hours of discharge duration to provide peaking capacity;
3. Lower costs and technology improvements that enable storage to be cost-competitive while serving longer-duration peaks that last four to 12 hours; and
4. Energy storage with durations lasting from days to months that could help achieve very high levels of renewable energy in the power sector, or as part of multi-sector decarbonization.

The first phase started around 2011, while the second phase has also started in some areas.

Save the Date

2021 CALENDAR

GUEST OF THE MONTH

WATER&POWER ASSOCIATES,INC.

REIKO KERR SR ASST GM POWER SYSTEM LADWP	APRIL 14, 2021 UPDATE ON POWER ISSUES
DELON KWAN ASST DIR WATER RESOURCES LADWP	MAY 12, 2021 2021 URBAN WATER PLAN & MWD ISSUES
JACK FELDMAN WEBMASTER WATER & POWER ASSOC	JUNE 9, 2021 WPA WEBSITE & VIRTUAL MUSEM

A window display with a simple message spelled out in big letters on the wall "Future Home Makers Prefer Modern Electrical Appliances"

Back to the Future, Are We Going Back to the All-Electric House?

By William Glauz

The next series of articles I plan to write will address the recent trend by many cities, primarily in the western United States, to require all new construction to have their energy needs met 100% from electricity, no natural gas. This has been in response to policies to reduce greenhouse gas (GHG) emissions to combat climate change. In this series I plan to review the history of electricity and natural gas use in homes and businesses, how GHG emissions affect climate change, the implications of natural gas on GHG emissions, policy decisions that have and are affecting GHG emissions, and how electrification of current natural gas processes will impact the user and the utility. This first article will look into the history of electricity and natural gas as energy sources for homes and businesses.

History of Natural Gas

What Is Natural Gas?

Natural gas is actually methane, a hydrocarbon gas, composed of one carbon atom and four hydrogen atoms (CH4), and is a product of natural decay and decomposition of organic material. Since organic material takes time to thoroughly decompose, natural gas forms underground either as a byproduct of bacterial organisms or from extreme pressure and heat in deeper rock layers. Deep deposits of natural gas are usually found at the same levels as shale and coal.

When Was Natural Gas First Used?

Humans first harnessed the use of natural gas over 3,000 years ago. Around 1,000 BC, legend has it, a goatherd discovered a burning natural gas seep on the slopes of Mt. Parnassus in Greece. Deemed a miraculous gift of the gods, a temple was soon established. Famed as the Oracle of Delphi, priestesses would predict the future by inhaling the seep's fumes.

The History of Natural Gas in the United States

Natural gas was first scientifically identified by Alessandro Volta, the father of the battery, in 1776. Between 1792 and 1798, inventor William Murdoch began experimenting with coal gasification to produce methane for lighting, specifically concentrating on transporting, storing, and purifying the gas. Throughout the 1800s gas was used primarily for lighting which drove the need to begin laying gas pipelines. Soon, interstate pipelines were built to bring gas from production fields to consumers, and state utility boards began to exercise control.

Today, natural gas is a fairly abundant, cost effective and domestic fuel used extensively throughout the United States. It is second only to petroleum as the primary energy source in the US at about 32 quadrillion BTUs per year. About 36% of natural gas is used to produce electricity, 33% used for industrial processes and about 27% used for commercial and residential consumers, primarily for space and water heating, along with cooking and clothes drying.

A Brief History of Electricity

I won't spend much time on the early history as most of our readers are very familiar with this subject and even were part of its history. However, electricity became an energy source a little after natural gas usage, with its real kick start in 1882 when Thomas Edison, with J.P. Morgan funding his efforts, launched the business that would later be known as General Electric (GE). In September of that year, Edison opened the United States' first central power plant in lower Manhattan, the Pearl Street Station. Electricity produced there powered lighting in the area and became a competitor to the use of natural gas for lighting. The production and delivery of electricity along with the development of electrical appliances took off from there.

