WELCOME to:

Power Operations & Planning Training

For Internal MWD Training

Guidelines:

- All Participants are currently on Mute
- Please feel free to use Q/A at bottom of your screen to submit your questions to the panelists during the presentation
- After the presentation, audio & camera use will be available for all participants to ask questions

- Presentation will take 40 minutes

Sit back, relax and enjoy

Our intention is to provide support for MWD team members to better understand energy markets.

Part 1: MWD's "New Normal" in the CAISO Marketplace – Dyanne Kellough 8/13/21 1pm

Part 2: How the CAISO and Energy Markets work & How MWD participates in the CAISO – Scot Rolfe 8/27/21 1pm

Part 3: Why the CAISO needs Resource Adequacy Capacity & How Resource Adequacy works for MWD – Sal Heredia 9/10/21 1pm

Part 4: NERC Compliance & It's importance to MWD – Nayeem Mohammad Abdullah TBD

Dyanne Kellough

MWD's "New Normal" in the CAISO marketplace explained

Topics for Today

- **MWD and CAISO Business Model**
- **MWD Previous Normal for Power**
- **MWD New Normal for Power**
- **Risk Management**
- **Putting it all Together for the CRA**
- **MWD and CAISO Operating Agreement**
- **Questions & Answers**

MWD and CAISO

What is the CAISO and How does it resemble MWD's business model?

1. CAISO: California Independent System Operator
   MWD: Metropolitan Water District of Southern California

2. CAISO: Oversees wholesale power
   MWD: Oversees wholesale water

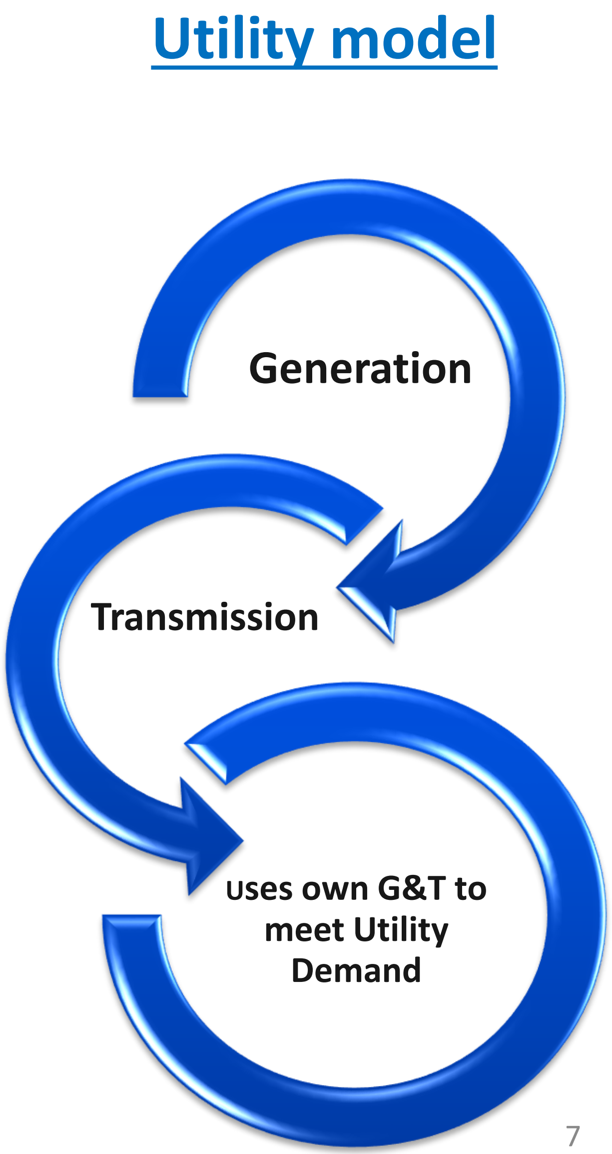
3. CAISO: Does not oversee residential power
   MWD: Does not oversee residential water

4. CAISO: Accountable to Federal Energy Regulatory Commission (FERC)
   MWD: Accountable to MWD's Board

5. CAISO: Does not own any generation or transmission
   MWD: Does own transmission, built hydro power generation and has contracts for hydro generation

MWD’s Previous “Normal”

MWD and SCE had a contractual relationship from 1958 - 2017



Most Recent Power Service Contract 1985 – 2017 …

- MWD and SCE worked under a utility model
- MWD and SCE balanced CRA

Being Balanced

What does that mean to MWD for power?

Balanced Example:

DEMAND

CRA Pump Load = 100MW

SUPPLY

- Hoover Generation Supply = 60MW
- Parker Generation Supply = 30MW
- Supplemental Energy = 10MW (Use SCE contract attributes)

100 MW Demand = **100MW Supply**

SOCAL Edison chose not to renew the contract with MWD

SOCAL Edison ended the 32-year power service contract with MWD in 2017

SOCAL Edison had insulated MWD from direct contact with the CAISO

MWD’s New “Normal”

NEW Normal

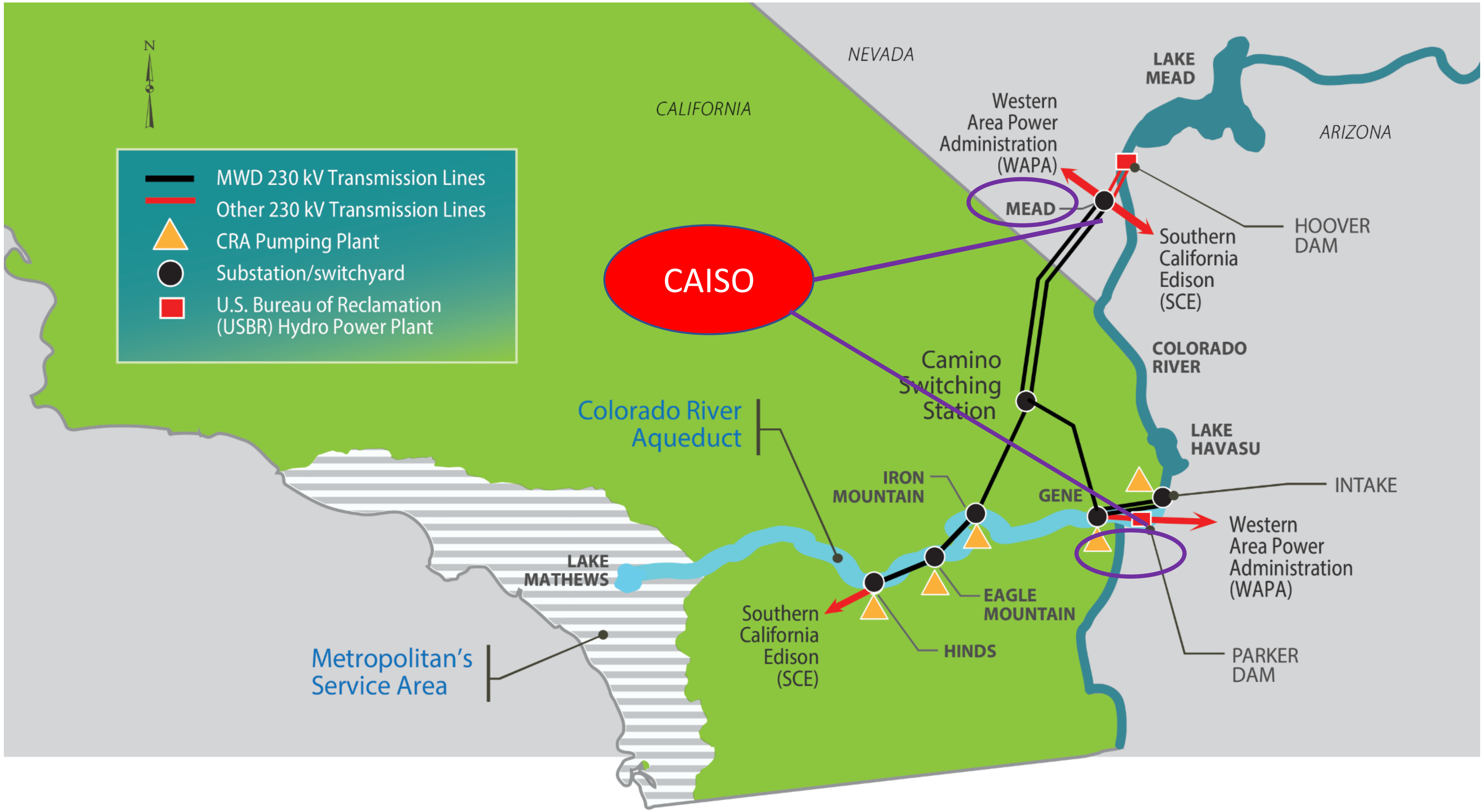
MWD is currently under contract with AEPCO – ends 12/31/2035

AEPCO (Arizona Electric Power Cooperative)
Provides the following services to MWD

- Transmission operator for the CRA 230 kV transmission system
- Scheduling coordinator for CAISO
- 24 -hour, 365 - day coverage

Map of how MWD is Interconnected to CAISO

CRA Transmission System



CONFIDENTIAL

NEW Normal

- We now have direct participation in the CAISO.
- The CAISO provides Open Access to all market participants for transmission and generation.
- Prices are no longer set by human communication, but instead by computer logic that computes power prices and schedules for over 7,000 locations every 5 minutes.

