The History and Process of Hoover Power Allocation: The Case of Arizona Post-2017

THE HISTORY AND PROCESS OF HOOVER POWER ALLOCATION:

THE CASE OF ARIZONA POST-2017

by

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A Thesis Submitted to The Honors College

In Partial Fulfillment of the Bachelors degree
With Honors in

Agribusiness Economics and Management

THE UNIVERSITY OF ARIZONA

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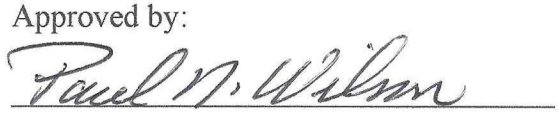

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ACKNOWLEDGEMENTS

I would like first and foremost thank my advisor, Dr. Paul Wilson, for his assistance throughout the entire Honors Thesis process. His expertise in Arizona agriculture and economics has helped shape this project into an accurate historical account and economic analysis for the post-2017 Hoover power contracts. I would also like to thank the Arizona Power Authority for their continued open and transparent communication. The Authority and its Commission have been forthcoming and honest with the general public of Arizona and myself in regards to post-2017 power contract renewals and new power allocations research.

TABLE OF CONTENTS

ABSTRACT

THE HISTORY AND PROCESS OF HOOVER POWER ALLOCATION:

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May 2015

The western region of the United States would not have developed without proper water development and management. The use of dams and other public works have developed ways of managing the West's natural water resources and its hydroelectric power. This paper explains the full history of how the West came to be United States territory and how water management developed in the West. Once a federal organization was set in place to control the water of the West, public works projects began to take shape in order to harness rivers, especially the Colorado River, for productive use in agriculture throughout the year. The paper goes into depth as to how he Hoover Dam was a major building block for control over the Colorado River. It not only held back the water, but also created clean, cheap power for the states of Arizona, California, and Nevada. The Arizona Power Authority allocates power for Arizona and they are currently in the process of determining who is eligible to receive power distribution for the post-2017 era. This process will be discussed in length and analysis as to what is best for the overall economic benefit for the state of Arizona.

CHATER ONE

THE EXPANSION OF THE WEST

From the beginning of history, people have been known to colonize around water sources. One example is Mesopotamia; translated from Greek to mean "between two rivers" because of the location to the Tigris-Euphrates River (Mark 2009). Mesopotamia, present-day Iraq, was home to the ancient cities of Babylon and the regions of Sumer. This area is known as the birthplace of civilization because people transformed from nomads to people of organization, technology, and intelligence. They were able to build homes and civilized life due, in part, to the water source that flowed through and around their cities. This strategic placement for villages and tribes was vital to human existence. In addition to ancient communities in the modern day Middle East, other parts of the world show a history of native people congregating around water sources. One place in particular would be the western region of North America, or more specifically, the western region of the United States of America.

Native Americans are believed to have colonized the Americas approximately 12,000 years ago by way of the land bridge between Siberia and Alaska (Lovgren 2003). These tribes then migrated south to North and South America. Along the way, they established villages beside natural water resources. In order to establish a thriving community, tribes chose to live where their basic needs were within a reasonable distance. One of these basic needs was water and that is why several tribes found it advantageous to live along the banks of the Colorado River and its tributaries. Once they were strategically located to the water, they could begin harnessing it for the benefit of their society. This meant utilizing water to produce more food and tradable crops in order to create an efficient agrarian society. From these simple systems, tribes were able to expand and build "more complex projects, [especially] as the climate became

hotter and drier" (Maugh II 2009). With more understanding of water resources, the Native Americans were able to channel water for their benefit and their advancement of agricultural. These Native Americans were the first to inhabit this land and its resources, but they were soon joined, in the late 16th century, by countries of Europe (Spain, France, and England) that started to explore this New World and would eventually obtain territories in the West.

In 1776, when the U.S. declared independence from Britain, it only consisted of thirteen colonies along the Atlantic coast. During this time, it was a vulnerable new country and had to fight for its survival. One way it sought to reassure its independence and continue to grow in military and economic power was by expanding its territory by acquiring land. The country started by continuing to acquire land along the east coast of North America. When cities became overpopulated and the newly elected democratic government saw opportunities to expand, it did. One of these first opportunities of great note was the Louisiana Purchase of 1803. The French had regained control of and settled a large portion of land. In order to change control of the situation, President Thomas Jefferson, and his Secretary of State James Madison, decided to begin diplomatic negotiations with the French. Still a very new country compared to the Old World, the United States did not want to be too aggressive, therefore the Jefferson Administration went about acquiring this land through ways of honorable business practices. With other demanding issues in French territories (i.e. Haiti), Napoleon did not have the resources to securely manage his land base in North America. Therefore, he approached his Foreign Minister about selling the Louisiana Territory. The Foreign Minister then approached James Monroe, a political ally of Thomas Jefferson, traveling in Paris at the time. After negotiations, the U.S. Senate ratified the purchase in October of 1803 and the United States had the potential to be a thriving force in North America. (see Figure 1)

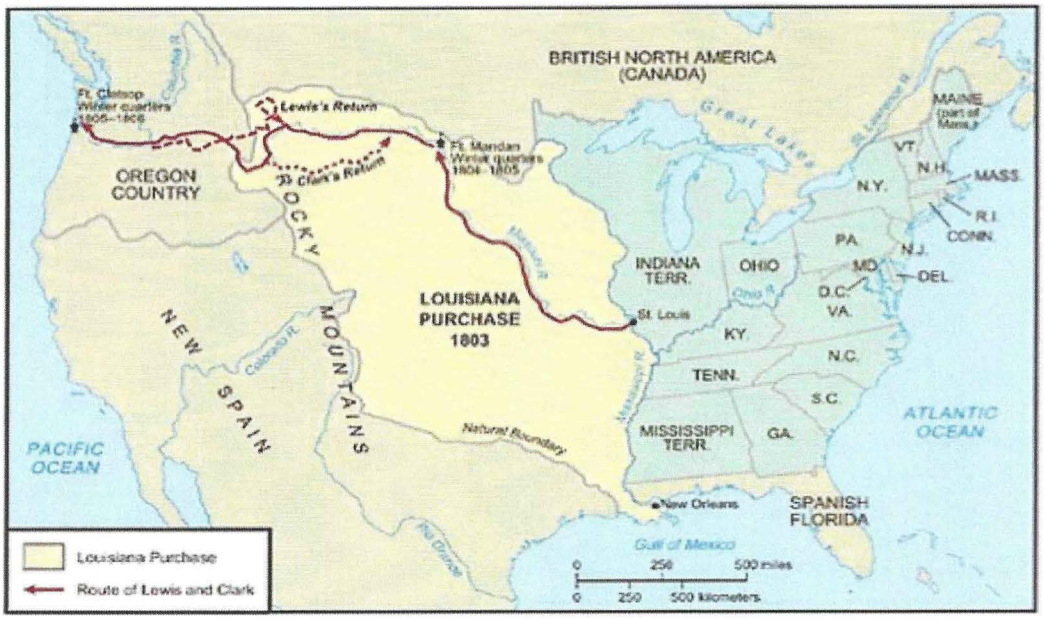


Figure 1. Current United States territory after Louisiana Purchase of 1803

However, the Spanish territory of Florida was not part of the Louisiana Purchase and there were conflicts between the U.S. and Spain as to where boundaries were to lie. With continued discussion and Spain being preoccupied with revolutions in Latin America, the U.S. led military forces into Florida (Library of Congress 2009). In 1819, Spain agreed to the Transcontinental Treaty that would establish a boundary of the Louisiana Purchase and turned the Florida territory over to the U.S. This treaty was officially ratified in 1821 and during this same year, Mexico gained its independence from Spain.

With an independent Mexico sitting across the southern border and along the western side of the United States' territory, confrontations between the two countries spiraled. In 1846, the United States declared war on Mexico (Library of Congress 2009). Two years later, Mexico ceded approximately 500,000 square miles (see Figure 2) to the United States and the boundary with Mexico was adjusted again in 1853 with the Gadsden Purchase.

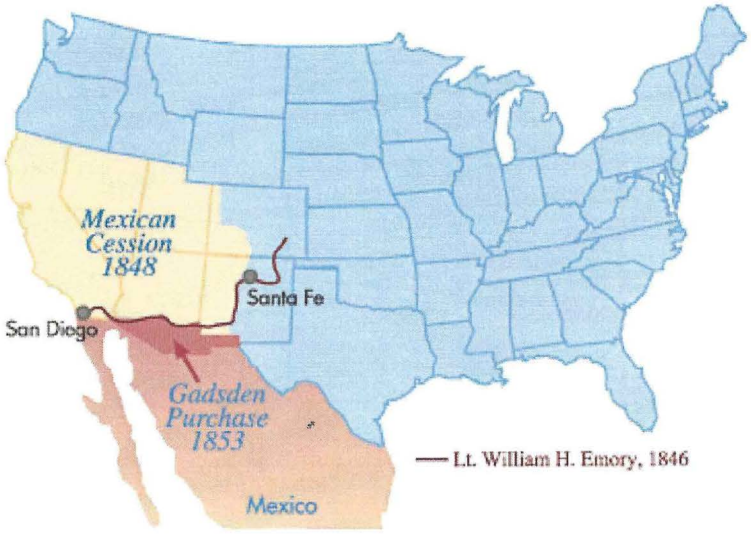


Figure 2. Territory ceded from Mexico and Mexico boundary established with Gadsden Purchase

The United States also had to worry about Great Britain posing a threat as it controlled the Oregon territory in the Pacific Northwest corner of the soon to be U.S. territory. In 1843, there was immigration along the Oregon Trail to the Territory, thus making it an eminent issue for Congress to discuss (Office of the Historian 2009). After some deliberations with the British Prime Minister and his officials, "President James Polk…proposed a settlement on the 49 degree line". Minor modifications were made and the Senate ratified the treaty in 1846, giving the United States more land and more strength.