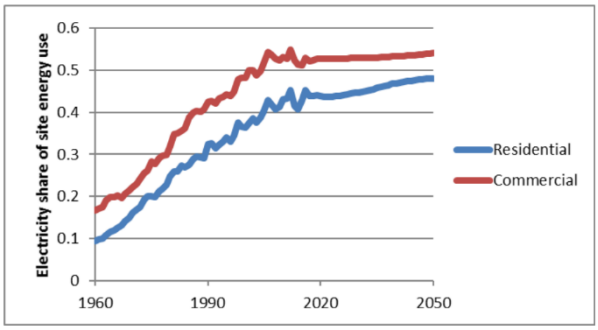
In the mid-1950s, GE and Westinghouse co-sponsored a nationwide campaign to promote the sale of electric appliances and to tout the benefits of electric power. At the time, utility companies were rushing to meet the increased demand for electricity in postwar America. However, as more power plants came on line the cost of electricity decreased and homeowners were encouraged to consume more power.

Nationwide hundreds of electric utilities, including LADWP, and appliance manufacturers launched the Live Better Electrically (LBE) campaign. To further the new program, in October 1957 the National Electrical Manufacturers Association launched the "Medallion Homes" campaign, which sought to initially sell 20,000 all-electric homes nationwide within a year.

The LBE initiative and Medallion Homes program were heavily promoted through a variety of magazine and newspaper ads, as well as TV spots, and even radio jingles. The main campaign spokesman was then-actor Ronald Reagan, the host of "General Electric Theater." As part of the show, Reagan took television audiences on a tour of his own Pacific Palisades home.

The title of the campaign changed slightly over the years, but the Live Better Electrically logo remained a constant, and Medallion Homes became Gold Medallion Homes.

The LBE campaign positioned natural gas, the biggest power source of the time, as an outmoded method to operate appliances like furnaces, cooking ranges, water heaters, and clothes dryers. Living in a Medallion home was marketed as the apex of modern living. By all accounts the Medallion Home campaign was a huge success. Some estimates note that the nationwide goal of about 1 million all-electric homes was achieved, although specific data on the actual number built is unknown. The program was still marketed heavily through the early 1970s.



Today, natural gas and electricity each provide about half of the energy consumed in the residential and commercial sectors, with the electricity share increasing considerably over the last 60 years, due to the LBE programs, expansion of air conditioning and population growth in the southwest US.

Where Are We Going From Here?

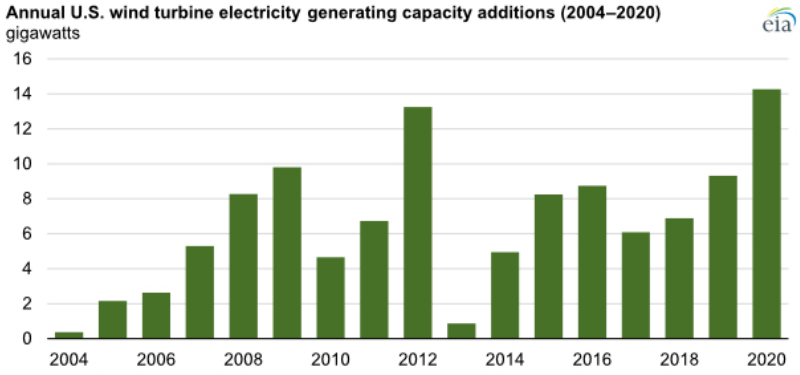
Many local jurisdictions have established policies to replace natural gas use with electricity, particularly in new construction. The next article in this series will look into these decisions, the reasons for these decisions, and the intended benefits and costs of implementing such policies.

U.S. Wind Power Capacity Installation Made History in 2020

Excerpted from Power Engineering Magazine by William Glauz

https://www.power-eng.com/renewables/wind/eia-u-s-wind-power-capacity-installation-made-history-in-2020/

According to recent data released from the Energy Information Administration (EIA), in both 2019 and 2020, project developers in the United States installed more wind power capacity than any other generating technology.