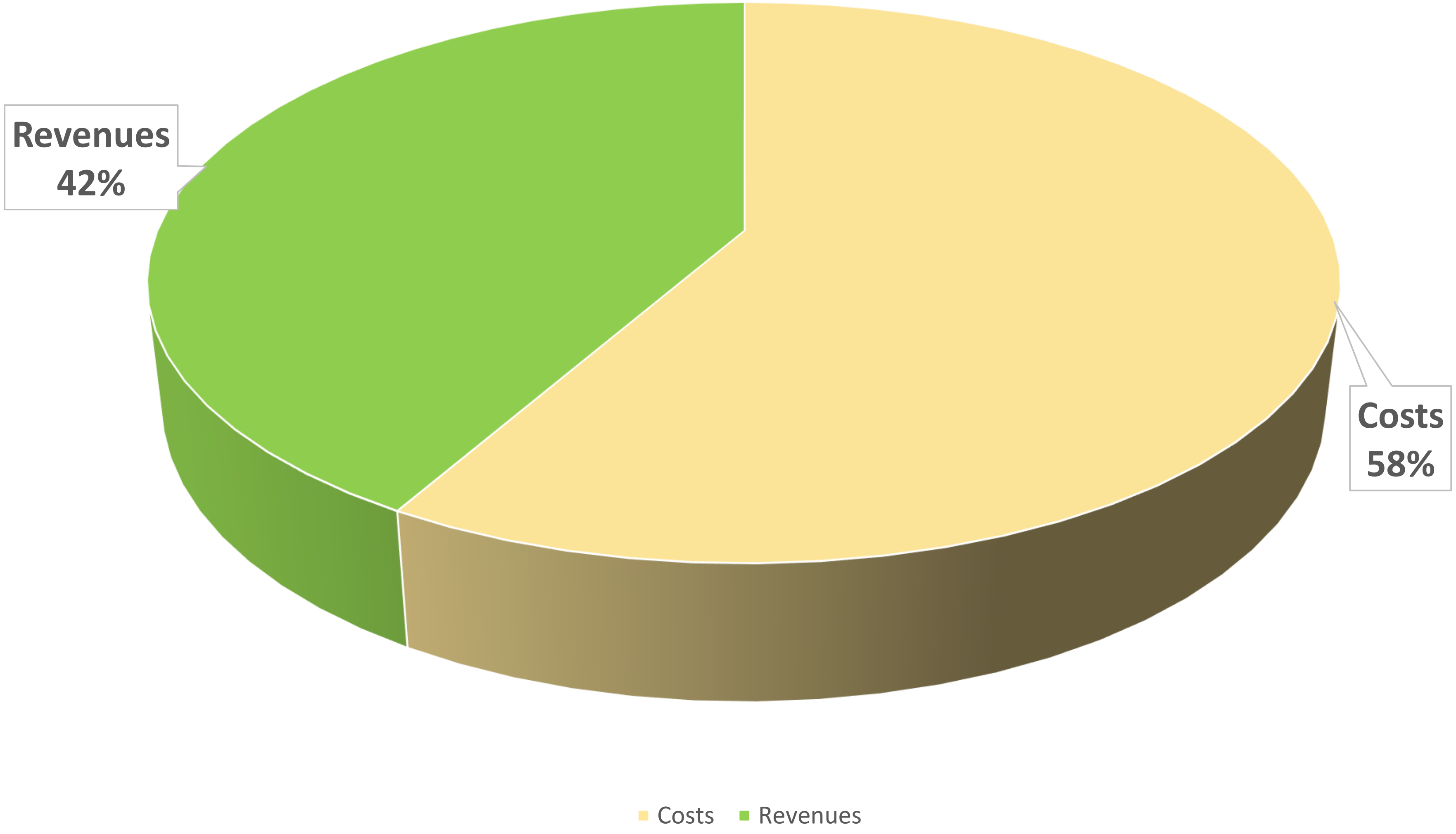
- CAISO transitioned to a computer logic-based market in 2008

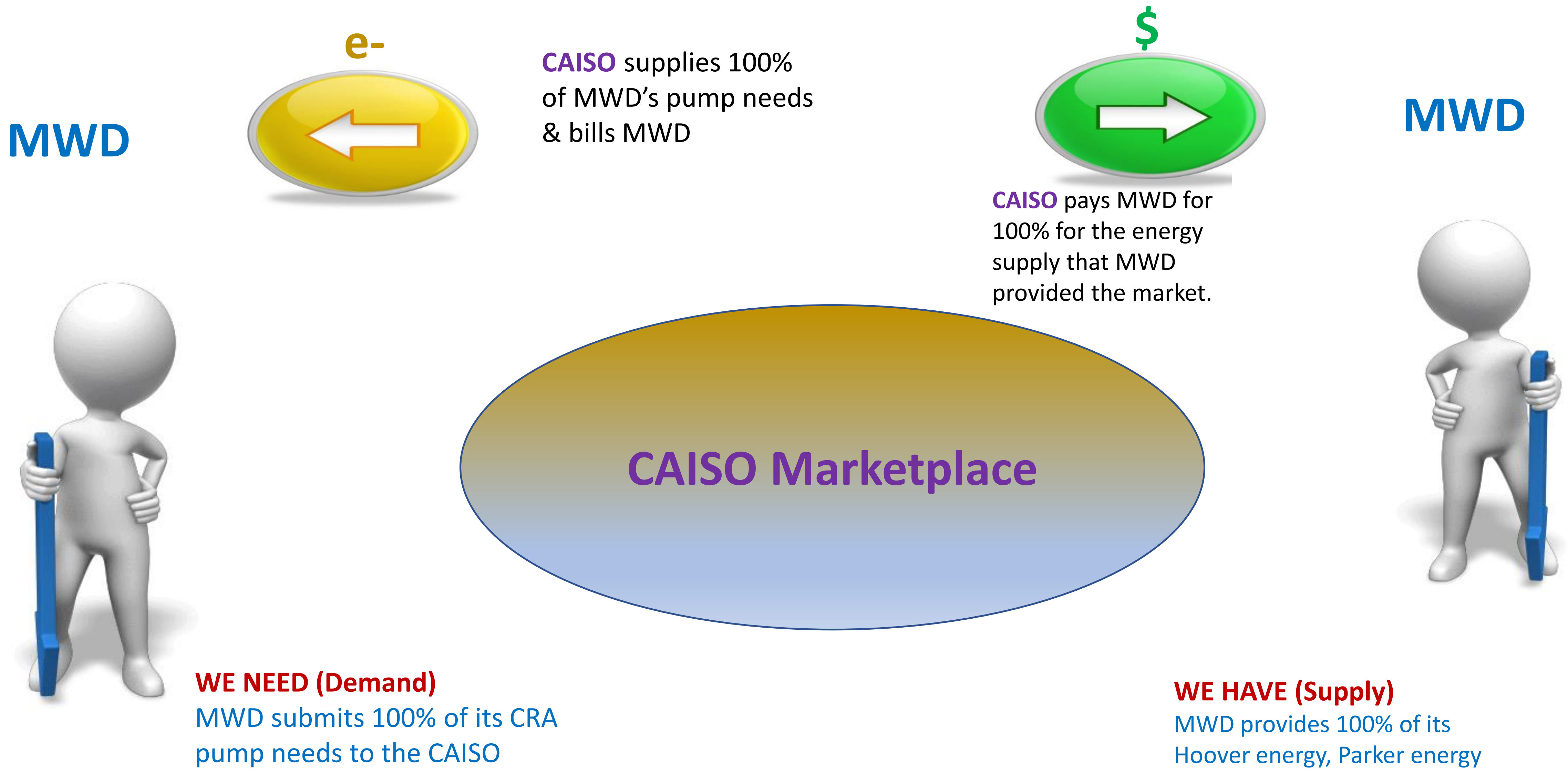
- CAISO market redesign technological upgrade (MRTU)

Only Natural that we are in a Learning phase

MWD has not had Direct Exposure to MRTU CAISO for Thirteen Years

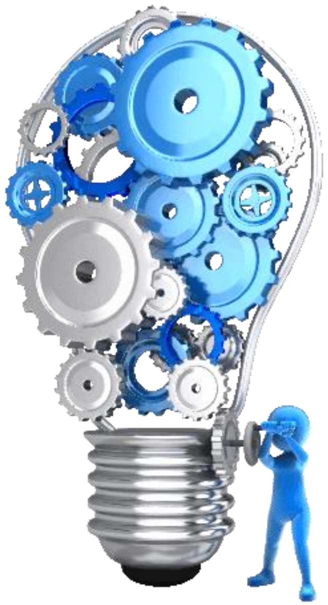
This is a chart of the NEW Normal for MWD Wholesale Power in CAISO