Through all of these acquisitions, the United States was able to gain the land for what is known today as *the West*. "The U.S. Census Bureau defines the West as including 13 states: [Alaska], Arizona, California, Colorado, [Hawaii], Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming" (Kenney 2). However, when these states were first recognized, they were simply just land. Most of them still had Native Americans living in the territory and it took decades for development and progress to be seen by its inhabitants and the rest of the country. It is important to note that the western portion of the United States was not

always as populated as it is now. This area of the country did not always have sprawling cities and vast amounts of urban areas. It took a century and great effort by American citizens, private companies, and the government to grow the West into the prosperous society it is today.

Once the land area was under the control of the federal or state governments, the development process could begin. The first step in development was having U.S. citizens move westward. Having the land would not do the U.S. any good if its citizens were not occupying the soil. There were several reasons people started moving west: an overcrowded East Coast, the idea of Manifest Destiny, their own religion, the Homestead Act of 1862 and various other motivations or incentives. As peopled started to populate the few cities on the East Coast, living conditions began to decline and urban areas were crowded. People saw the West as a vast area of open property and a way to escape the industrial life of East Coast cities.

The idea of moving westward was even greater when paired with the idea of Manifest Destiny. It was in 1845, in a New York newspaper, that John L. O'Sullivan gave the expansion to the West the majestic name of manifest destiny. His description was that "Our manifest destiny is to overspread the continent allotted by the Providence for the free development of our yearly multiplying millions" (Mintz and McNeil 2013). This spirit and inspiration that people had a right to move from their homes in the East to make sure every inch of the continent was populated with U.S. citizens gained momentum throughout the late 19th century.

In addition to the simple idea of occupying every acre across the continent, people moved west for religious reasons. It was not just the idea of moving to a foreign place in the U.S. that enticed people; it was the foreign people as well. The west was known for untouched, unexplored Native American civilizations and some religious citizens took it as their duty to enlighten this foreign population. It was for this reason that many missionaries moved west and

ended up staying to create their own civilization on the western half of the United States. For example, take the Latter Day Saints that have an enormous concentration in the state of Utah. So, for one reason or another, people packed up everything they could carry and moved to an unfamiliar territory.

In addition to the personal sentiments people had about moving to the West, the government furthered the expeditions and the expansions by granting land to citizens willing to move West of the Mississippi River. President Abraham Lincoln signed the Homestead Act of 1862 that granted pioneers and their families 160 acres with few limitations. Citizens simply had to prove that they were 21 years or older and that they were willing to improve the land for at least five years. For people living in an overpopulated city, in a small apartment barely escaping factory smog of the Industrial Revolution, the Homestead Act was extremely appealing. This program only asked that citizens file for an application, file for the title deed, and improve the land (National Archives 2010). In a sense, the government would give them free land and all people had to do was clear the land, build a home, and improve the land. This helped expansion towards the West and gave people incentive to settle and improve the land west of the Mississippi River. The Homestead Act also gave an incentive towards agriculture. With little to no civilization in the western portion of the United States, people had to rely on the simple ways of agriculture to start their lives and build up and outward from there. However, once people made their way to their 160 acres of "free" government land, they found it to be a very difficult life. The Homestead Act allowed people to continue moving west and gathering land lasted for over a hundred years and was finally repealed in 1976, when it was seen that it was no longer needed for the economic development for the Western states.

At one point in United States' history, it was "the American Dream" to move Westward and find treasure only of one's wildest imaginations. This is the founding ideal for the "California Gold Rush". This "Gold Rush" began in 1848 when an agriculturalist found a gold nugget in a river near Sacramento, California (Harvard 2015). People flocked to mining not only in California, but Arizona and other areas of the West. Americans dreamt of finding the hidden gold, silver, and other valuable elements in order to live lavishly in the West. As people learned about the supposed riches in the West, people abandoned their East Coast lives in pursuit of treasures along the unmarked trail to the Pacific Ocean. However, when it was finally realized that only a small percentage of people were able to make their living off mining gold and silver, strategic moves had to be made in order to sustain life. This meant building civilized towns that could withstand the heat and aridness of an unfamiliar Western territory and all its inhabitants.

CHAPTER TWO

THE DEVELOPMENT OF THE COLORADO RIVER

"A mighty river; now a source of destruction,

is to be curbed and put to work in the interests of society."

- U.S. Senate Committee on Irrigation, 1928

Again, history repeated itself as people started to build up towns not only around mining areas, but around a more important resource; water. Water development and management was what brought life to the West in the 20th century and there was one water source in particular that would become the lifeline to dozens of modern cities: the Colorado River.

The Colorado River has millions of years of history and is the backbone to many tributaries that flow throughout the western portion of the United States of America. It is this mighty river that carved the majestic walls of the Grand Canyon that now stand approximately 4,000 feet above the river rapids. These millions of gallons of water not only shaped one of the Seven Wonders of the World, but also helped shape the modern day life in the West. By witnessing the power that this river held, many men wanted to try and control it and use it in their own favor.

This concept gave rise to the development and management of water resources throughout the Western portion of the United States. With limited water resources, but such mighty power coming from rivers, the federal government stepped in to create policies in order to develop and manage water resources for the West. Once public policy was set in place, the

federal government could give implementation responsibilities to state governments, private companies and even individual citizens.

As stated earlier, people came west and needed to be re-rooted in agriculture in order to make a life for themselves and their families. However, limited precipitation and water resources made it hard for settlers to grow crops and provide a sustainable life. For the majority of agriculture in the West, settlers required irrigation. When they first established their property, they "simply diverted water from streams" (Bureau of Reclamation 2006), but this arrangement would not last and the need for more water grew and grew. With more and more people moving to the West, the demand started to outweigh the supply and the simple technology of diverting stream water. So settlers wanted to start storing the excess run off water from rains and snows during wetter parts of the year. In order to do this, westerners called upon the Federal Government. They had already helped subsidize different types of transportation west and the settlers called upon Congress to help with water management. Without a steady flow of water throughout the year, the West would never develop economically.

The Federal Government answered this call and passed the Reclamation Act of 1902. However, government assistance came at a price; water users had to repay construction costs for the benefits that they would receive. This reclamation was to mean, "irrigation would 'reclaim' arid lands for human use" (Bureau of Reclamation 2006). Many believe that this would also aid in the "homemaking" of the West. Numerous people moved West with the help of the Homestead Act, but they needed continued help to make their dry lands livable. This Reclamation Act aided the Homestead Act in making the 160 acres of government land more appropriate for productive human use. In 1907, the Reclamation Services became an

independent bureau within the Department of Interior and has continued to be a valuable player in Western water management.

One of the ways that the Bureau of Reclamation became valuable to the citizens in the West was due to their public projects. One of the biggest projects the Bureau of Reclamation needed to work on was the uncontrollable Colorado River. This was a lifeline that runs 1,450 miles long throughout the West (see Figure 3) and even parts of Mexico (National Geographic 2015). However, settlers had not learned how to control it; they simply learned to live with the floods and droughts that went on season after season.

Figure 3. Colorado River Basin with dam locations and Colorado contributories

Thousands of years before white settlers came west, the Hohokam people learned to divert water from smaller tributaries of the Colorado River, the Salt and Gila Rivers. This civilization ebbed and flowed with the nature of the river, but with new management in the West, it was time to take "a mighty river… and put it to work in the interests of society" (Hoover 1928).

In the late 1800s, Major John Wesley Powell led a river expedition through the Grand Canyon of the Colorado and after this fateful trip he became a more proponent of large water projects for the West. He "saw the potential for large water projects to supply lower river lands with a well-regulated supply of water" (Bureau of Reclamation 2006). It was this exploration that spurred Congress into endorsing the irrigation of arid lands in the West. However, it was the actions of President Theodore Roosevelt that gave the Bureau of Reclamation the power it needed to start "reclaiming" the underdeveloped resources the West's temperate and dry climate.

The Bureau had many issues to deal with in the West with some of the most useful being dam construction projects. Building dams was to be a huge undertaking, but "the agency was charged with helping open the West through the development of irrigated agriculture" and they needed to use every idea possible to best improve disbursement of water throughout this area. Even though, these grand plans of controlling water needed to set into motion, nothing could be done before the Federal Government legally knew whose water was being controlled. Water rights between the seven states of the Colorado River basin needed to be resolved before the Bureau of Reclamation could make any plans about damming or diverting any water source.