In EIA's Preliminary Monthly Electric Generator Inventory, annual wind turbine capacity additions in the United States set a record in 2020, totaling 14.2 gigawatts (GW) and surpassing the previous record of 13.2 GW added in 2012. After this record year for wind turbine capacity additions, total wind turbine capacity in the United States is now 118 GW.

The impending phase-out of the full value of the U.S. production tax credit (PTC) at the end of 2020 primarily drove investments in wind turbine capacity that year, just as previous tax credit reductions led to significant wind capacity additions in 2012 and 2019. In December 2020, Congress extended the PTC for another year.

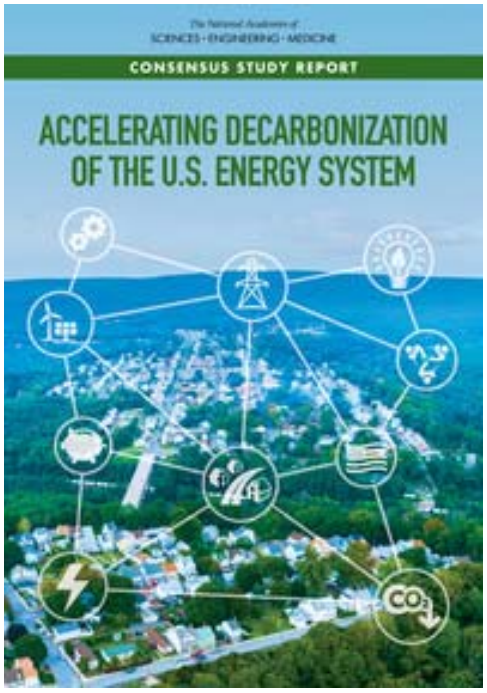
Texas has the most wind turbine capacity among states: 30.2 GW were installed as of December 2020. In 2020, Texas generated more electricity from wind than the next three highest states (Iowa, Oklahoma, and Kansas) combined. However, Texas generates and consumes more total electricity than any other state, and wind remains slightly less than 20% of the state's electricity generation mix.

Nationally, 8.4% of utility-scale electricity generation in 2020 came from wind turbines. Many of the turbines added in late 2020 will contribute to increases in wind-powered electricity generation in 2021. EIA expects wind's share of electricity generation to increase to 10% in 2021, according to forecasts in EIA's most recent Short-Term Energy Outlook.

National Academies Report Sees $300B Cost by 2030 for a Zero-Carbon Economy

Excerpted from APPA by William Glauz

The incremental cost of achieving a net-zero carbon economy by 2050 could be as much as $300 billion through 2030, according to a report from the National Academies of Sciences, Engineering, and Medicine.



The report, Accelerating Decarbonization of the U.S. Energy System, the first of two, said that achieving the 2050 goal is feasible and presented a technical blueprint and policy road map for the next 10 years.

The report also found that immediate action would be required to achieve the greenhouse gas emission reduction goals and that most near-term reductions would come from the electricity sector, electrification of vehicles, and home heating.

The survey of recent studies indicated that cumulative energy expenditures during the transition to a net-zero carbon economy would be between $100 billion and $300 billion through 2030 – a roughly 3 percent increase relative to a business-as-usual baseline of approximately $9.4 trillion – and $4 trillion to $6 trillion through 2050 beyond the $22.4 trillion in a business-as-usual baseline.

The authors of the National Academies report noted, however, that if emissions mitigation technologies improve faster than modeled in recent studies, the cost of decarbonization could be lower. They also pointed out that any direct costs could be offset by public and private benefits such as avoided health impacts from improved air quality, new economic and employment opportunities, downward pressure on global oil prices, and, potentially, the avoidance of “some planet-altering climate change-related damages.” Those benefits could amount to “hundreds of billions of dollars annually” and offset “some, all, or more than the cost of the transition,” the report found.

