LED Lighting:

WHAT ENERGY MANAGERS NEED TO KNOW

Why LED?

- Long life. Most LED lamps have L70s = 40-60,000 hours; some are up to 100,000+
- Long warranty: Most lamps between 3 to 10 years; some up to 20.
- No failures. LEDs dim, but they typically do not fail.
- Quality of light. CRIs of 80+.
- Variety of color temperatures. Product offerings from 2500 to 6500K.
- Quiet operation. No humming.
- No mercury.
- Abundance of product offerings have been developed.
  - Replacements for 60 to 1000 watt incandescent.

Types of LEDs

- Tradition A19 and A21 lamps:

- Corn cob lamps:

- Horizontal 4-pin LED:

- Vertical 4-pin LED:

Types of LEDs, continued

- Flood lamps:

- Linear fluorescent LED T8 lamps:

- Disk-type LED lamps:

I-Lumen-ation

- How to compare lumens…..
  - Angle of illumination

Types of linear fluorescent retrofits

- Type A: “Plug and Play” LED lamps
- Type B: Integrated driver LED lamps
- Type C: Remote driver LED lamps

No failures?

- Linear fluorescent lamps had a life expectancy expressed in hours….for instance, 20,000 hours.
- That number, by definition, was the number of hours for ½ of a large sample of lamps installed at the same time to fail…..so if you installed 1,000 of the above example lamps, 500 of them should have failed at 20,000 hours.
- LEDs do not ‘fail’. They start to get dim when you first install them and they continue to gradually dim, forever, until a point where they produce no perceptible light.
- LED life expectancies are also expressed in hours, but this is the time required where lamps produce a defined diminished percentage of the lumens that were produced when the lamp was new. An L70 rating means the number of hours that will pass before a new lamp produces 70% of the original lamp lumen output.
- This means that it will be much more important for school Maintenance Departments to track when lamps were installed, since the number of lamps that fail will no longer be a sufficient indicator for when it is time to re-lamp a classroom.

Type A, Plug and Play

- With this type of retrofit, the intent is to replace the existing fluorescent lamps with new LED lamps. They operate with the existing ballast until the ballast fails, then the ballasts are replaced, just as in a traditional linear fluorescent fixture renovation.
  - Product manufacturers claim this type of retrofit to be the "most bang for the buck" and state that it is the most savings possible with the least cost.
  - One problem is that the lamps are only compatible with certain, frequently only instant start, ballasts. If your facility does not have compatible ballasts installed, then you have to replace the ballasts to install the plug and play lamps and the "best bang for the buck" is minimized or eliminated altogether by the costs of the ballasts.
  - Another problem is that installing new LED lamps with existing ballasts often accelerate the demise of the existing ballast, again minimizing the best bang for the buck argument.
  - Manufacturers also claim this to be the 'safest' type of retrofit.
  - Energy savings can be inconsistent: exact power consumption can vary with different existing ballast and lamp combinations.

Type B; without the -allast

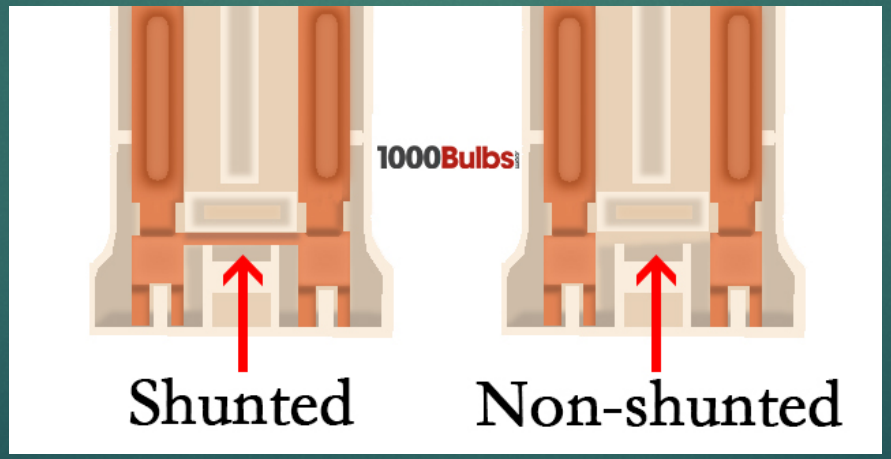
- This type of retrofit removes the ballast from the equation completely – lamps have integrated LED drivers and the fixture is ‘direct-wired’ from the circuit to the tombstones.
  - Manufacturers of Type A equipment will at times claim ‘direct wire’ is a hazard, if not because there is line voltage at the tombstones, but also because lighting maintenance is done from ladders….they claim “if the shock doesn’t hurt you, then the fall will”.
  - Direct-wire requires that the tombstones be non-shunted. Most existing tombstones are shunted, especially if the ballasts are instant-start, therefore they will often need to be replaced as part of the project.
  - Tombstones are relatively cheap, and not a big sticker-add to your project, but there are a lot of them in a large renovation project.