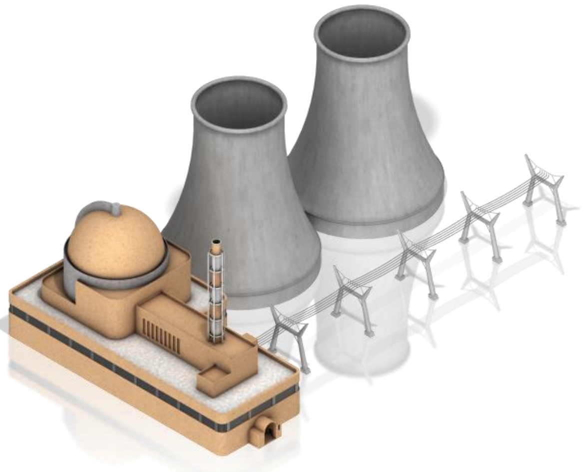


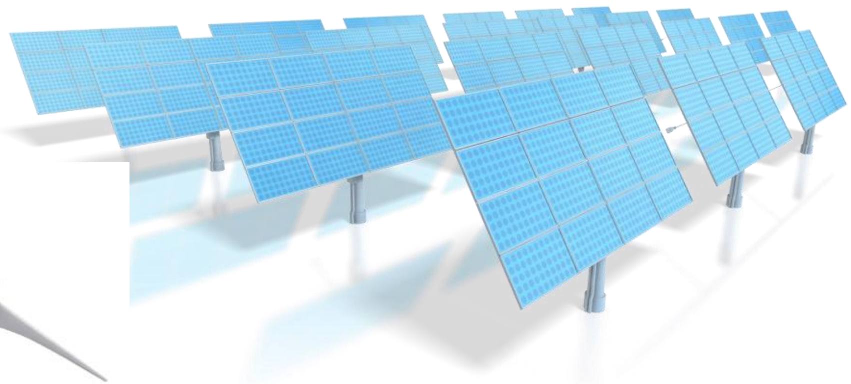

MWD
e-
CAISO supplies 100% of MWD's pump needs & bills MWD
$
MWD
CAISO pays MWD for 100% for the energy supply that MWD provided the market.
CAISO Marketplace
WE NEED (Demand)
MWD submits 100% of its CRA pump needs to the CAISO
WE HAVE (Supply)
MWD provides 100% of its Hoover energy, Parker energy