The Colorado River basin states decided to meet in order to agree in advance upon their respective rights, but their conversations yielded no discernable answer. Therefore, the Federal Representative for this meeting, Herbert Hoover, presented what is known today as the Hoover

Compromise. This agreement "proposed that the water be apportioned to two groups, the Upper and the Lower Basin States, and the division of water between the individual States of each basin would be left for future agreement" (Bureau of Reclamation 2006). With this settlement, "Congress passed and President Calvin Coolidge signed the Swing-Johnson bill, better known as the Boulder Canyon Project Act" (Online Nevada Encyclopedia 2014).

After this understanding, the next task that lay before the Bureau of Reclamation was to physically locate the dam, now known as the Hoover Dam. As stated above, the Bureau of Reclamation worked on several projects to improve irrigation for agriculture throughout the Western United States, but in the early 1920s, the Hoover Dam was the most important project on the agenda.

Before construction took place in the location in Boulder Canyon, "Secretary of the Interior Ray Lyman Wilbur announced [in 1931] that [the dam] would be built in Black Canyon due to the fault at the upper end of Boulder Canyon and greater storage capacity" (1). As a result of having the Hoover Dam placed in Black Canyon, it created one of the world's largest man-made lakes: Lake Meade (see Figure 4).

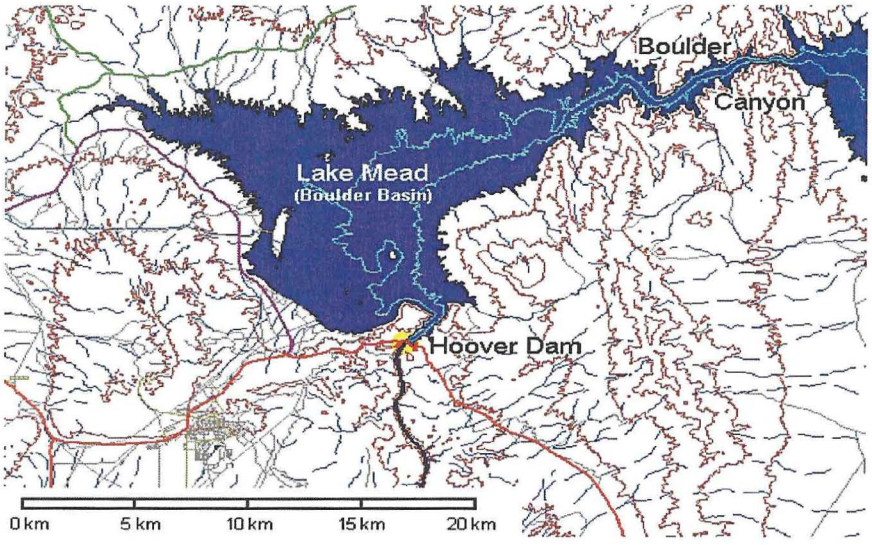


Figure 4. Hoover Dam location relative to Lake Meade and Boulder Canyon

With the location completely finalized, the U.S. Government awarded, at the time, the largest labor contract in United States history to six companies from San Francisco that amounted to $48,890,995.50 (Online Nevada Encyclopedia 2014). The labor contract was signed and construction began in 1931, with the United States already two years into the Great Depression. This project was able to start employing thousands of men, giving hope to many families during a period of the harshest unemployment rates the country had seen thus far in its short history. Since the Boulder Canyon Project Act became a gigantic public works project, it was not only under jurisdiction of the Bureau of Reclamation, but also under of the American Public Works Association (American Public Works Association 2015). The project was able to combine employment with the need for water regulation along the Colorado River. Since the project was employing thousands of Americans in a location with little civilization, people "lived in jerry-rigged dwellings in makeshift tent camps next to the river" at the beginning of construction (Online Nevada Encyclopedia 2014). Engineers knew that the continued years of construction called for a more sustainable living environment for workers and their families. A town site was chosen from federal land that was on a plateau 1,800 feet above the Colorado River (The Bureau of Reclamation 2006). Here, temperatures and living conditions were more tolerable as the new town was able to grow from land leases and permits granted by the Bureau of Reclamation. The town was named Boulder City in honor of the Boulder Canyon Project. With these simple accommodations, the addition of private business and utilities, Boulder City had a population of more than 6,000 people by 1934 and continued to grow even after construction ceased.

Building appropriate living quarters for workers was not the only issue that accompanied a dam location of such secluded nature. At the time, there were no roads, railways or paths to the

canyon to accommodate such an industrial feat. "Construction materials would be required in quantities never before shipped to a single construction job" and that meant sufficient roads needed to be put in place before materials could be delivered to the construction site (The Bureau of Reclamation 2006). Roads and railroad lines were laid and finally, the Bureau of Reclamation only had one more obstacle before concrete for the dam foundation could be poured: diverting the river. The river's water fluctuation and the narrow width of the canyon made diverting the river a difficult task for engineers (The Bureau of Reclamation 2006). It was decided that "four diversion tunnels were cut over a period of a year through the bedrock of Black Canyon [and when complete], they were lined with concrete (Online Nevada Encyclopedia 2014). The tunnel excavation continued until November 1933 and was incorporated into the dam's operations when they were no longer needed to divert water (The Bureau of Reclamation 2006). Two outer tunnels created the major spillway outlets and allowed water to be diverted and collect in a reservoir. Each spillway was designed for the volume of floodwaters to pass through without harming the actual dam (National Park Service 2014). The inner tunnels would carry that water from the reservoir and create a flow of water for the power plant (The Bureau of Reclamation 2006).

With the massive Colorado water force diverted through concrete tunnels, the foundation of the dam could proceed. Workers scaling the canyon walls removed loose rock (The Bureau of Reclamation 2006). "The first bucket of concrete was placed on June 6, 1933" and the foundation began to rise. Concrete trucks were on strict time schedules to pour concrete around the clock as laborers worked 24 hours a day to make sure approximately 160,000 cubic yards of concrete were able to be poured into the dam each month (see Figure 5).

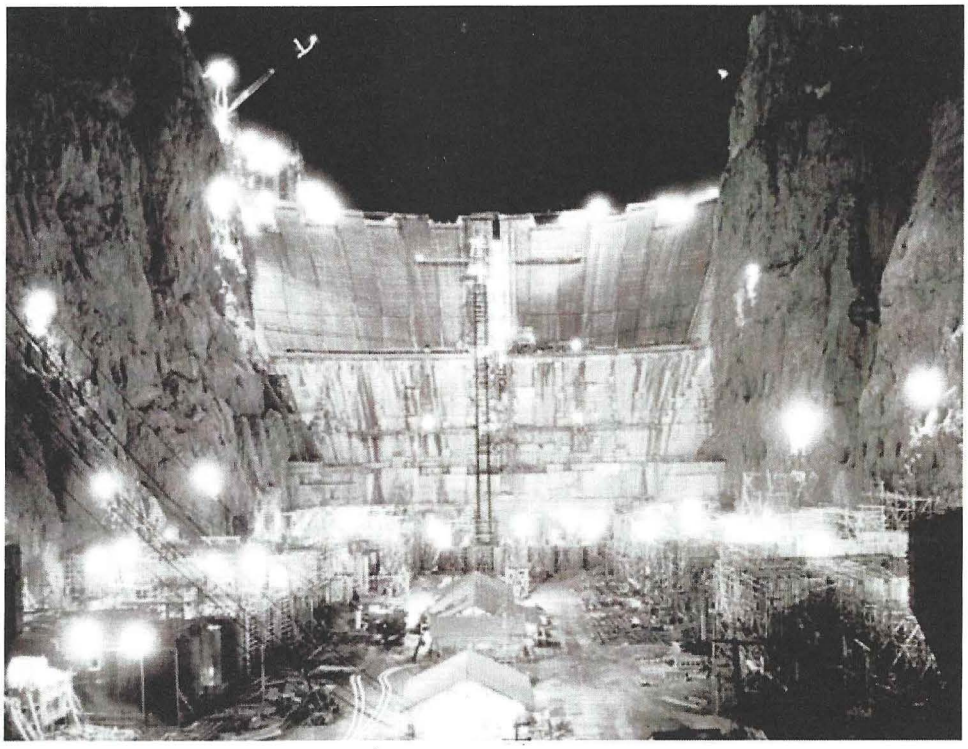


Figure 5. Nighttime construction of the Hoover Dam

The concrete continued to pour until May 29, 1935 (The Bureau of Reclamation 2006). However, timing was not the only issue because engineers had to develop a way for the concrete to cool. It was suspected that without a specific cooling process, it would take the enormous amount of concrete one hundred years to cool, and it would eventually crack, rendering this endeavor completely useless (Online Nevada Encyclopedia 2014). The solution was to "build in pier-like columns and cool the concrete by running ice cold water through pipes embedded in the blocks" (The Bureau of Reclamation 2006). Even as gaps appeared between the blocks, cement grout was pumped in combing the entire structure to make it one complete configuration. With the addition of pipe sections and the concrete to fill out the dam's crest, construction was complete by the summer of 1936. The job that the U.S. government allotted seven years to finish, only took five years due to the "efficient personnel, innovative techniques, the finest

equipment of the time, and detailed planning before the start of construction" (The Bureau of Reclamation 2006).