Approximately $0.50 to $0.75 each

Shunted versus non-shunted

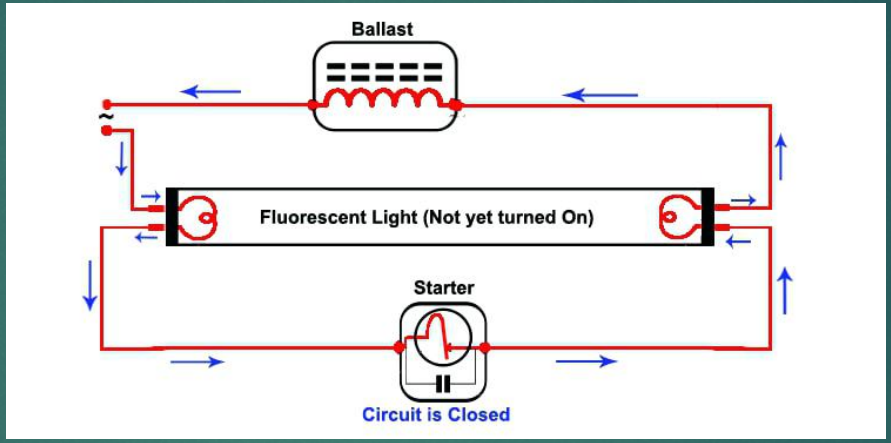
Shunted tombstones are connected internally and have continuity to both contacts;

Non-Shunted tombstones are not connected internally and only one contact is energized.

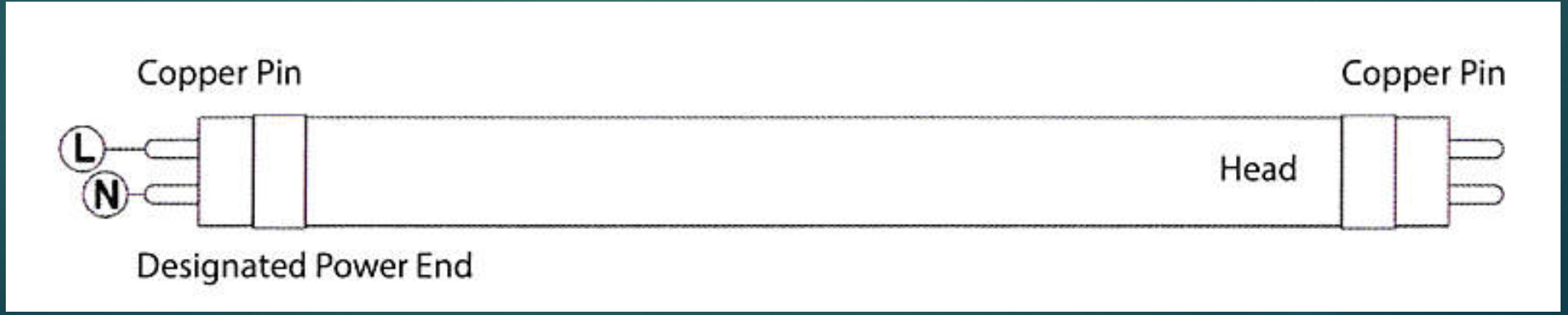


Why non-shunted?