The report proposed an economy wide price on carbon dioxide emissions beginning at $40 per ton of CO2 and rising by 5 percent per year. A price on CO2 would unlock “innovation in every corner of the energy economy, send appropriate signals to myriad public and private decision makers, and encourage a cost-effective route to net zero,” the report said, but the authors also noted that the proposed carbon price was set at a level lower than would be needed to fully fund a 30-year transition to a net zero economy out of concerns about “equity, fairness, and competitiveness.”

Mystery History – April 2021

The above photo was taken in 1860. It shows one of LA's first above ground water reservoirs that was located at the center of the LA Plaza. The dirt road seen at upper-left is now known as Olvera Street (Originally Wine Street).

Who built this large brick and wooden water storage tank?

A) William Dryden
B) Prudent Beaudry
C) Jean Sainsevain
D) David Alexander
E) Damien Marchessault

For how many years was this structure used before being dismantled?

A) 5 B) 10 C) 15 D) 20 E) 25

Answers on page 20

GUEST SPEAKERS

Summaries by Robert Yoshimura

GUEST OF THE MONTH
JANUARY 2021

Emil Abdelsheid, Manager of Power System Information and Advanced Technologies

Los Angeles Department of Water & Power

UPDATE ON SMART GRID AND METERS AND CITYWIDE COMMUNICATION

January's guest speaker described DWP's current efforts regarding Power Distribution Automation (DA) intended to "Build a Bridge to Each Customer." His presentation summarized DA, the gateway to achieving a smart grid, why we need DA, the current and future state of DA in Los Angeles, and a description of smart meters as a foundation for the future.

Distribution automation is essentially a communication and control system that enables remote monitoring and control of various operational aspects of the entire power distribution network within the city. It is comprised of a robust communication network, sensors and devices with remote control, and a capability for system and equipment health monitoring. Such features will enable more effective management of the electric distribution system and a communication platform to deploy smart meters. The communication network is the gateway to a smart grid that transmits data from system devices and smart meters to improve outage response, enhance operations, and will ultimately lead to a fully automated distribution system. The network consists of numerous devices located throughout the distribution system including master bridges, access points, relays, and fixed or switched overhead capacitors.

The need for distribution automation is fourfold: (1) to improve electric distribution system reliability and resiliency; (2) to improve distribution system operational efficiency; (3) to improve situational awareness and distribution grid visibility; and (4) to improve customer service. Under the current state of distribution operations, only the substations are remotely monitored and controlled. There is little visibility outside the substations in the main part of the distribution network known as the "middle mile" consisting of 1,705 4.8 kV circuits, and 689 34.5 kV circuits. A primary goal of DA is to gain visibility and control of everything happening within that "middle mile".

The future state of distribution operations will be quite different from that described above. A wireless communication network will be installed throughout the LADWP service territory. Sensors and devices will be installed at target locations. For example, line monitors will be able to detect system faults as they happen and pinpoint their location so a rapid response can be made either remotely or by deploying field forces to the appropriate location. These and other sensors will bring real-time field data into various operational systems.

A major component of a smart grid is the smart meters that will be installed at every service location. The smart meters are the foundation for DA and other smart city initiatives. Smart meters enable bi-directional metering providing usage information for both delivered power (from utility to customer) and received power (from customer to utility). Thus, for customers with rooftop solar units, the smart meter will calculate the difference between delivered and received power for billing at appropriate

rates. Another benefit of smart meters is their ability to receive firmware upgrades from other smart meters. Thus, firmware upgrades need only be installed in 3% to 5% of meters.

Outage management will improve significantly once DA is implemented. In many cases, sensors will be able to detect issues before they result in a problem such that corrections can be made to avoid an outage. Smart meters can determine how an outage can be resolved before a truck is dispatched. They will pinpoint outages and provide accurate information to field crews. That, in turn, will enable crews to target service calls and quickly resolve issues to improve restoration times. In its initial deployment, LADWP plans to install a total of 4,905 smart meters in its seven local construction districts plus the Owens Valley. Ultimately, every meter in the system will be replaced.