At this point, the dam was successful in controlling the river's indecisive nature, but there was still one more purpose of the dam that needed to be completed: harnessing the water to produce hydroelectric power. This type of power generated by the Hoover Dam is a pollution-free and low-cost electrical power source (The Bureau of Reclamation 2006). During the time of 1936 and 1961, the Hoover Dam Powerplant installed 17 commercial generating units as the demand in the southwest for power continued to grow. These units have a capacity of 2,078 mega-watts and generate upwards of four billion kilowatt hours of electricity per year. It is this power that helps provide electricity to millions of Americans in California, Nevada and Arizona. The energy is provided through long-term contracts that effectively began from 1937 to 1987 and renewed to be currently held from 1987 to 2017. It is the revenue from the power contracts that have repaid the original construction costs set forth by the United States Government in 1937 and they also continue to pay for day-to-day maintenance of the Hoover Dam (The Bureau of Reclamation 2006).

The energy produced by the Hoover Dam is divided between fifteen principal contractors across the three states of California, Nevada and Arizona. This paper will focus on the 18.9527 percent of Hoover Dam power that is allocated throughout the state of Arizona by the Arizona Power Authority.

CHAPTER THREE

DEFINING THE ARIZONA POWER AUTHORITY

All electric energy or power coming under authority jurisdiction and all property acquired by it shall be public property, and as such shall have the tax exemptions, rights and privileges granted to operating units.
§30-102. Arizona power authority; powers and jurisdiction

As stated in the above quote, the Arizona Power Authority (referred to as the Authority or A.P.A.) has legal jurisdiction and administrative oversight for the hydroelectric power produced from the Hoover Dam power plant in regards to the percentage of power allotted to the state of Arizona. This organization functions as an entity of the Arizona state government in order to distribute the low-cost hydroelectric power to the benefit of the state. "Within the scope of [this] management, APA cooperates with federal, state, and non-governmental agencies to address regulatory and environmental matters that impact electric and water uses of the Colorado River. In addition, the APA serves as an informational resource for its customers on electricity utilization. APA is not subject to appropriation" (Mulholland 2010).

The Authority was established after the Boulder Canyon Project Act was formed at the federal level (Authority 2015). When the Hoover Dam power plant was producing hydroelectric power for the states of Arizona, California and Nevada, a process for allocation and regulation still had not been established. There was not a sufficient infrastructure within the state governments to handle the fair distribution of low-cost power. Therefore, in 1944, the Arizona State Legislature created the Arizona Power Authority. It was to be an entity charged with the responsibility of acquiring and marketing Arizona's share of Hoover power. A year later, the Authority gained a contractual agreement with the Bureau of Reclamation for Arizona's share of the Hoover Dam power. The Authority later agreed to adhere to the federal transmission system

set forth by United States code, Title 16 Chapter 12G §838b, establishing the Secretary of Energy as the administrator for an stable form of electrical transmission to customers (Cornell University Law School 2015). In accordance with the agreement, the Authority received its first delivery of low-cost hydroelectric power from the Hoover Dam Powerplant in 1951. Later, in 1977, the "Western Area Power Administration (Western) became the federal agency responsible for the transmission of federal power and the administration of federal power contracts" (Authority 2015). Western falls under federal jurisdiction as a branch of the United States Department of Energy and has the responsibility for marketing power for the majority of the Western United States. "The service area encompasses a 15-state region [for] the central and western [portion of] the United Sates" (Western Area Power Administration 2015).

It was during the last 1970s when Western began to evaluate a new marketing plan for the Hoover Dam power because its original power contracts would expire in May of 1987 (Authority 2015). It was this process that brought forth the Hoover Power Plant Act of 1984. This legislation authorized the uprating program, initiated the visitor facilities program, gave the Secretary of Interior authority to create a bridge crossing, amended the Colorado River Basin Project Act of 1968 and the Boulder Canyon Project Act of 1928, reserved Schedule A energy of long term contingent capacity and associated firm energy for renewal contract offers, allotted portions of Schedule B energy (long term contingent capacity and associated firm energy resulting from uprating program), and allotted Schedule C (excess) energy (US Bureau of Reclamation).

This act allowed the Authority to obtain "an Electric Service Contract dated June 1987 with Western to receive Arizona's allocation of Schedule A and B power and C energy from the Hoover Dam" (Authority). This amount of allotted power and energy is distributed to 39 power

customers throughout the state of Arizona (Authority). The customers (see figure 6) consist of cities and towns, irrigation districts, electrical districts, and conservation districts (Authority).

Schedule of Capacity and Energy Sales Year Ending June 30, 2007
July 1, 2006 thru June 30, 2007

	Average Billing Demand (kW)	Energy Delivered (kWh)	Sales ($)
Sale of Hydro Power			
Aguila Irrigation District	3,363	10,995,000	$ 257,381
Avra Valley Irrigation & Drainage District	578	1,623,000	$ 40,075
Buckeye Water Conservation District	1,869	8,926,000	$ 184,882
Central Arizona Water Conservation District	118,556	149,823,000	$ 5,504,671
Chandler Heights Citrus Irrigation District	682	2,964,000	$ 63,036
Cortaro-Marana Irrigation District	2,121	18,573,000	$ 337,338
Electrical District No. 2, Pinal	14,883	56,109,000	$ 1,246,899
Electrical District No. 3, Pinal	32,277	52,697,000	$ 1,661,619
Electrical District No. 4, Pinal	12,886	55,066,000	$ 1,178,717
Electrical District No. 5, Pinal	9,846	44,474,000	$ 935,966
Electrical District No. 5, Maricopa	280	1,046,000	$ 23,306
Electrical District No. 6, Pinal	3,850	17,887,000	$ 374,399
Electrical District No. 7, Maricopa	5,345	22,088,000	$ 478,419
Electrical District No. 8, Maricopa	14,646	51,577,000	$ 1,174,477
Harquahala Valley Power District	1,726	7,349,000	$ 157,245
Maricopa County Municipal Water District No. 1	6,359	28,738,000	$ 603,969
McMullen Valley Water Conserv. & Drainage Dist.	4,821	16,903,000	$ 386,310
Ocotillo Water Conservation District	1,769	7,415,000	$ 159,280
Queen Creek Irrigation District	471	1,657,000	$ 38,052
Roosevelt Irrigation District	2,687	14,255,000	$ 286,625
Roosevelt Water Conservation District	1,875	8,451,000	$ 180,102
Salt River Project	28,458	100,917,000	$ 2,293,503
San Tan Irrigation District	378	1,504,000	$ 32,783
Silverbell Irrigation & Drainage District	568	4,204,000	$ 78,284
Tonopah Irrigation District	1,061	4,703,000	$ 99,456
Wellton-Mohawk Irrigation & Drainage District	2,135	8,401,000	$ 184,059
City of Page	283	837,000	$ 20,561
City of Safford	1,281	1,937,000	$ 64,218
Town of Thatcher	851	1,097,000	$ 39,728
Town of Wickenburg	675	2,191,000	$ 51,700
Ak-Chin Indian Community	0	0	$ -
Arizona Electric Power Cooperative	0	0	$ -
Arizona Public Service Company	0	0	$ -
Citizens Utilities Company	0	0	$ -
City of Mesa	0	0	$ -
Tohono O'odham Utilities Authority	0	0	$ -
San Carlos Project	0	0	$ -
Tucson Electric Power Company	0	0	$ -
Total Hydro Power Sales	276,582	704,407,000	$18,137,058
Total Net Prior Year Adjustment (FY07 Accrual)			$(1,289,933)
Total Supplemental Power Sales	528,296	45,421,000	$6,034,405
Other Electric Services Income**			$5,419,452
Total Power Income			$28,300,982 *

Figure 6. List of APA Customers and Sales for post-1987 Hoover power contracts

The decisions as to how allocations of the previously stated energy are determined by the Arizona Power Authority Commission (referred to as 'Commission'). According to Arizona

State Law, the Commission consists of five electors appointed by the governor. In order to be a qualified elector, one must have business and administrative experience. An elector must not hold any other salaried public office or be associated with another organization that sells or distributes power for profit. Once appointed to the commission, a member serves a term of six consecutive years, but can be removed by the governor for cause (§30-105). The current Arizona Power Authority Commission consists of Chairman Stephen M. Brophy, Vice Chairman Joe Albo, Commissioner Dalton Cole, Commissioner Russell Jones, and Commissioner Richard Walden. All of the Authority's current commissioners have extensive experience within various types of Arizona businesses.

CHAPTER FOUR

THE HOOVER POWER ALLOCATION POST-2017 PROCESS

The current Hoover Power contracts are officially void in 2017, but discussion as to new contract agreements started years before that expiration date. According to Chairman Brophy, this process started with lobbying for new legislature. With a number meetings, discussions, and congressional votes, the Hoover Power Allocation Act of 2011 was signed by President Barack Obama on December 20, 2011. This is federal legislation that amended and added to the Hoover Power Plant Act of 1984. One of the most important additions made to this act was Schedule D Power: a long-term resource pool of contingent capacity and associated firm energy for new allottees.