Traditional fluorescent: Electricity flows through the plasma inside the tube and BOTH ends of the lamp

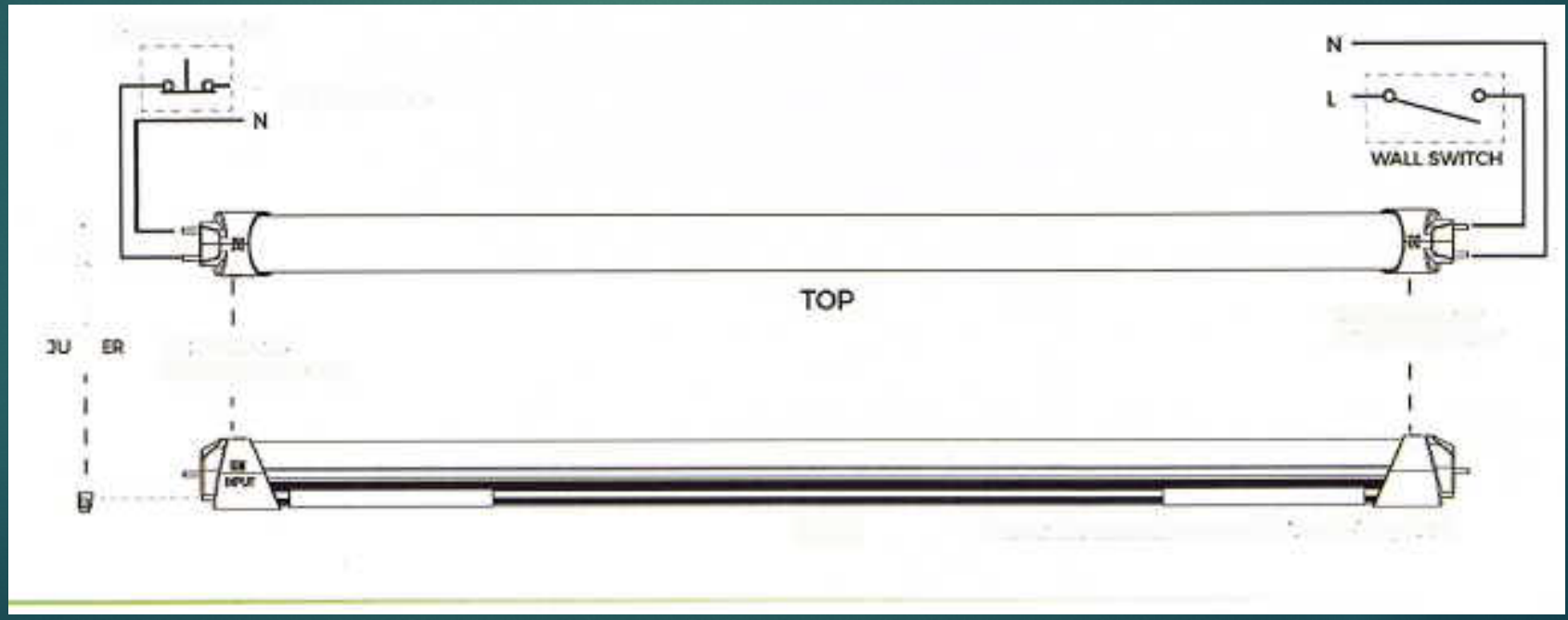


Integral-driver LED: Electricity only flows through the driver side of the lamp; the other side only serves to hold the lamp securely in the fixture.