Upon completion, the DA system will enable a fully integrated and flexible distribution grid. The communication network will be completed by the end of 2021, and smart meter installation will take 3 to 5 more years. At that point, LADWP will be more fully automated than any of the three investor-owned utilities in California.

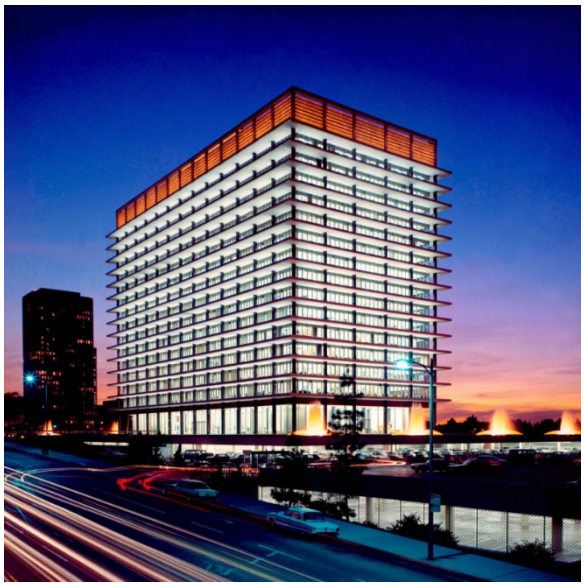
General Membership Meeting

Marty Adams, General Manager

Los Angeles Department of Water & Power

GUEST OF THE MONTH
FEBRURAY 2021

UPDATE ON ISSUES FACING LADWP



The organization is in transition with a number of changes and reorganizations planned. The former CFO has retired and a reorganization is planned to improve the efficiency of the financial management function. Two new divisions will be created to accommodate new functions mandated by the Mayor. The first will be the office of the Inspector General, whose function will be to assure that all activities of the managers and employees are in the best interests of the City. The second addition will be the Diversity, Equity, and Inclusion Division headed by a Diversity Officer. This new division will take half of the existing Human Resources Division including recruitment, hiring, and training functions and will also focus on addressing the needs of underserved communities. The goal will be to mold the culture of LADWP to focus on such values. Succession plans are also being developed for all high-level management positions.

The former Information Technology Manager has also retired, and Mr. Adams is seeking a replacement with a different skill set appropriate for the increasingly complex IT system needed for a large utility (LADWP is the 14th largest utility in the nation). He expects to replace all existing legacy systems by 2024. The recent hacking of a Florida water treatment plant has refocused attention on cybersecurity issues. Mr. Adams reports that LADWP appears capable of dealing with such issues and currently has 37 IT professionals dedicated to cybersecurity.

Dealing with the Covid pandemic has taken two-thirds of Mr. Adam's time over the past year. LADWP has experienced 1,000 new cases among employees since the holidays. Most office employees have been working from home, but recently managers were brought back to the office and other employees are now working in the office two days per week. Field crews are observing Covid protocols and have

revised their schedule to stagger shifts. The arrangement is working well, and he is hoping for a return to normal by the end of the year.

The budget has been affected by the Covid-caused recession, but it has not affected operations to the extent it has at the City, where furloughs are being considered, and employee transfers to other Departments are sought. LADWP has volunteered to contract-out some of its work to City crews to keep them employed without moving employees into the Department. Mr. Adams is meeting with the Mayor every two weeks on this issue and has developed a better relationship with the City as a result.

The aftermath of the billing system scandal continues to affect operations. Problems with the billing system have been resolved and the system appears to be stable. The next version of software may be launched later this year, but planned features such as level-pay plans and monthly billing will be deferred. The class-action lawsuit against the Department is ongoing but is now also stable.

A recent external issue is the lawsuit on behalf of the community surrounding the Valley Steam Plant where a natural gas leak was discovered but caused no threat to neighbors. LADWP's monitoring system revealed no escape of natural gas beyond the borders of the plant and no standards for reporting of such leaks exists. The Department was handling the problem as a maintenance issue and was not "hiding" the problem as reported in the media. However, environmental justice advocates feel otherwise.