The Hoover Power Plant Act of 1984 defined Schedule A power, Schedule B power and Schedule C excess energy. The Hoover Power Allocation Act of 2011 expands on these schedules to add Schedule D power because based on the uprating plan, there will be more power allotted for the next cycle of power contracts. The Arizona Power Authority will be allocated 11.1 percent of the schedule D power for customers not already in possession of a power contract with the Authority, with the expectation of federally recognized Indian Tribes (Hoover Power Allocation Act of 2011). If the schedule D power is not allocated and placed under contract by October 1, 2017, it will be distributed to the schedule A and schedule B contractors in the same proportion as those contractors' allocations of schedule A and schedule B contingent capacity and firm energy.

Once the Hoover Power Allocation Act was passed, the Arizona Power Authority started drafting their *Public Information and Comment Draft Plan (Final Draft Plan)* for the Hoover

Power Allocation Post-2017. The purpose of this document is for the authority to provide a power allocation plan that is open to the public for commentary and recommendations. The Final Draft Plan was edited several times, each time after the commission's executive session and a session open to the public. During the draft process, the authority did not state any initial decision made by the authority. Due to time constraints written within the law for power allocation, the Final Draft Plan was part of the Preliminary Process. The Preliminary Process involved meetings with the public, drafting an allocation plan and defining the authority's rationale for potential decisions. This drafting process allowed the authority to carefully discuss an allocation plan with the public without being under strict time constraints.

Once a Final Draft Plan was settled, the authority made notice that long-term power was available to eligible applicants or prospective Purchasers. An application for Electric Service for Post-2107 Hoover Power Allocation needed to be submitted to the authority's office no later than 5:00pm on April 27, 2015 (Authority 2015). With this announcement, the Arizona Power Authority entered the Formal Process that is held under strict regulatory guidelines. "No later than 60 days after the deadline for receipt of Long-term Power applications, the Authority must notify interested parties of the names of the prospective Purchasers that are eligible to receive an allocation of Long-term Power" (*Final Draft Plan* 2/16/2015). In addition, the Authority must issue a "draft form of contract" no more than 90 days after it has received a prospective Purchaser's application for Long-term Power. After the notice of all names that are eligible to receive allocation, the prospective Purchasers are obligated to apply for a Power Purchase Certificate. "Not earlier than ten days, but not more than 30 days, the Authority must hold a hearing on the prospective Purchaser's Power Purchase Certificate" (*Final Draft Plan* 2/16/2015). In addition to the timeline that sets in after a notice of Long-term Power is made

public, a different timeline of 60 days begins when the Authority provides a preliminary proposal at the public information Conference. The "continuance" of the public information Conference can be more widely interpreted and that is why the Authority must vigilantly adhere to the restrictions triggered by a notice of Long-term Power.

As regulatory guidelines are followed, the Authority also needs to fairly allocate certain amounts of power to their customers. Under Title 30, "the Authority should distribute power "in an equitable manner so as to render the greatest public service and at levels calculated to encourage the widest practical use" (*Final Draft Plan* 2/16/2015). This must be done fairly, but also by following several preferences that have been outlined in state law. The preference for Schedule A power, if there is an insufficient amount of power supplies for pending power applications, set forth by Title 30 distributes power in the following manner: (1) districts; (2) incorporated cities or towns, or cooperatives subject to a limitation; (3) applicants other than districts using power primarily for irrigation or drainage or both; or if none of the first three categories apply, (4) any qualified applicant". The only preference stated for Schedule B in the *Final Draft Plan* would be under Title 45 stating that "the Authority must grant non tax-exempt public utilities an option to purchase up to 25 percent of the Schedule B resource". In addition to preference allocation, if Schedule D-2 power is not allocated to appropriate applicants, it must be disposed of proportionally between Schedule A and Schedule B power. Due to a total of 11,510 kW for the D-2 capacity, there would be 8,542 kW distributed to Schedule A/non-uprating facilities and 2,968 kW would be attributed to Schedule B/ up-rating facilities.

As of right now, the Authority has five alternatives that will potentially guide their methodology for allocation. Alternative 1 (see Figure 7-10) has been commented as the best plan of allocation by 14 Arizona Power Authority customers, but all of the alternatives to the

current contract plan are simple conjectures and when the Authority receives all applications by May 18, 2015, the commission will have a better idea as to what alternatives would provide the best allocation for their specific customers for the contracts to expire in 2067. The Commission needs to keep in mind that the alternative with the widest benefits should be chosen and the Commission must evaluate each application to determine their specific allocation. Once this process is complete, contracts are drawn up and the Authority's capacity to provide long-term power for its customers should not expire for another 50 years.

Districts Receiving '87 Allocation Districts Not Receiving '87 Allocation Cities/Towns (Own Elec System) Receiving '87 Allocation Cities/Towns (Own Elec System) Not Receiving '87 Allocation Co-operatives Other Eligible Cities/Towns (Do Not Own Elec System) Military Installations	**Alternative 1** **Schedule A**							
Spreadsheet Description	**Schedule A Capacity (190.869 MW)** Status Quo Formula= Current MW * 1.01 for capacity, MW allocation/190.869 * 613689 for energy							
Alternative 1 - Schedule A remains status quo. All entities currently receiving Hoover power under the 1987 allocation are allocated the same in 2017 with a 1% capacity increase and a 5% energy decrease. Under the Proposed Alternative, 2 entities fail the Federal Resource Test. They are ED7 and Ocotillo WCD. Alternatives 2 and 3 look at solutions to this issue.	5 Yr Avg Normalized Load (MW)	Federal Resource Test Needs (MW) 2017 Maximum Allocation	1987 Allocation Schedule A Capacity (MW)	1987 Allocation Schedule A Energy (MWh)	Anticipated 2017 Schedule A Capacity (MW) Allocation	Anticipated 2017 Schedule A Energy (MWh) Allocation	Capacity INC/DEC (MW) From 1987	Energy INC/DEC (MWh) From 1987
Aguila Irrigation District	7.84	7.839	2.450	8,389	2.474	7,955.237	0.024	(433.763)
Avra Valley I&DD	1.82	1.822	0.630	2,168	0.636	2,045.632	0.006	(122.368)
Buckeye WC District	7.95	7.949	2.980	10,201	3.009	9,676.165	0.029	(524.835)
Central Arizona Water Conservation & Drainage District			-	-	-	-	-	-
Chandler Heights ID	1.56	1.190	0.930	3,164	0.939	3,019.743	0.009	(144.257)
Cortaro Marana ID	7.19	7.191	6.440	22,003	6.504	20,910.907	0.064	(1,092.093)
ED 2	63.54	54.154	19.450	66,473	19.642	63,154.587	0.192	(3,318.413)
ED 3 Pinal (inc ED1)	218.05	204.855	15.900	54,351	16.057	51,627.862	0.157	(2,723.138)
ED 4 Pinal	56.02	51.470	19.450	66,473	19.642	63,154.837	0.192	(3,318.163)
ED 5 Pinal	27.31	24.566	14.770	50,476	14.916	47,958.712	0.146	(2,517.288)
ED 6 Pinal (Inc ED5 M)	36.32	29.327	8.360	28,579	8.443	27,145.215	0.083	(1,433.785)
ED 7 Maricopa	12.34	7.873	10.500	35,902	10.604	34,093.871	0.104	(1,808.129)
ED 8 Maricopa	67.47	67.467	13.390	45,749	13.522	43,477.803	0.132	(2,271.197)
Harquahala Valley Power Dist	27.69	27.691	2.490	8,495	2.515	8,085.118	0.025	(409.882)
Maricopa Co. Mun. WCD	23.20	17.856	8.840	30,215	8.927	28,703.792	0.087	(1,511.208)
McMullen Valley WCDD	17.76	17.761	3.800	12,974	3.838	12,338.734	0.038	(635.266)
Ocotillo WCD	2.79	1.712	2.390	8,175	2.414	7,760.414	0.024	(414.586)
Queen Creek ID	11.90	10.146	1.770	6,043	1.788	5,747.253	0.018	(295.747)
Roosevelt ID	17.58	12.701	3.220	11,020	3.252	10,455.454	0.032	(564.546)
Roosevelt WCD	11.99	9.795	6.760	23,106	6.827	21,949.959	0.067	(1,156.041)
Salt River Project	6663.00	6535.519	38.790	132,589	39.174	125,952.500	0.384	(6,636.500)
San Tan ID	2.16	1.338	0.520	1,777	0.525	1,688.458	0.005	(88.542)
Silverbell I&DD	1.26	1.257	0.710	2,417	0.717	2,305.395	0.007	(111.605)
Tonopah Irrigation District	10.08	10.077	1.550	5,297	1.565	5,032.905	0.015	(264.095)
Wellton-Mohawk ID	14.87	11.655	2.910	9,953	2.939	9,448.873	0.029	(504.127)
			189.000	645,989	190.869	613,689		
2017 Allocation exceeds Federal Resource Test Needs								