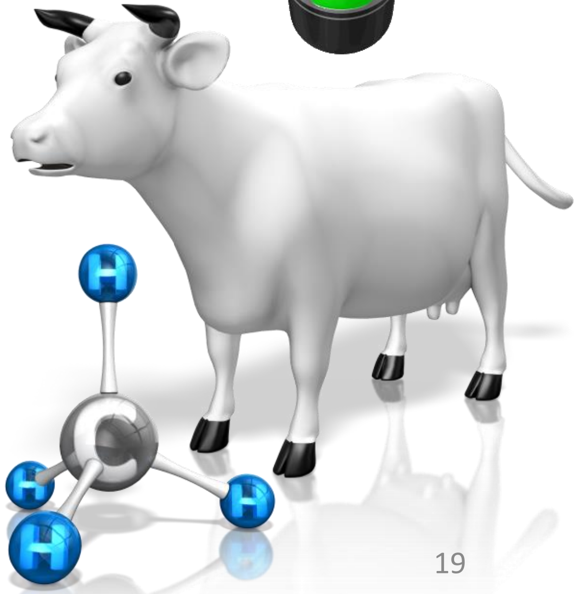
New Normal

CAISO bills MWD for 100% CRA pump demand



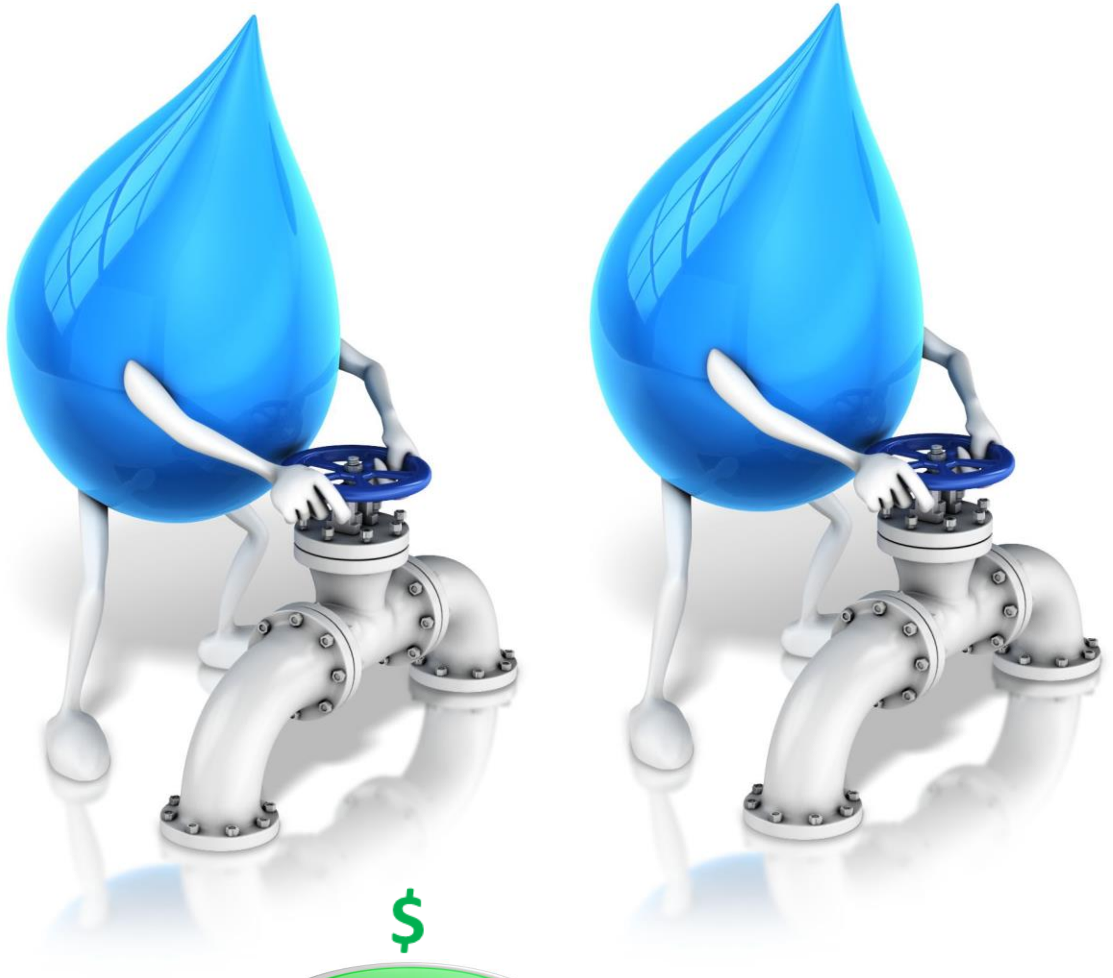




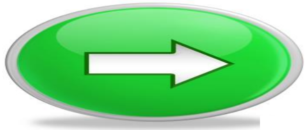


New Normal

CAISO pays MWD for 100% supply from Hoover and Parker



$

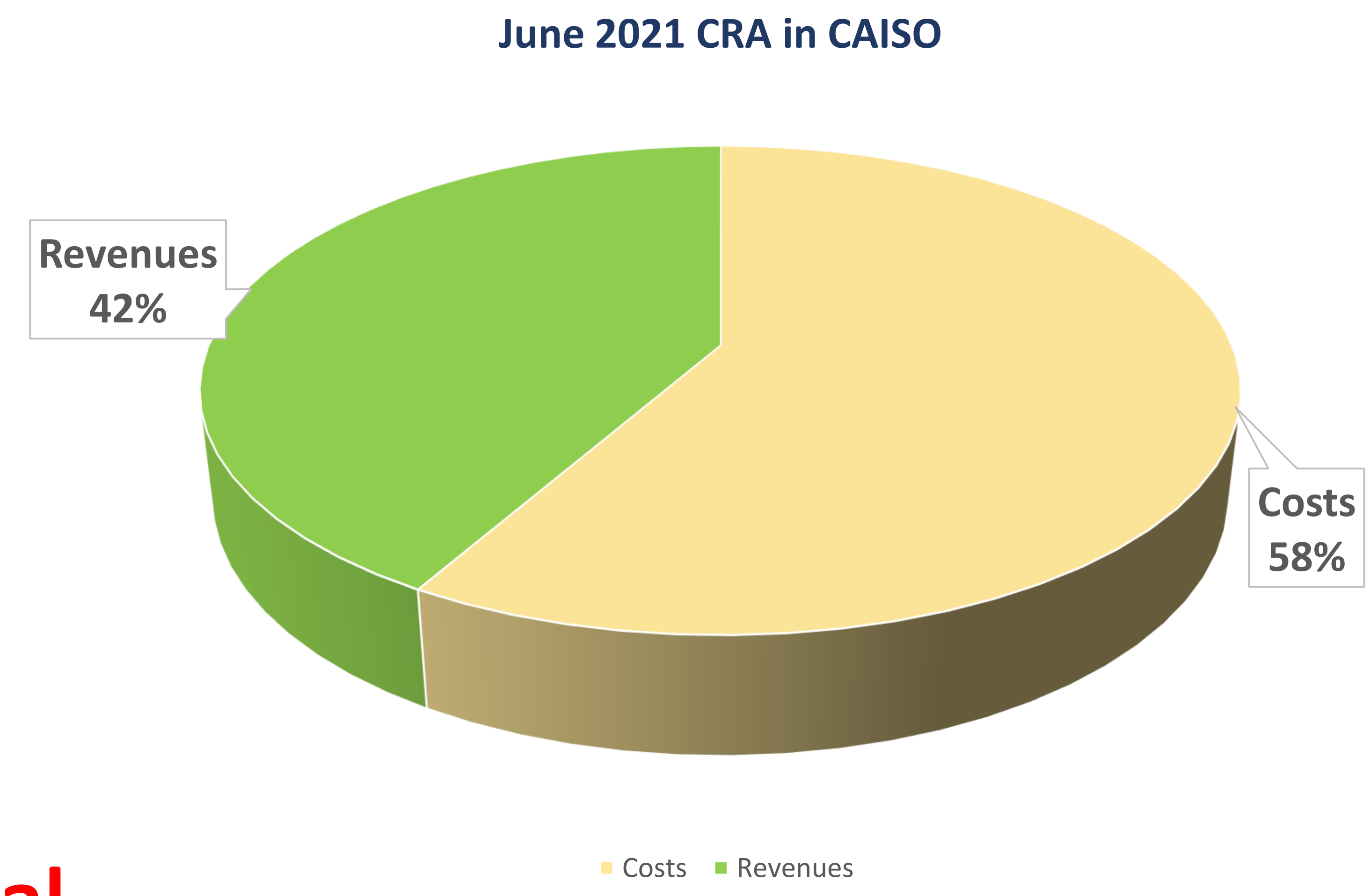


MWD

CAISO Marketplace

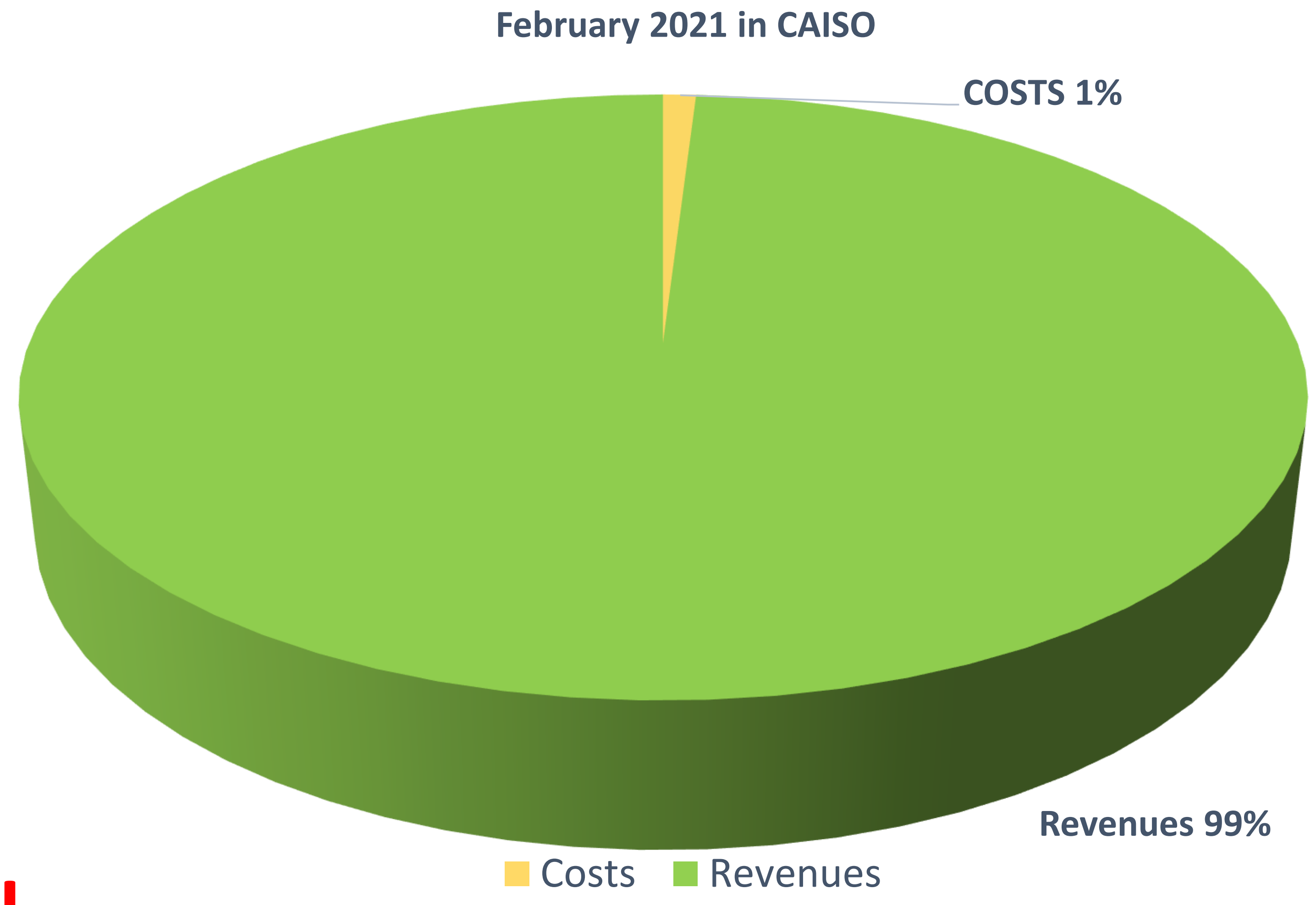
CAISO pays MWD for 100% for the energy supply that MWD provided the market.

MWD CRA		June 2021 Dollars
MWD $ to CAISO	$	10,099,095.63
CAISO $ to MWD	$	7,227,321.01
NET $	$	(2,871,774.62)



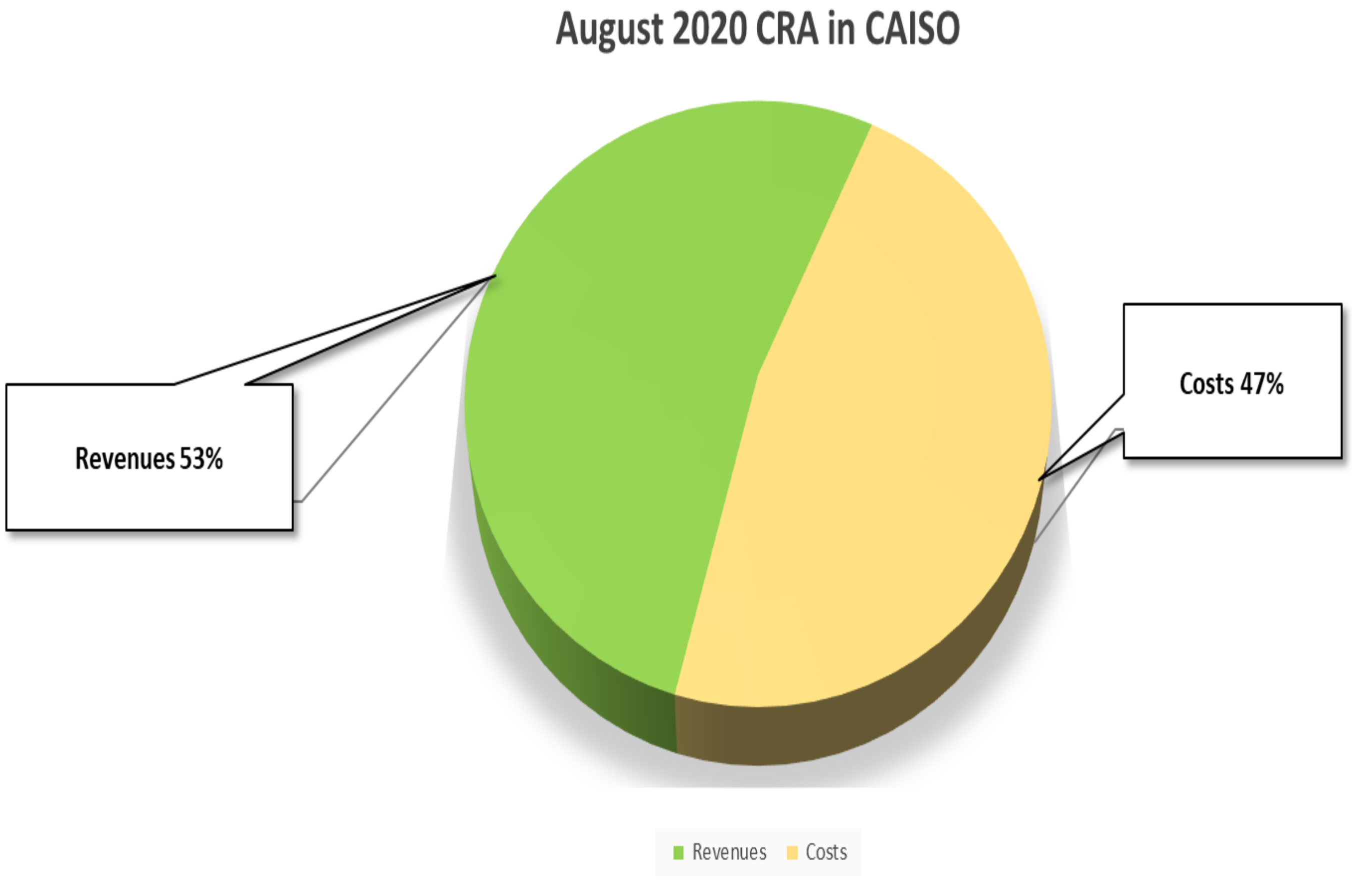
New Normal

MWD CRA	February 2021 Dollars
MWD $ to CAISO	$62,521.60
CAISO $ to MWD	$6,286,352.14
NET $	$6,223,830.54