Power Issues

The primary issue facing the Power System is the mandate to convert to 100% clean energy by 2045. The National Renewable Energy Laboratory (NREL) is nearing completion of its LA 100 study and has released its preliminary findings. Those findings have confirmed what LADWP already knew: that a certain amount of local generation capacity is needed to sustain reliable power deliveries. About 2,000 MW of local generation is required which is significantly less than the 3,400 MW of existing capacity. Environmental justice advocates are encouraging the Department to reduce or eliminate its reliance on the Valley Steam Plant for reasons explained earlier. However, any reduction in use of Valley Steam Plant will depend on the fate of the three coastal steam plants which the Mayor has ordered to be phased out.

Because battery storage in-lieu of local generation capacity is problematic from an environmental standpoint, other alternatives are being sought if natural gas-fueled generation is not possible. LADWP is considering the conversion of in-basin generation plants to hydrogen fuel as it is already doing at the Intermountain Power Project in Delta, Utah.

Water Issues

One of the biggest projects now in the planning stages is Operation NEXT, the water reuse program involving additional treatment of wastewater at the City's Hyperion Wastewater Reclamation Plant and distribution of that treated water to injection wells in the coastal basin. Ultimately, expansion into the San Fernando basin and directly into the domestic water distribution system is also planned. However, regulations for direct potable reuse of reclaimed water are likely more than ten years away.

LADWP recently made a decision to change ranch leases in Long Valley to omit irrigation water as a part of the lease. Mono County and a coalition of ranchers and environmentalists have filed a lawsuit against the Department alleging that such dewatering requires an environmental review under the California Environmental Quality Act (CEQA). The lawsuit further alleges that the irrigation provided by the ranchers creates ecosystems for birds, scenic views for tourists, and enables ranchers to continue their occupations. According to the lawsuit, eliminating such irrigation would have a significant impact on both the environment and the local economy.

As part of its efforts to restore the ecosystem of Rush Creek (which flows from Grant Lake to Mono Lake), LADWP has been releasing water into the creek for many years. Recent studies have shown that

more water is needed to sustain the restoration, and significant changes at the Grant Lake outlet will be needed to enable such increased flows.

Mr. Adams announced that LADWP won its lawsuit against Inyo County for its attempt to forcibly confiscate land and water rights without an environmental review. The Department has for years leased land and provided water to Inyo County for the operation of three landfills in the Owens Valley. Inyo County began eminent domain proceedings on those three parcels of land in 2018.

GUEST OF THE MONTH
MARCH 2021

Deven Upadhyay, Assistant General Manager/Chief Operating Officer

Metropolitan Water District of Southern California

MWD Report on Statewide Water Issues

Deven Upadhyay provided an update on current supply/demand conditions, current storage, State Water Project issues, Colorado River issues, and a brief update on the Regional Recycled Water Project.

Current Supply/Demand Conditions

MWD's State Water Project (SWP) allocation for 2021 is 10% of its contracted amount. This is the second lowest allocation in history after the 5% amount granted in 2015, an extreme drought year. This year, precipitation to date is 60% of normal, and based on historical trends, even if heavy rainfall occurs during the next two months, the best case for an increase in allocation would be 20%. In the Colorado River basin, on the other hand, the supply outlook is much more optimistic, because greater precipitation has fallen than in California and because of the large amount of storage available there. The expected supply from the Colorado River is thus 82% of normal. Total available supply for 2021 is expected to be 1.2 million acre-feet (MAF) consisting of 1.008 MAF from the Colorado River and 191,000 acre-feet (AF) from SWP.