Figure 7. Hoover 2017 Allocation Methodologies- Alternative 1 Schedule A Power

Districts Receiving '87 Allocation
Districts Not Receiving '87 Allocation
Cities/Towns (Own Elec System) Receiving '87 Allocation
Cities/Towns (Own Elec System) Not Receiving '87 Allocation
Co-operatives
Other Eligible
Cities/Towns (Do Not Own Elec System)
Military Installations

Alternative 1

Schedule B

Spreadsheet Description	Schedule B Capacity (189.860 MW)							
	Status Quo							
	Formula= Current MW * 1.01 for capacity, MW allocation/190.869 * 613689 for energy							
Alternative 1 - Schedule B remains status quo. All entities currently receiving Hoover power under the 1987 allocation are allocated the same in 2017 with a 1% capacity increase and a 5% energy decrease.	5 Yr Avg Normalized Load (MW)	Federal Resource Test Needs (MW) 2017 Maximum Allocation	1987 Allocation Schedule B Capacity (MW)	1987 Allocation Schedule B Energy (MWh)	Anticipated 2017 Schedule B Capacity (MW) Allocation	Anticipated 2017 Schedule B Energy (MWh) Allocation	Capacity INC/DEC (MW) From 1987	Energy INC/DEC (MWh) From 1987
Aguila Irrigation District	7.839	7.839	3.840	4,327	3.878	4,113.691	0.0380	(213.309)
Avra Valley I&DD			-	-	-	-	-	-
Buckeye WC District			-	-	-	-	-	-
Central Arizona Water Conservation & Drainage District	484.545	484.545	161.600	182,235	163.198	173,117.849	1.5984	(9,117.151)
Chandler Heights ID			-	-	-	-	-	-
Cortaro Marana ID			-	-	-	-	-	-
ED 2			-	-	-	-	-	-
ED 3 Pinal (inc ED1)			-	-	-	-	-	-
ED 4 Pinal			-	-	-	-	-	-
ED 5 Pinal			-	-	-	-	-	-
ED 6 Pinal (Inc ED5 M)			-	-	-	-	-	-
ED 7 Maricopa			-	-	-	-	-	-
ED 8 Maricopa	67.467	67.467	10.810	12,185	10.917	11,580.470	0.1069	(604.530)
Harquahala Valley Power Dist			-	-	-	-	-	-
Maricopa Co. Mun. WCD			-	-	-	-	-	-
McMullen Valley WCDD	17.761	17.761	5.290	5,970	5.342	5,667.039	0.0523	(302.961)
Ocotillo WCD			-	-	-	-	-	-
Queen Creek ID			-	-	-	-	-	-
Roosevelt ID			-	-	-	-	-	-
Roosevelt WCD			-	-	-	-	-	-
Salt River Project			-	-	-	-	-	-
San Tan ID			-	-	-	-	-	-
Silverbell I&DD			-	-	-	-	-	-
Tonopah Irrigation District			-	-	-	-	-	-
Wellton-Mohawk ID			-	-	-	-	-	-
Page - Own System & Operating	26.405	14.468	1.040	1,173	1.050	1,114.225	0.0103	(58.775)
Safford - OSO	19.797	18.656	2.080	2,345	2.101	2,228.250	0.0206	(116.750)
Thatcher - OSO	7.020	5.503	1.050	1,185	1.060	1,124.838	0.0104	(60.162)
Wickenburg - OSO	7.213	5.213	2.290	2,580	2.313	2,453.217	0.0227	(126.783)
			188.000	212,000	189.860	201,400		

Figure 8. Hoover 2017 Allocation Methodologies- Alternative 1 Schedule B Power

Districts Receiving '87 Allocation
Districts Not Receiving '87 Allocation
Cities/Towns (Own Elec System) Receiving '87 Allocation
Cities/Towns (Own Elec System) Not Receiving '87 Allocation
Co-operatives
Other Eligible
Cities/Towns (Do Not Own Elec System)
Military Installations

Alternative 1

Schedule D2/A

Spreadsheet Description	Schedule D2/A Capacity (8.542 MW)						
	New Entities						
Alternative 1 - Schedule D2/A lists all entities that are not currently receiving Schedule A or B and have provided data. Districts have first priority. Total district requests are less than the 8.542MW total of Schedule D2/A therefore all districts receive their requested allotment. The remaining entities 5 year average Normalized loads are totaled and the Federal Resources they currently receive are subtracted. Each entities load is equal to a percentage of the total load. This percentage is applied to the remaining D2/A allotment of 4.294MW to determine their allotment. If the allotment is less than the 0.1MW minimum they are moved to Schedule D2/B. The remaining entities in D2/A have the load retotaled, the percentage recalculated and applied to the remaining allotment pool to determine their capacity and energy allotment for 2017.	Formula= 5 Year Load Avg/Total 5 Year Load*8.542 To determine Capacity Allocation (0.1MW Minimum Allocation), Capacity Allocation/8.542 * 20,856.975(MWh) to determine Energy Allocation						
	5 Yr Avg Normalized Load (MW)	Federal Resource Test Needs (MW) 2017 Maximum Allocation	% of Total 5 Yr Avg Load	2017 Schedule D1 Capacity Allocation (MW)	2017 Schedule D1 Energy Allocation (MWh)	Anticipated 2017 Schedule D2/A Capacity (MW)	Anticipated 2017 Schedule D2/A Energy (MWh)
Hohokam IDD	1.500	0.500				0.500	1,220.848
Markham Irrigation District	0.220	0.220				0.220	537.173
Franklin Irrigation District	0.567	0.567				0.567	1,384.442
Silver Creek Irrigation District	0.468	0.468				0.468	1,142.714
Gila Valley Irrigation District	2.493	2.493				2.493	6,087.150
Fredonia OSO							
Mesa (inc AzPPA share)	83.110	68.419	8.60%			0.369	901.548
Williams							
Avra Water Cooperative							
Duncan Valley EC							
Graham County EC	43.543	43.231	5.43%	0.312	681.163	0.233	569.652
Mohave EC	199.257	198.112	24.90%	1.145	2,499.781	1.069	2,610.491
Navopache EC	80.339	72.451	9.11%	0.888	1,938.695	0.391	954.677
Sulphur Springs EC	199.243	196.512	24.70%	2.731	5,962.361	1.060	2,589.408
TRICO EC	168.878	165.878	20.85%	3.000	6,549.646	0.895	2,185.758
Chandler - City							
Gilbert							
Glendale - City							
Peoria - Town							
Scottsdale - City	34.697	32.331	4.06%	2.366	5,165.487	0.174	426.019
Tempe - City							
Tucson - City	20.000	18.752	2.36%	1.248	2,724.653	0.101	247.093
Oro Valley - Town							
Page Water Utility							
Hualapai Tribe							
Metropolitan Domestic Water ID							
	829.067	795.686	1.000	11.690	25,521.786	8.542	20,856.975

Figure 9. Hoover 2017 Allocation Methodologies- Alternative 1 Schedule D2/A Power

Districts Receiving '87 Allocation Districts Not Receiving '87 Allocation Cities/Towns (Own Elec System) Receiving '87 Allocation Cities/Towns (Own Elec System) Not Receiving '87 Allocation Co-operatives Other Eligible Cities/Towns (Do Not Own Elec System) Military Installations	# Alternative 1 ## Schedule D2/B						
Spreadsheet Description	**Schedule D2/B Capacity (2.968 MW)**						
	New Entities						
Alternative 1 - Schedule D2/B lists all entities that are not currently receiving Schedule A, B, or D2/A and have provided data. The entities 5 year average Normalized loads are totaled and the Federal Resources they currently receive are subtracted. Each entities load is equal to a percentage of the total load. This percentage is applied to the D2/B allotment of 2.968MW to determine their 2017 allotment. Entities not meeting the 0.1MW minimum allotment are highlighted in yellow. Their individual allotment will need to be adjusted.	Formula= 5 Year Load Avg/Total 5 Year Load*2.968 To determine Capacity Allocation (0.1MW Minimum Allocation), Capacity Allocation/2.968 * 4,256.025 to determine Energy Allocation						
	5 Yr Avg Normalized Load (MW)	Federal Resource Test Needs (MW) 2017 Maximum Allocation	% of Total 5 Yr Avg Load	2017 Schedule D1 Capacity Allocation (MW)	2017 Schedule D1 Energy Allocation (MWh)	Anticipated 2017 Schedule D2/B Capacity (MW)	Anticipated 2017 Schedule D2/B Energy (MWh)
Hohokam IDD							
Markham Irrigation District							
Franklin Irrigation District							
Silver Creek Irrigation District							
Gila Valley Irrigation District							
Fredonia OSO	2.684	0.684	1.08%			0.032	45.858
Mesa (inc AzPPA share)							
Williams	8.169	7.169	11.29%			0.335	480.651
Avra Water Cooperative	0.563	0.563	0.89%			0.026	37.773
Duncan Valley EC	7.354	7.354	11.59%			0.344	493.067
Graham County EC							
Mohave EC							
Navopache EC							
Sulphur Springs EC							
TRICO EC							
Chandler - City	13.478	12.802	20.17%	0.676	1,475.854	0.599	858.296
Gilbert	3.470	2.470	3.89%			0.115	165.598
Glendale - City	8.726	8.300	13.07%	0.426	930.050	0.388	556.464
Peoria - Town	13.266	12.575	19.81%	0.691	1,508.602	0.588	843.077
Scottsdale - City							
Tempe - City	5.943	5.702	8.98%	0.241	526.155	0.267	382.298
Tucson - City		-					
Oro Valley - Town	2.796	2.796	4.40%			0.131	187.441
Page Water Utility	0.750	0.750	1.18%			0.035	50.296
Hualapai Tribe	3.000	1.994	3.14%	0.381	831.805	0.093	133.685
Metropolitan Domestic Water ID	0.500	0.321	0.51%	0.179	390.796	0.015	21.521
	70.700	63.481	1.000	2.594	5,663.262	2.968	4,256.025