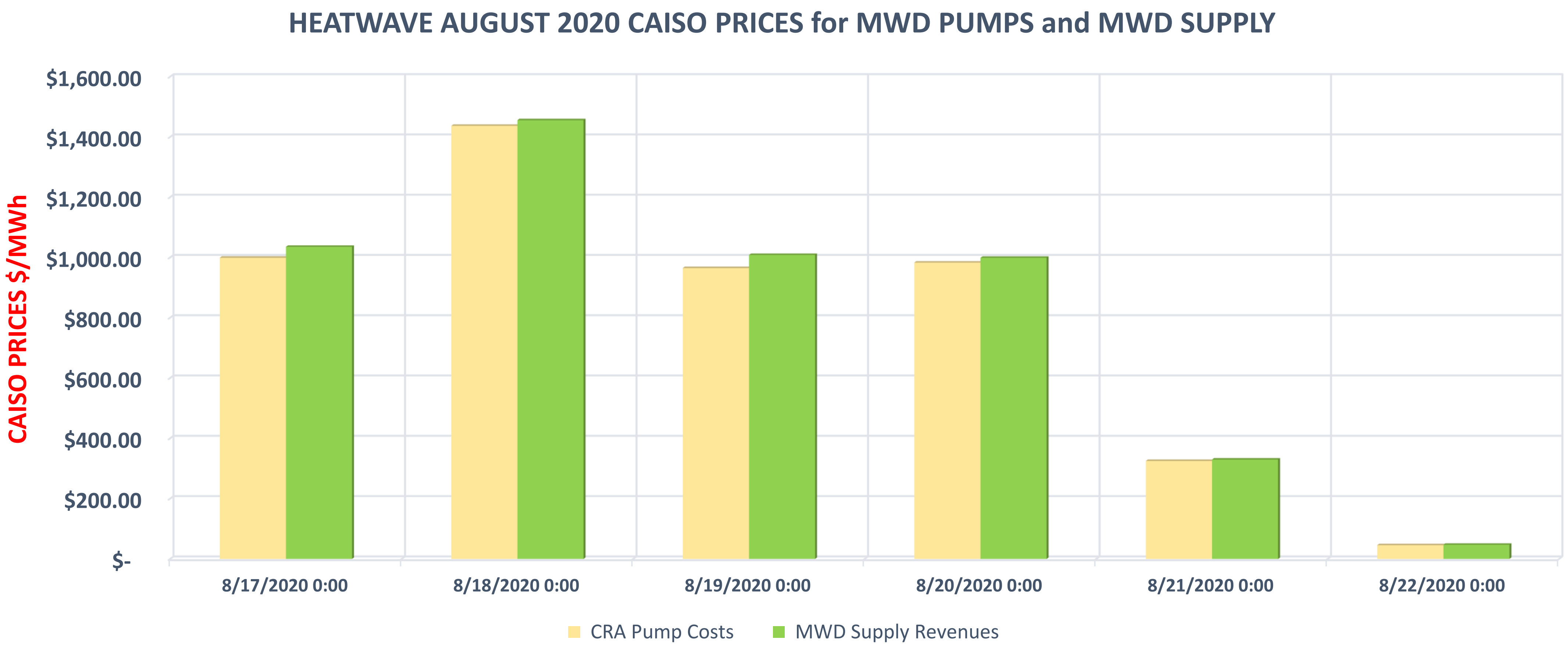
New Normal

MWD CRA		August 2020 Dollars
MWD $ to CAISO	$	9,279,030.53
CAISO $ to MWD	$	10,379,471.17
NET $	$	1,100,440.64



New Normal

CRA is Naturally Protected "Hedged" from Huge Price Swings in CAISO



New Normal

- **MWD from a supply quantity perspective can approximately cover up to a five-pump load on the CRA from Hoover and Parker**

# of CRA PUMPS as CAISO Costs	% as CAISO Revenue from Hoover and Parker
6	95%
7	82%
8	74%

*Economic supplemental energy can come from CAISO or outside CAISO

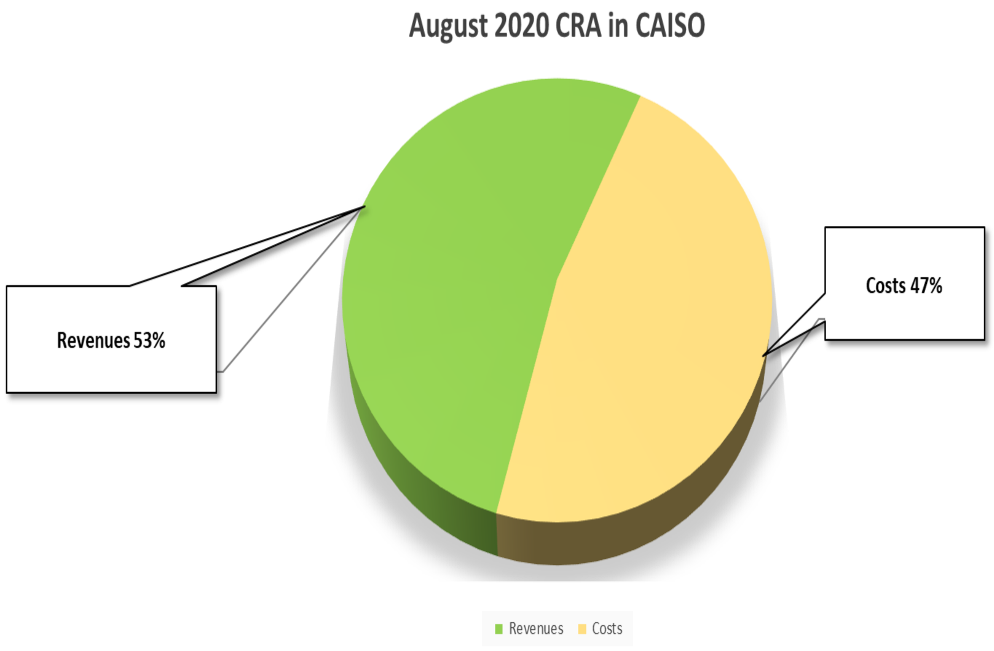
- If outside likely consider the cost of Green House Gas (GHG)

These values are in general and can change from month to month and hour to hour

New Normal

MWD CRA		August 2020 Dollars
MWD $ to CAISO	$	9,279,030.53
CAISO $ to MWD	$	10,379,471.17
NET $	$	1,100,440.64

- MWD dropped from 7 to 3 pumps during August 2020 heatwave
- MWD kept supply quantity from Hoover and Parker constant and did not lower it due to reduced CRA pump needs
- Thus, an overall CAISO profit for August 2020, and we assisted CAISO following market driven incentives