MWD provides water supply for between 40% and 60% of southern Californians within their service area. The forecasted demand for 2021 totals 1.57 MAF consisting of 1.46 MAF for consumptive uses and replenishment, and 116,000 AF for obligatory uses and losses. The difference between the forecasted demand and supply is 370,000 AF which will have to be made up from other sources and storage if this year's demand is to be fulfilled. This shortage scenario has triggered a number of dry-year actions including water transfers, withdrawals from water banking, and flex storage available in a number of reservoirs. All such actions are part of MWD's Water Surplus and Drought Management plan under which arrangements have been made with the SWP, the Colorado River Board, other agencies on the Colorado River, and groundwater storage banks to store and exchange water to balance year-to-year imbalances between supply and demand. Water quality issues with groundwater stored in Central Valley water banks will be alleviated by exchanging SWP surface water for groundwater with local farmers for whom the water quality issues are not a concern.

MWD's conservation efforts have significantly reduced demand and outcomes have exceeded expectations. Conservation goals established several years ago called for a reduction in gross per

capita consumption of 146 gallons per day by 2020. Actual per capita consumption in 2020 was only 121 gallons per day which is significantly less than the goal. MWD's measurements of per capita consumption may differ from those of other water agencies because it includes all water use within the service area including agricultural, industrial, commercial, and residential divided by the total population of the region.

Storage

At nearly 4 MAF, storage levels in MWD's reservoirs are the highest ever recorded primarily because demands are currently much lower than they have been in the recent past. Total storage consists of 3.2 MAF of planned dry-year storage, and 750,000 AF of emergency storage. Local storage is maintained at Diamond Valley Lake, Lake Skinner, and Lake Matthews which are fully controlled by MWD and as such provide the most flexible storage from an operating standpoint. Off-site storage is in SWP reservoirs, groundwater banks, and in Lake Mead on the Colorado River under agreements mentioned earlier. As of the end of 2020, MWD's Intentionally Created Surplus (ICS) stored in Lake Mead totaled 343,000 AF.

State Water Project Issues

The State Water Resources Control Board (SWRCB) is responsible for maintaining and updating a water quality control plan for the Bay-Delta intended to establish water quality control measures and flow requirements to protect beneficial uses in the estuary. The SWRCB is currently addressing alarming declines in the numbers of native species in the Bay-Delta estuary. They have identified four factors for which mitigations will ultimately be developed that are likely to affect water withdrawals from the Delta: 1) High water temperatures, 2) Lack of food, 3) Habitat issues, and 4) Predator management. Impacts on water operations include the need to control unimpaired flows and the need for volume agreements with water users to control flows within and through the Delta. A recent new amendment to all State Water contracts will partially address these issues by increasing flexibility in making exchanges between water contractors and enabling multi-year transfer agreements.

The repair of the Oroville emergency spillway has been completed at a cost of $1.154 billion. $279 million of that cost will be allocated to SWP contractors of which MWD will be responsible for $150 million.

Colorado River Issues

The issue of dealing with shortages has been a contentious one in recent years. The agencies on the Colorado River began development of a shortage plan in 2005 and produced interim guidelines in 2007. Under those guidelines, in the event of a shortage, only Arizona and Nevada are obligated to cut their usage from the River. These interim guidelines remained in effect until a dispute arose over the status of ICS, which is water stored in Lake Mead by water agencies for use when needed. The concern was that agencies such as MWD feared a loss of their ICS storage in times of drought if the water level in Lake Mead were to drop below the critical shortage level. Agreements signed before ICS was created forbade withdrawals of water below that level. In 2018, a Drought Contingency Plan was developed and agreed to by all lower basin agencies that allowed MWD to take their ICS regardless of the elevation of Lake Mead.

Regional Recycled Water Project

The Regional Recycled Water Project is an ambitious plan to reuse all of the effluent from the County Sanitation District's Joint Water Pollution Control Plant located in Carson, California. MWD is partnered with both the County Sanitation District and the Water Replenishment District in this effort. Initially, the water produced will be used for groundwater replenishment in the West Basin. As the project develops, pipelines will transport the water to the San Gabriel Valley for groundwater replenishment there, and ultimately, for direct potable reuse at either the Weymouth or Diemer water treatment plants.