Figure 10. Hoover 2017 Allocation Methodologies- Alternative 1 Schedule D2/B Power

CHAPTER FIVE

ANALYSIS OF THE MUTAUL GAINS APPROACH

The purpose and philosophy behind the Mutual Gains Approach is to minimize the skepticism concerning the efficacy of negotiations between regulators and regulatees (Susskind, Levy, and Thomas-Larmer 2000). Both sides often believe that trying to have negotiations end in their favor will only anger the other party and significantly decrease the efficacy of the negotiation. With the Mutual Gains Approach, it is believed that beneficial negotiations "can result in gains for both regulators and regulatees, and for the community at large". First, it is essential that all sides exercise agency discretion. The Hoover Power Allocation Post-2017 closely follows this guideline. For instance, regulators (being the Arizona Power Authority) exercise discretion by recognizing they have power under Arizona State Law, but also knowing they have to execute the allocation in a fair and just manner for all parties involved. Regulatees (being the prospective Purchasers and current customers) are aware that each entity is different and their applications will be tailored to fit their certain needs and will be evaluated for allocation on a case-by-case basis, with overall expectations needing to be followed. Finally, the community has supported the Arizona Power Authority due to the open and transparent process that they have set forth for power allocation post-2017. Meetings, with the exception of executive session, are held for public view and commentary. The Authority even created a Preliminary Process for the public to comment on allocation draft plans in order to not be constrained by strict deadlines formed by law.

Another key concept of the Mutual Gains Approach is the best alternative to a negotiated agreement, referred to as BATNA. This is "each party's best estimate of what he or she will do

if no agreement is reached" (Susskind, Levy, and Thomas-Larmer 2000). Meaning that if after negotiations, the outcome is not better than one's BATNA, then one should walk away from the negotiations. With this in mind, the Mutual Gains Approach has four steps to follow in order to challenge the conventional way of going about regulator/regulatee negotiations:

1. Prepare
2. Create Value
3. Distribute Value
4. Follow Through

After reviewing the parts of the Hoover Power Allocation Post-2017 Process that have passed and those planned to come in the future, this process can be seen as an excellent example of the Mutual Gains Approach. Step one is to prepare for negotiations. The Arizona Power Authority has done well by taking the time to create a draft allocation plan that was not under any law constraints that would cut discussions or public opinion short. By having the Preliminary Process, they thought about their customers' opinions and how they could contribute to negotiations. Also, the potential purchasers have prepared for the post-2017 allocation by continuing to be a reliable customer that is able to renew a contract or by gaining eligibility as a new entity for a first-time contract. Second, the Authority has created value by having low-cost hydroelectric power available for the next 50 years. They are also creating value by making sure the allocation has the most benefit for the overall well being of Arizona. Potential customers are creating value by retaining and obtaining eligible applicant status in order to purchase said power. Without customers, the power that the Authority has to sell would have little value.

Therefore, the potential Purchasers are creating a demand for the Authority's product and creating more value to the Hoover power.

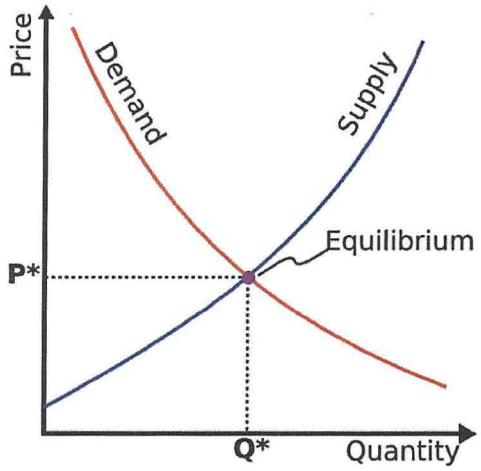
The third step to the Mutual Gains Approach is distributing that value. The Authority has a track recorded of distributing power to contract holders for the past 64 years. Current customers and potential new customers are willing to compromise given their power might exceed Arizona's allocation. Respectful public forums and meetings have shown that each customer wants to voice their opinion, but they are aware of the divisions and decisions that need to be made with the limited resource given to the Authority. Finally, each side will surely follow through if the steps to process remain as planned. As of now, no customers have been chosen for the post-2017 allocation. Nevertheless, if history is an indicator for the Authority and since low-cost, clean energy is an incentive for Arizona businesses, municipalities, and individuals, there is no doubt that both the regulator and regulatee will follow through with their specific contractual obligations.

CHAPTER SIX

ECONOMIC ANALYSIS FOR ARIZONA'S HOOVER POWER ALLOCATION

As explained in comparison to the Mutual Gains Approach, the majority of this process has been transparent, just, and expedient thus far. However, the Arizona Power Authority has 392.239 megawatts of power to allocate across the state of Arizona and the Commission must decide what allocation plan provides the Arizona economy with the most benefit.

If the APA were a for-profit business, it would most likely use the market for distribution of its power. One option would be an auction. The entities with the ability to pay the highest price would be able to purchase the power and give the APA a high profit margin. A second option would be to simply sell the power on the free market. This would allow the market to reach a specific price where amount of power being supplied and the demand for power intersects (see Graph 1).



Graph 1. Supply and Demand graph exhibiting equilibrium at a certain price and quantity.

With either of these market processes, the Arizona Power Authority would not have to determine price or allocation because the economic market would do that by adhering to the Law of Supply

and Demand. However, the Arizona Power Authority is not based on for-profit gains and this is the exact reason why Arizona law stipulates that a commissioner cannot be "associated with any public service cooperation engaged in generating, distributing, or selling power to the public generally in this state for profit" (Title 30, Section 105). This is to ensure that the Commission will seek to enhance the overall economic welfare of Arizona by way of appropriately allocating low-cost power to its qualified entities. This is also why the price of power is not under the control of the Arizona Power Authority. The low-cost price is determined by the federal government as to what they see as an appropriate cost below true market value for certain entities in Arizona, California, and Nevada.

Unfortunately, there are no clear criteria as to how the APA Commission must do this. The Arizona Power Authority had a similar situation in 1987 when contracts were first being written for these current entities, but for the post-2017 contracts, another schedule of energy has been added and new entities are going to be given the opportunity to access this power. The APA does state that it "anticipates [a] demand for post-2017 Hoover power [that] will exceed the available power supplies and that it will have to apply… preference provision" (see Chapter 4). With the possibility of power supply subject to change each year, the Commission should pre-preference entities according to state law. However, the Authority will not know how many entities fall under each category until the finalized applications have been approved.

Although, it is certain, as of right now, that the Authority has five alternative allocation plans. Each alternative has allocated 190.869 MW of power to Schedule A and 189.860 MW of power to Schedule B. This is a wise strategy because the Authority has already determined how much power is allocated to Schedule A and Schedule B, so distributing to specific entities within each Schedule power would be the only task left once applications have been reviewed. The

alternative plans do differ in way of Schedule D2 power allocations. In four out of the five plans, there is 8.542 MW of Schedule D2/A power and 2.968 MW of Schedule D2/B power allotted to new entities. In the fifth plan, the Schedule D2 power is combined and the group category (i.e. districts not receiving 1987 allocation, cities/ towns not receiving 1987 allocation, co-operations) must together have a minimum 0.100 MW purchase or they will be removed. At this point, it cannot be said as to which alternative will bring greatest welfare because many variables are subject to change, including the possibility that more alternative plans may be introduced.

Existing entities and entities speculated to join the post-2017 contracts have voiced their opinions on the alternatives. One key issue discussed was how the agricultural load of an entity would impact its allocation. Several entities receiving post-1987 power are irrigation and rural electrical districts focused on agriculture. As stated above, the Hoover Dam was originally built to help develop agriculture, but the agriculture load will not be a factor in deciding power allocation for post-2017 contracts. The amount of an agricultural load an entity carries will have no basis for preference allocation. This will limit the amount of preferences the Commission needs to adhere to when allocating power to each specific entity.