New Normal

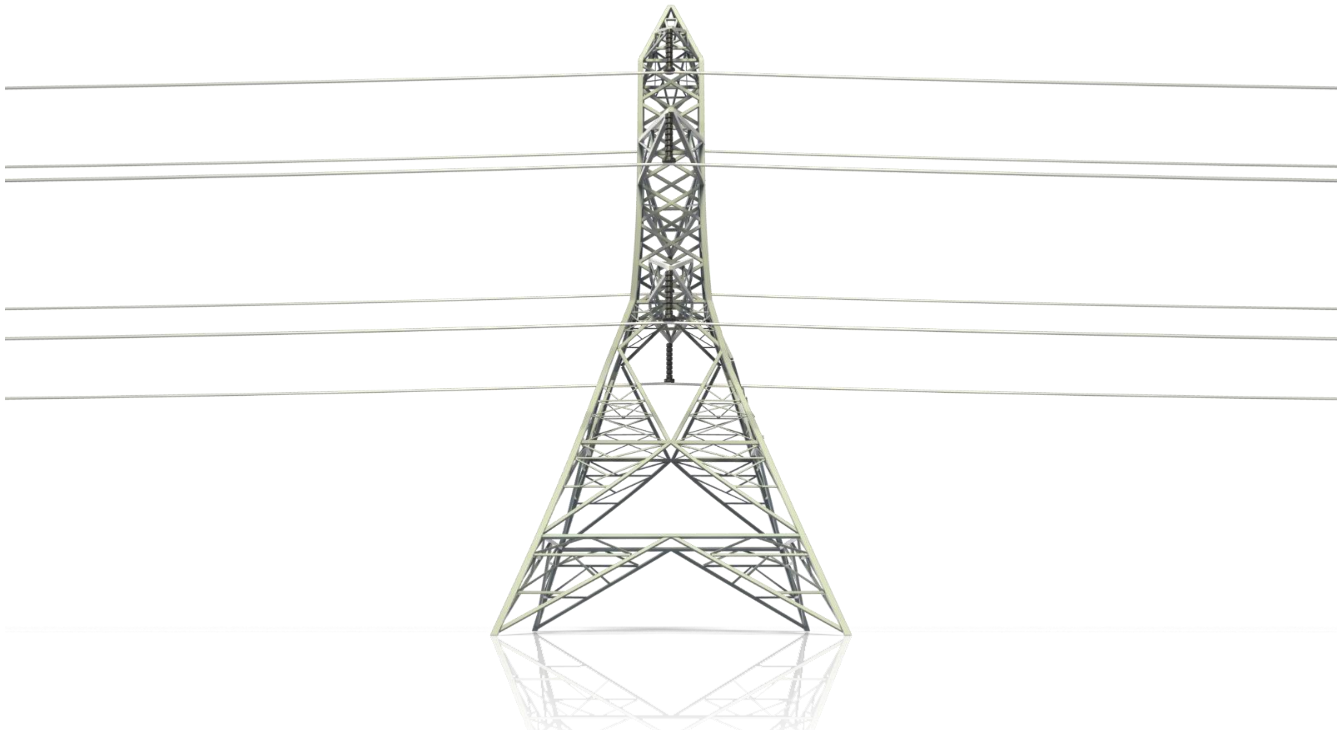
New Normal

MWD no longer must be concerned about being balanced with Supplemental Energy and knows that the CAISO will supply power for 100% of MWD's CRA pump needs

Need to analyze and monitor the CAISO and energy market

*MWD decides to buy power outside of CAISO knowing it only needs to do so because MWD thinks it will benefit MWD's bottom line

New Normal

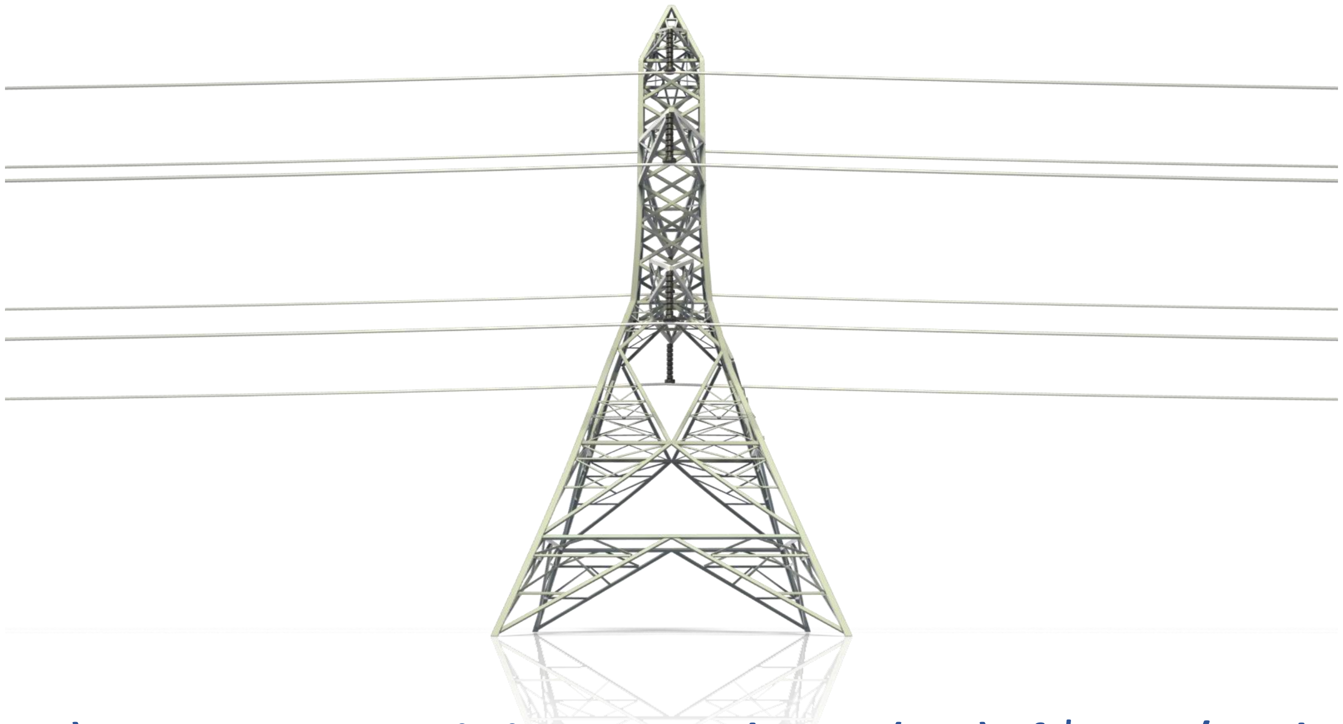


MWD OWNED TRANSMISSION

Gives Transmission Ownership Rights (TORs) to MWD per CAISO Tariff

New Normal

TORs are used for CAISO Settlement Accounting



- In the CAISO, load serving entities (LSEs) pay CAISO Transmission Access Charges (TAC) of $13.35/MWh
  - TAC is used to reimburse entities that have turned their transmission over to the CAISO.
  - TAC is used to reimburse transmission owners for capital investment in their transmission system

- MWD's TORs provide for the ability to avoid paying CAISO TAC

- Not always economical to use TORs

**If there is interest, POP can provide training for TOR CAISO settlements*

New Normal

We don’t know the power price
from the CAISO until after the fact

MWD’s **New Normal** due to CAISO timelines….

10:00 AM: CAISO Receives MWD’s schedules for pump needs and supply from Hoover and Parker

2:00 PM: CAISO Publishes Prices & Schedules

Risk Management

What is a Hedge and Why Hedge?

A Hedge is used for budgeting with price assurance…..Like a price insurance policy

MWD Power Portfolio

Component 1: Long term contracts for Power Supply

- The contract is a known price for budgeting

New Normal

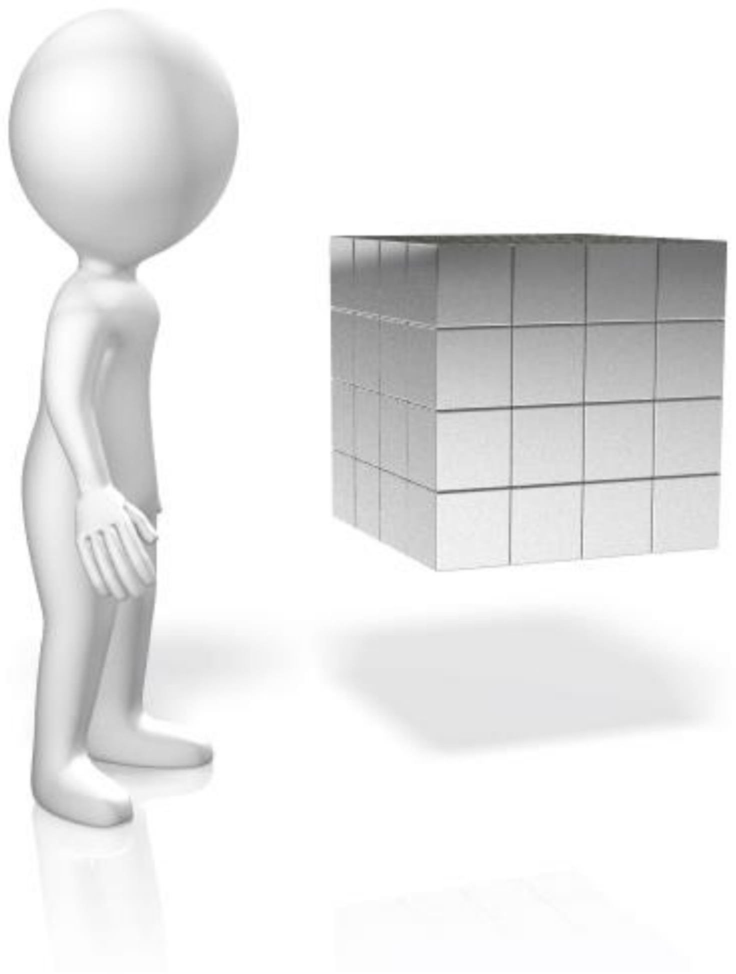
Component 2: CAISO Marketplace

Price is unknown until after MWD schedules load and supply

MWD could buy price insurance through a Hedge to assure a known price for power

Cost of executing a Hedge can be very costly. The seller adds a risk premium for uncertainty