SNWA/MWD COLLABORATION ON REGIONAL RECYCLED WATER PROGRAM

By Robert Yoshimura

As reported in the January edition of this newsletter, the Southern Nevada Water Authority (SNWA) and the Metropolitan Water District of Southern California (MWD) have signed an agreement to jointly explore the development of MWD's Regional Recycled Water Program (RRWP) to benefit both parties. Under this agreement, SNWA will provide a part of the funding for the environmental planning activities of the project. Neither party is obligated to continue the partnership beyond the first phase. However, the eventual goal of the partnership, should they decide to proceed, would be a water exchange between the agencies. Ultimately, if the program is built, SNWA would pay for a portion of the cost of construction and operation and receive, in lieu of a direct purchase of that water, a portion of MWD's water allocation from the Colorado River.

So, what are the benefits to either agency if the program is built, and are there any drawbacks should the two agencies agree to proceed?

For MWD, the RRWP is an ambitious and expensive undertaking whose cost for the environmental planning activities is estimated to be $30 million. The two phases of the program are expected to produce up to 150 million gallons per day of recycled water when built out. MWD is currently partnered with the County Sanitation Districts of Los Angeles County who are providing $4.4 million to this initial effort. SNWA's additional contribution of $6 million will further ease the burden on MWD and its water customers. Additionally, SNWA has indicated its willingness to contribute as much as $750 million for the full development and implementation of the $3.4 billion program.

A key question for MWD will be to determine whether the establishment of a joint regional reliability partnership with another water agency on the Colorado River and the financial contributions to offset the cost of such a large-scale project are sufficient to justify surrendering a portion of MWD's Colorado River supply. MWD has long expressed concerns about the reliability of its water supplies due to climate change, ongoing drought, and the uncertainties associated with the sustainability of the State Water Project, which in recent years has produced only half of its contracted amount of water.

While the development of RRWP continues, the City of Los Angeles is concurrently developing a parallel project known as Operation NEXT, which endeavors to recycle all of the effluent from its Hyperion Water Reclamation Plant by 2035. That project is expected to produce 174 million gallons per day for groundwater recharge and eventually direct potable reuse within the same general service area that MWD operates in. Some on this Board have expressed concerns that if both the RRWP and Operation NEXT are built out to full potential, they could produce more water than southern California can use. Thus, in such a scenario, the ability to sell a part of the water to other agencies would enable the full value of these reclaimed water projects to be realized to the benefit of southern California.

For SNWA, its service area is in dire need of additional water to sustain its economy and its current rate of growth. SNWA has fully developed its local groundwater supplies, which provided the Las Vegas metropolitan area with its only source of water prior to 1970. In 1970, SNWA began construction of facilities to extract water from Lake Mead. However, Nevada's allocation of Colorado River water is only 300,000 acre-feet per year (AF/Y) – significantly less than California's 4.4 million AF/Y or Arizona's 2.85 million AF/Y. Furthermore, the 20-year drought in the Colorado River basin has depleted the water stored in Lake Mead to a point near its critical shortage level. Since 1999, the water level has dropped by more than 150 feet and reduced the amount stored to less than 50% of capacity.

SNWA has implemented water conservation plans and constructed a desalting facility for the Welton-Mohawk Irrigation District (in Arizona) to reduce their use of Colorado River water. Various agreements with other water agencies in Arizona, California, and Mexico, have provided SNWA with other agencies' unused allocations of Colorado River water since 2005. Today, that unused supply is nearly exhausted and the only way to keep up with future demand growth will be new water such as that provided by MWD's RRWP.

While the cost of water from the RRWP is high, SNWA will benefit from the economies of scale by partnering with MWD on such a large project that would outperform any smaller reclamation project that SNWA could pursue on its own. Aside from cost, there appears to be no other drawbacks. The success of this partnership will seemingly be determined by MWD's ultimate conclusion regarding the balance of benefits and cost as it applies to them.

MYSTERY HISTORY

Answer to Mystery Question:

William Dryden, 10 years (1858 – 1868)