It is difficult to say which alternative will bring the greatest economic benefit to Arizona, since the new Hoover power customers are not known. Within the application, the proposed qualified entity will state the amount of electrical power used and where they are currently receiving power. Then, from the application, the Commission will decide how much of the entity's power usage will be able to come from low-cost Hoover power. By way of allocating power to customers, the Commission is adhering to the Equi-Marginal Principle. "The principle of equi-marginal utility explains the behavior of a consumer in distributing his limited income

among various goods and services. This law states that how a consumer allocates his money income between various goods so as to obtain maximum satisfaction" (dineshkbaski.com 2015). From this definition, the principle can be "applicable to [any] situation where a limited resources [APA power, for instance] needs to be allocated among more than one independent uses" (Universal Teacher 2015). The Power Authority has a limited, or fixed resource, Hoover power, and the Commission has to allocate in a way that will maximize the satisfaction of Arizona economy. There is no true standard of measurement for what methodology will bring about the best outcome because this process has only been done once before and that was under different circumstances. However, the Commission will have to meticulously decide what entity gets what power. Historic precedent might take place for entities that have proved to be reliable customers for the post-1987 power, but new entities will still have a fair chance to receive their share of power. These allocations will most likely have to bring about compromises due to the limited power to supply to each qualified entity, but the Commission is absolutely bound by Arizona State Law to allocate fairly and conclude with the best economic benefit for Arizona. Although there may not be a clear way to know how the Commission will finally decide how to allocate the post-2017 Hoover power, it can be noted that the Arizona Power Authority will negotiate and defend their allocations within the legality of the law and the duty they have to general public of Arizona.

DEFINITIONS

1. Schedule A Power – Long term contingent capacity and associated firm energy reserved for renewal contract offers to current Boulder Canyon Project contractors.
2. Schedule B Power – Contingent capacity resulting from the uprating program and associated firm energy
3. Schedule C Power – Excess energy.
4. Schedule D Power – Long term schedule D resource pool of contingent capacity and associated firm energy for new allocates.
5. The Redbook – Authority set forth allocation principles and methods that it used to allocate Schedule A and B power to selected entities. Explains purpose and effect of recapture provision for Schedule B, which included benefit to Central Arizona Water Conservation District for Central Arizona Project water supply.
6. Western Area Power Administration – Market and transmit wholesale electricity from multi-use water projects. One of four marketing administrations within the United States Department of Energy.
7. Long Term Power – Any supply of Power that is available to the Arizona Power Authority for a period more than 366 consecutive days and that is subject to the jurisdiction of, and disposition by, the Arizona Power Authority including any power recaptured by the Arizona Power Authority and any power tendered or relinquished by a Purchaser.
8. Power Purchase Certificates – The certificate required before a purchaser enters into a Power Sales Contract under A.R.S. ~30-151 et. seq.

9. Power Sales Contract – A Contract under which the Arizona Power Authority sells Long Term Power to a Purchaser.
10. Short Term Power – Any supply of Power that is available to the Arizona Power Authority for a period no more than 366 consecutive days
11. Qualified Entity – Any entity that is eligible to purchase Power from the Arizona Power Authority under A.R.S Title 30, Chapter 1 or A.R.S. Title 45, Chapter 10.
12. Recapture – The recovery or retaking by the Arizona Power Authority from a Purchaser of Long Term Power that exceeds the Purchaser's needs, for reallocation among other qualified entities

REFERENCES

"16 U.S. Code § 838b - Operation and Maintenance of Federal Transmission System; Construction of Improvements, Betterments, Additions and Replacements; Criteria." *16 U.S. Code § 838b*. Cornell University Law School, n.d. Web. 23 Mar. 2015.

"About Arizona Power Authority." *Arizona Power Authority*. The Arizona State Government, n.d. Web. 10 Dec. 2014.

"About Western." *Powering the Energy Frontier: Western Area Power Administration*. Western Area Power Administration, n.d. Web. 26 Feb. 2015.

"APWA: Public Works Projects of the Century." *APWA: Public Works Projects of the Century*. American Public Works Association, n.d. Web. 21 Mar. 2015.

"The Bureau of Reclamation: A Brief History." *U.S. Department of Interior, The Bureau of Reclamation*. The United States Government, n.d. Web. 23 Mar. 2015.

"California Gold Rush (1848–1858)." Open Collections Program: Immigration to the US, California Gold Rush, 1848-1858. Harvard University, 2015. Web. 06 May 2015.

"Colorado River Map -- National Geographic." Change the Course. National Geographic, n.d. Web. 04 May 2015.

"Equimarginal Principle in Economics." Equimarginal Principle. Universal Teacher, 2015. Web. 06 May 2015.

"Equi-marginal Principle (A-Levels)." Equi-marginal Principle (A-Levels). Dineshbakshi.com, 2015. Web. 06 May 2015.

"Homestead Act (1862)." Our Documents. The National Archives of the United States of America, 2010. Web. 04 May 2015.

"H.R. 760." *Authenticated U.S. Government Information* (2011): 1-7. *Authenticated U.S. Government Information*. U.S. Government Publishing Office. Web. 22 Mar. 2015.

"The Importance of the West." *U.S. Territorial Acquisitions*. Independence Hall Association, n.d. Web. 3 Jan. 2015.

"Introduction: Hoover Dam." *Public Broadcasting System: American Experience*. Public Broadcasting System, n.d. Web. 15 Jan. 2015.

"The Louisiana Purchase." *Thomas Jefferson's Monticello*. United Nations Educational, Sciences, Cultural Organization, n.d. Web. 15 Mar. 2015.

Lovgren, Stefan. "Who Were The First Americans?" National Geographic. National Geographic Society, 03 Sept. 2003. Web. 29 Apr. 2015.

Mark, Joshua J. "Mesopotamia." Mesopotamia. Ancient History Encyclopedia, 02 Sept. 2009. Web. 01 May 2015.

Maugh, Thomas H., II. "Native American Irrigation Canals Unearthed in Arizona Are Earliest Known in Southwest." Tribunedigital-chicagotribune. Chicago Tribune, 24 May 2009. Web. 01 May 2015.

Mintz, S., & McNeil, S. 2013. Manifest Destiny. *Digital History*. Web. 21 Jan. 2015

Mulholland, Joseph W., and Jack Brown. *The Arizona Power Authority*. Phoenix: n.p., 2010. *Fiscal Year 2010 Appropriations Report*. The Arizona Power Authority, 2010. Web. 22 Mar. 2015.

"Online Nevada Encyclopedia." Hoover Dam Construction. Online Nevada Encyclopedia, n.d. Web. 14 Dec. 2014.

"The Oregon Territory, 1846 - 1830–1860 - Milestones - Office of the Historian." The Oregon Territory, 1846 - 1830–1860 - Milestones - Office of the Historian. The Office of the Historian, Jan. 2009. Web. 01 May 2015.

"Parallel Histories: Spain, United States and the American FrontierHistory." History. Library of Congress, 2015. Web. 01 May 2015.

Susskind, Lawrence, Paul F. Levy, and Jennifer Thomas-Larmer. "The Mutual Gains Approach." *Negotiating Environmental Agreements: How to Avoid Escalating Confrontation, Needless Costs, and Unnecessary Litigation*. Washington, D.C.: Island, 2000. 17-40. Print.

United States. National Park Service. ""The Greatest Dam in the World": Building Hoover Dam." *National Parks Service*. U.S. Department of the Interior, n.d. Web. 20 Jan. 2015.

The United States of America. Arizona State Legislature. *Arizona Power Authority; Powers and Jurisdiction*. N.p.: n.p., n.d. *Title 30; Section 102*. Arizona State Legislature. Web. 21 Jan. 2015.

"Water in the U.S. American West." (n.d.): n. pag. *Building Strong Collaborative Relationships for a Sustainable Water Resources Future*. US Army Corps of Engineers, Mar. 2012. Web. 22 Mar. 2015.

IMAGE REFERENCES

Colorado River Basin. Digital image. *Mission 2012 Clean Water*. Massachusetts Institute of Technology, 21 Nov. 2008. Web. 22 Mar. 2014.

Dutch, Steven. Map of Lake Mead (Boulder Basin) in relation to the Hoover Dam. Digital image. *Hoover Dam, Arizona-Nevada*. The University of Wisconsin- Green Bay, n.d. Web. 22 Mar. 2015.

Emory's Expedition of 1846. Digital image. Beyond Lewis and Clark. Kansas Historical Society, 2015. Web. 01 May 2015.

Hoover 2017 Allocation Methodologies- Alternative 1. Digital image. The Arizona Power Authority. The Arizona Power Authority, 16 Feb. 2015. Web. 06 May 2015.

Lewis, Jewell M., Joseph W. Mulholland, Michael C. Francis, John I. Hudson, Richard S. Walden, and Dalton H. Cole. List of Arizona Power Authority's Hydro Power Customers and Sales for post-1987 contracts. Digital image. *Arizona Memory Project*. State of Arizona Library, n.d. Web. 22 Mar. 2015.

The Louisiana Purchase and the Route of Lewis and Clark. Digital image. Pearson Education, n.d. Web. 21 Mar. 2015.

Night Construction. Digital image. *Arizona Vacation Guide*. Arizona Leisure Vacation Guide, n.d. Web. 17 Feb. 2015.

Supply and Demand Graph Free Market. Digital image. Free Markets Are Best, But Most Markets Aren't Free. Progressiprocity, n.d. Web. 01 May 2015.