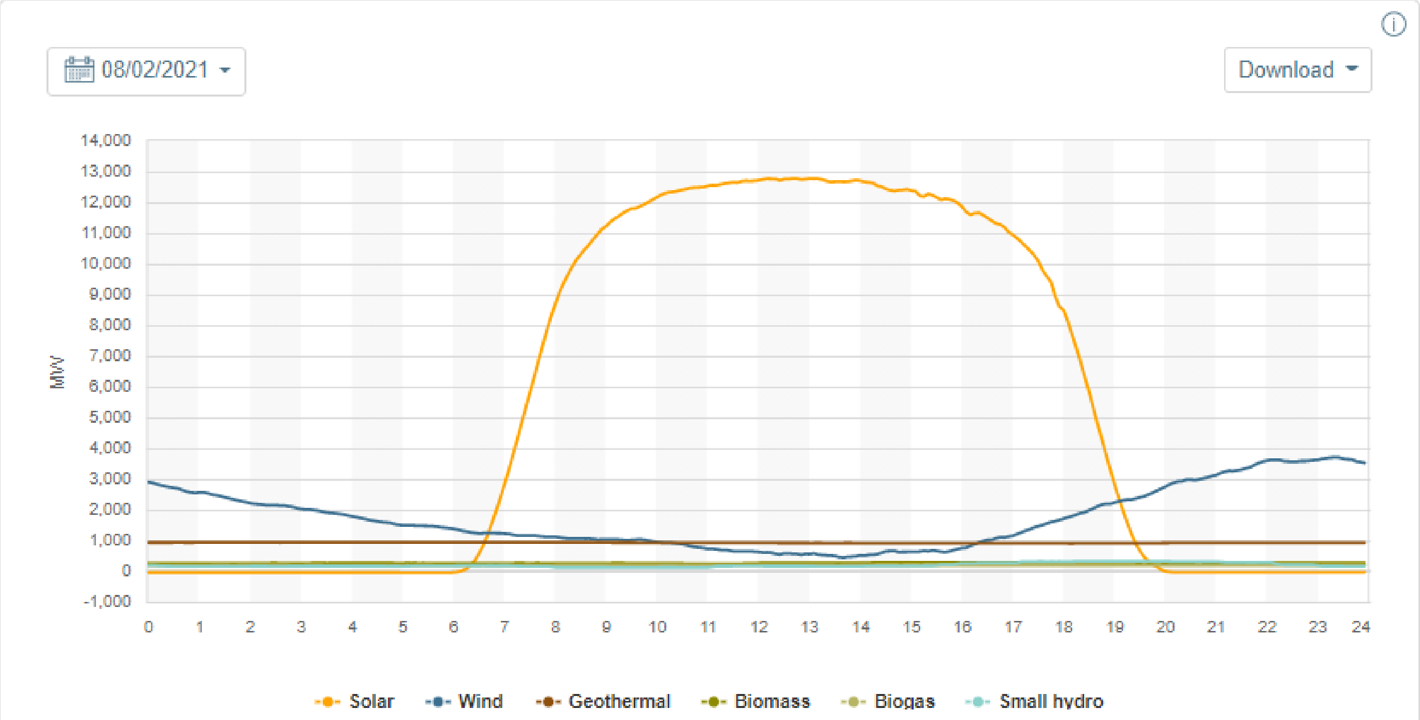
CAISO SOLAR Renewable generation has become the NEW NORMAL and Batteries are a developing reality…thus creating an even newer normal in the next few years….



New Normal

Renewables trend

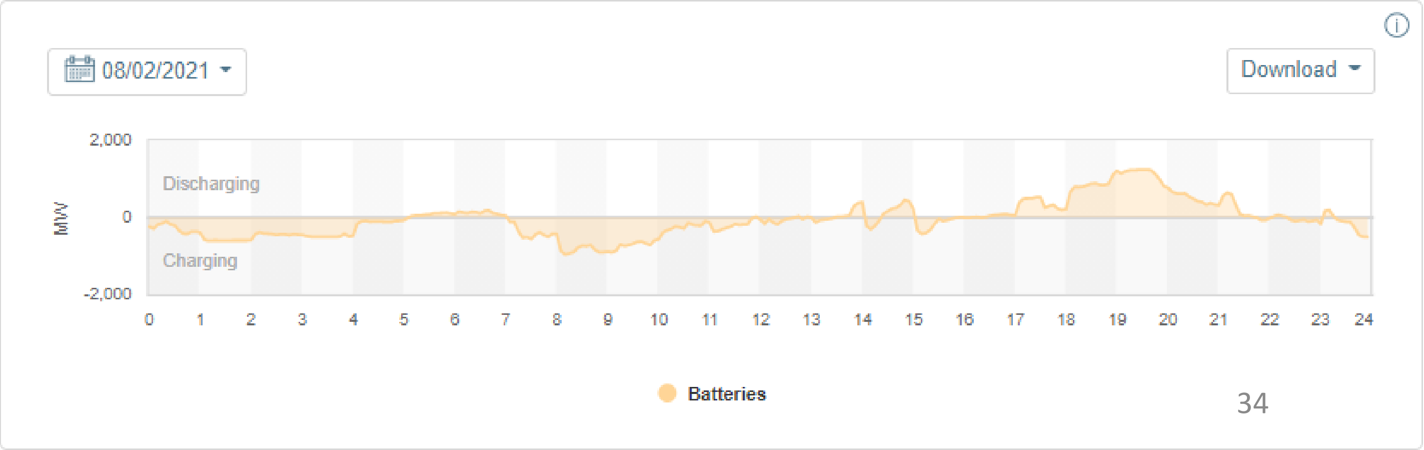
Energy in megawatts broken down by renewable resource in 5-minute increments.



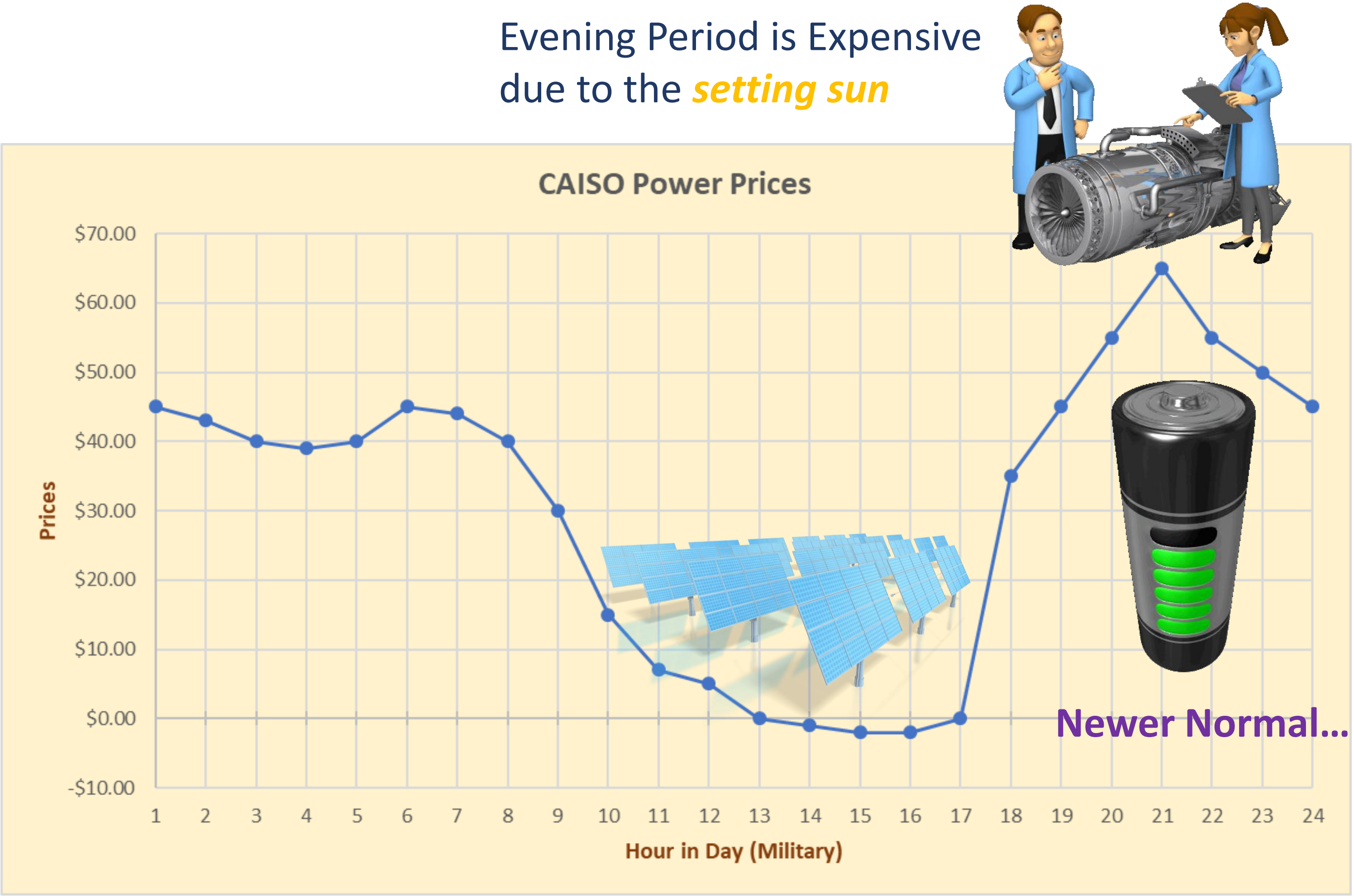
Typical CAISO demand peaks at 38,000 MW in the summer

Batteries trend

Energy in megawatts in five-minute increments.