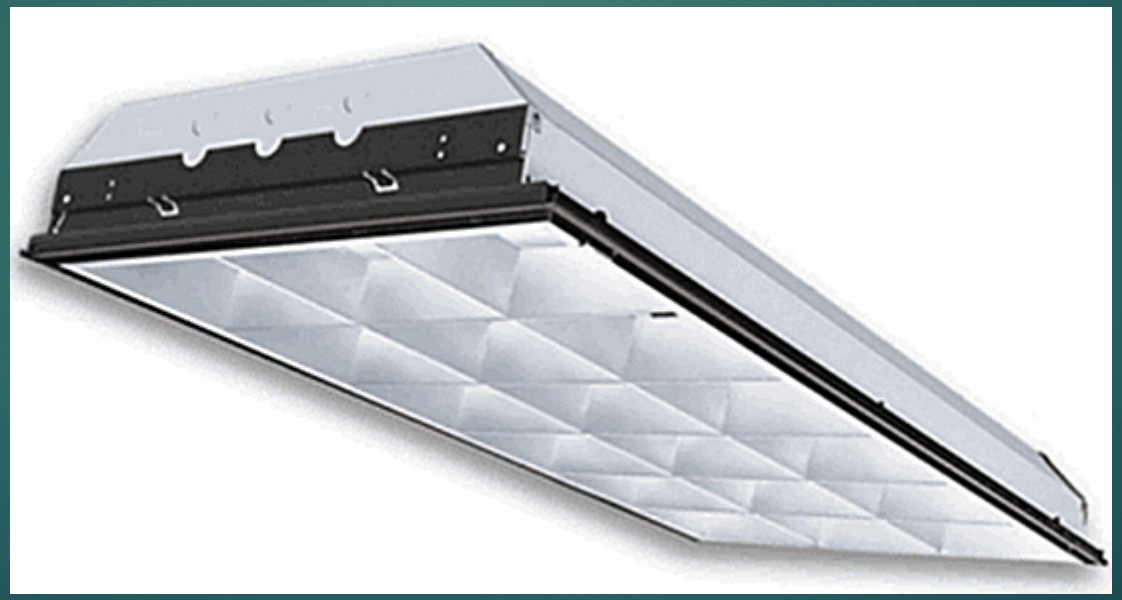
LED Emergency Lamp

- In addition to its integral day to day driver, these lamps also have integrated emergency drivers. For these lamps, both ends are powered – one traditional and one emergency.



Watch the height of the new tombstones

- Tombstones come in different heights.....if you have parabolic lensed fixtures where the lens rotates up and into the existing fixtures....check the new height clearance.....



Speaking of tombstones.....

- Some Contractors advise that retrofitting 4-pin or biax plug-in CFL fixtures should always include replacing the lampholders
  - The high heat produced by CFL lamps over time often weakens the plastic lamp holder – they can break when removing the existing lamp or in turn, installing the new one
  - Replacing the lamp holder to start with avoids change orders later

Some manufacturers go to greater lengths than others....

- Manufacturers of traditional linear fluorescent lamps produced lamps that were all the same length....approximately 47.5” from tip to tip.
- LED lamp manufacturers do not necessary follow that general rule.
- A recent project utilized lamps that were approximately 1/16” longer than standard. The fixtures to be retrofit were runs of up to 16 fixtures in a classroom.
- The 1/16” per lamp resulted in a 1” gain across the 16 fixtures and the fixtures no longer suspended plumb.

Other lengths to check

- Enclosed fixtures…..just as during our switch to CFLs….LED lamps are occasionally longer than their incandescent counterparts….limited space within lensed fixtures can be a problem

#1 Enemy of LEDs H E A T !

- Especially in enclosed fixtures….retrofitting existing fixtures may result in a shortened LED life due to the existing fixture not being constructed to ventilate heat away from the LED driver
  - LEDs actually generate less heat than do other types of lamps
  - However, the internal driver components in LED lamps that convert line voltage electricity to low voltage electricity for use by LED lamps are much more sensitive to heat than other lighting systems are

Type C LED Retrofits

- Remote drivers: designed to remove the heat produced by the driver away from the lamp.
- As technology has improved, heat dissipation has become less of an issue.
- Predictable energy savings, but typically the highest retrofit cost per fixture.

ELECTRICAL BASICS And ELECTRICITY PROCUREMENT

Texas Energy Manager Training

Texas Energy Managers Association

PROCUREMENT

The Players

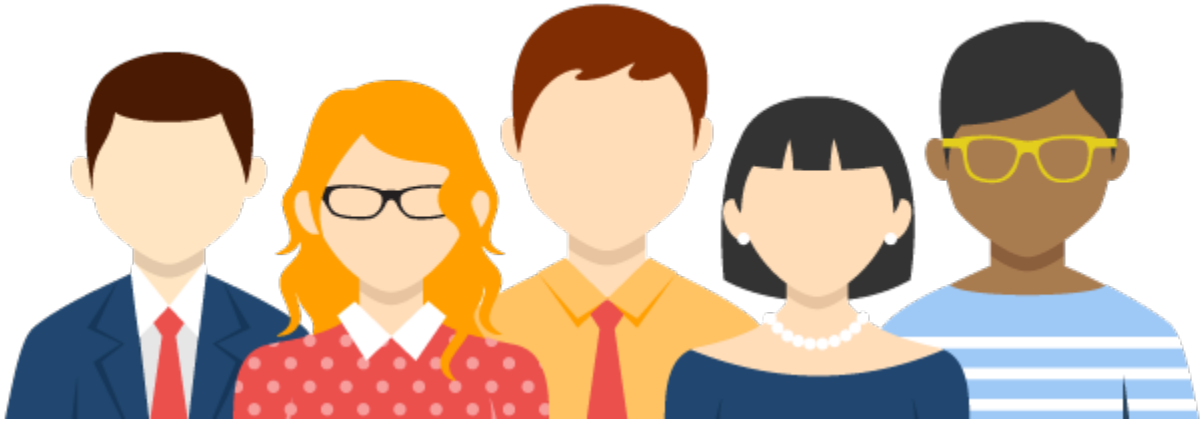
Customer

REP

T&D

ERCOT

PUC



The Customer

YOU!