DUCK CURVE IS THE NEW NORMAL



MWD’s Big Picture for CRA Power

Holistic View…..

…Piece by Piece We Arrive at the Whole

MWD's CRA power portfolio is comprised of…

Hoover Contract Costs

Parker Contract Costs

Risk Management Components

Mead Substation Contract Costs

Green House Gas Costs

CAISO Revenue for Supply

New Normal

CAISO Costs for Demand

New Normal

MWD and CAISO Operating Agreement

MWD's Operating Agreement

An agreement between the CAISO and MWD that governs the operation of MWD's 230kV CRA Transmission System.

When MWD is not utilizing all its transmission capacity, the CAISO can make MWD's transmission capacity available to other CAISO market participants

<u>CASE A:</u>

If system wide emergency, then CAISO changes hats to the Reliability Coordinator (RC) and instructs MWD to drop load to help save the grid

MWD has no choice

<u>Example:</u>

Gene and Intake can drop 101MW of pump load for 4 hours.

<u>CASE B:</u>

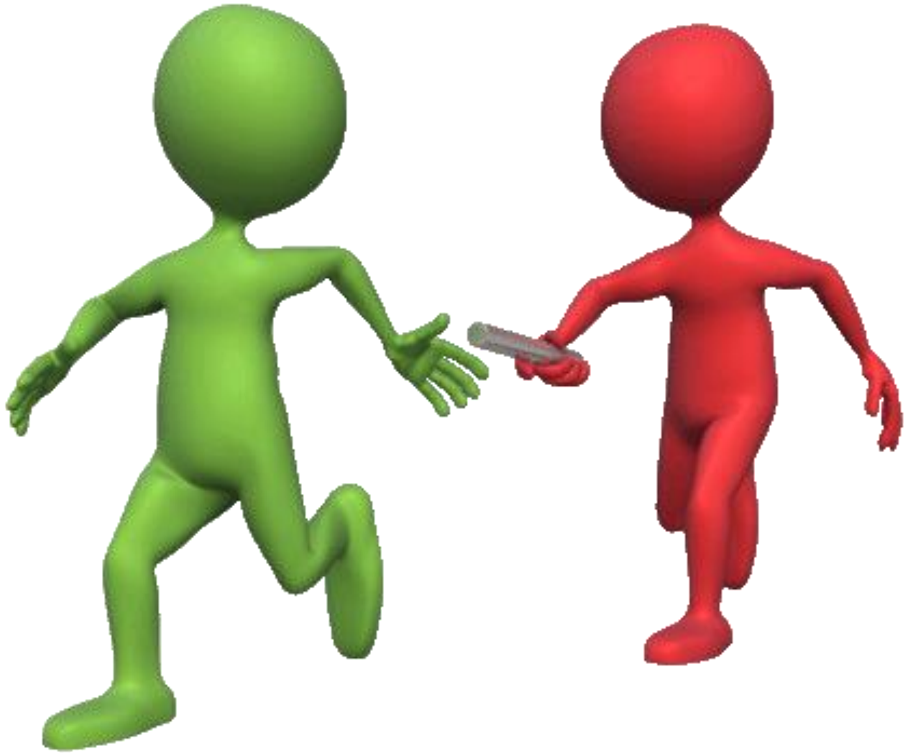
CAISO (not acting as a RC) requests for pump interruption at Gene and Intake

MWD makes the final decision to drop pump load. MWD receives $1,000 per MW per Hour for dropping load

<u>Result CAISO pays MWD for the interruption</u>

101MW * 4 hours * $1000 = $404,000

MWD and Power have Evolved



Passing of the Baton…

…from MWD's Past to MWD's New Normal

MWD's New Normal

MWD & CAISO are similar in Responsibility

MWD & CAISO are not similar in ownership of Assets

Elimination of Balancing Requirement

Direct involvement in CAISO Power Market

Transmission Ownership Rights

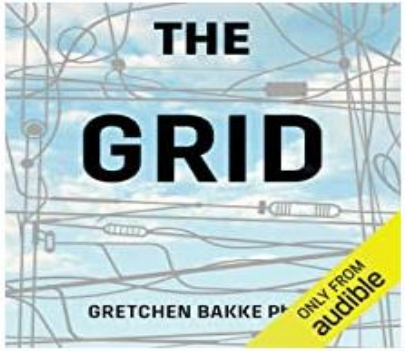
Computer system-based Power Market

Power Grid Assistance via Operating Agreement

Final Thought

Books you May Find Interesting: Water & Power

Best Seller

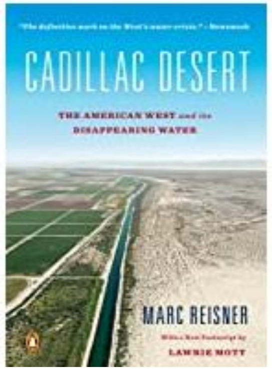


The Grid: The Fraying Wires Between Americans and Our Energy Future
by Gretchen Bakke, Emily Caudwell, et al.
429

Audible Audiobook
$0.00 ~~$20.24~~
Free with Audible trial

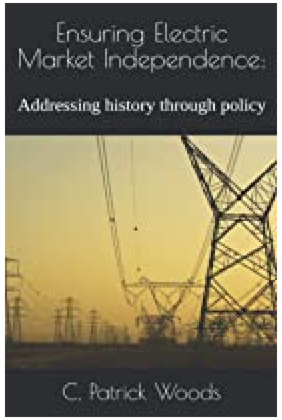
Paperback
$16.29 ~~$18.00~~
prime Get it as soon as **Sun, Aug 1**

Best Seller



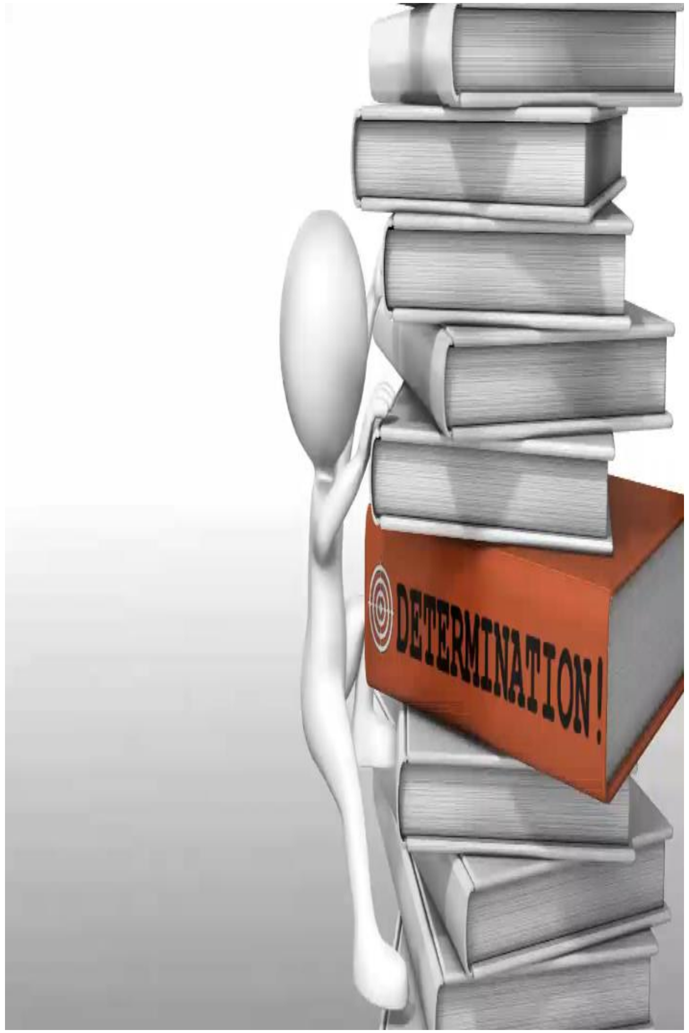
Cadillac Desert: The American West and Its Disappearing Water, Revised Edition
by Marc Reisner | Jun 1, 1993
764

Paperback
$17.99 ~~$20.00~~
prime Get it as soon as **Tomorrow, Jul 31**
FREE Shipping on orders over $25 shipped by Amazon



Ensuring Electric Market Independence:: Addressing history through policy
by C. Patrick Woods | Nov 27, 2020
4

Paperback
$14.99
prime Get it as soon as **Sun, Aug 1**
FREE Shipping on orders over $25 shipped by Amazon
More Buying Choices
$13.87 (3 used & new offers)



Open for Questions