Without you, there is no reason for anybody else to be interested or involved in this process

The Retail Electricity Provider

REP

One of the parties inserted into the deregulated (competitive) electric playground

This entity sells you electrical energy and provides you with an electric bill.

The Transmission and Distribution

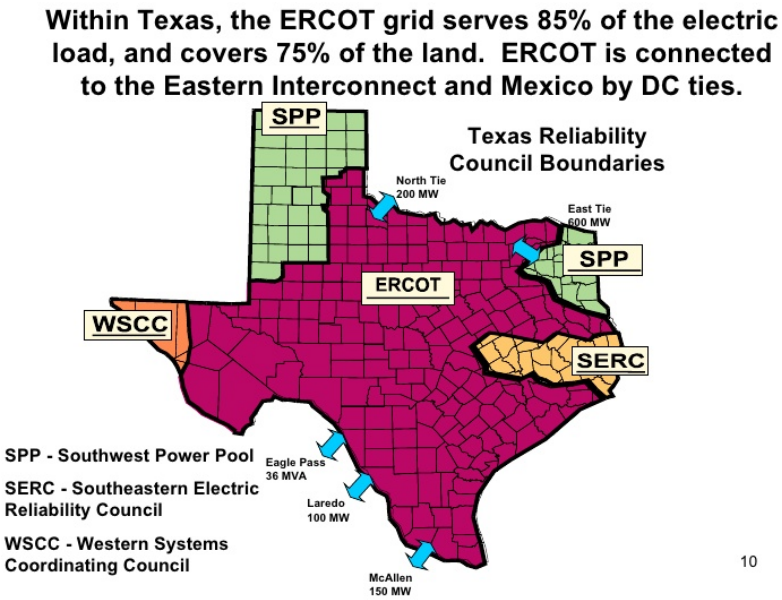
The names have occasionally changed, but this is basically the re-organized electric company that you had before deregulation took effect.

They buy or generate the electricity and deliver it to your facility.

Their fees appear on the REP's bill as "pass-through" charges

The Electric Reliability Council of Texas

ERCOT



This is the Independent System Operator (ISO) for the Texas electricity grid…..understand that ‘Texas’ here does not mean ALL of Texas

This is the area that deregulation opened up electric competition in 2002

The Public Utility Commission

PUC

This is the State Agency that used to regulate rates for all of the State's electric utilities. Their more streamlined responsibility under deregulation includes monitoring the REP and T&D companies in competitive energy markets; along with regulating the IOUs that remain in the non-competitive markets.

The rates for Electric Cooperatives and Municipalities are managed by their Board of Directors or the City Councils, respectively.

Ironically, the PUC can handle complaints that a consumer might have against any of the above referenced groups, even if they do not directly regulate them, but they recommend this process be a last resort.

How did Deregulation come about?

Prior to 2001, the general opinion of IOUs is that they were monopolies and even though the PUC regulated prices in the supposed best interest of consumers, it was believed that introducing competition into the electricity market would result in lower prices for most consumers in Texas.

SENATE BILL 7

- Introduced in January 1999, SB7 eliminated regulated electricity rates and dismantled monopoly providers

- It was believed that Competition and Market Forces would lower electricity prices for consumers

How has it worked out?

Like everything that involves large sums of money and power, pun intended, it DEPENDS ON WHOM YOU ASK.

It is generally understood that consumers in competitive energy markets have paid more money for their electricity since deregulation started in 2002 than their counterparts in non-competitive areas. The numbers are hard to ignore.

There are differences in the opinions for how much more and why there is a difference based on the financial and political perspectives of the individual you ask.

How has it worked out?

Yellow = National Average price / kWh
Green = TX REPs (competitive market)
Red = TX non-competitive market players
Orange = Texas average cost/kWh

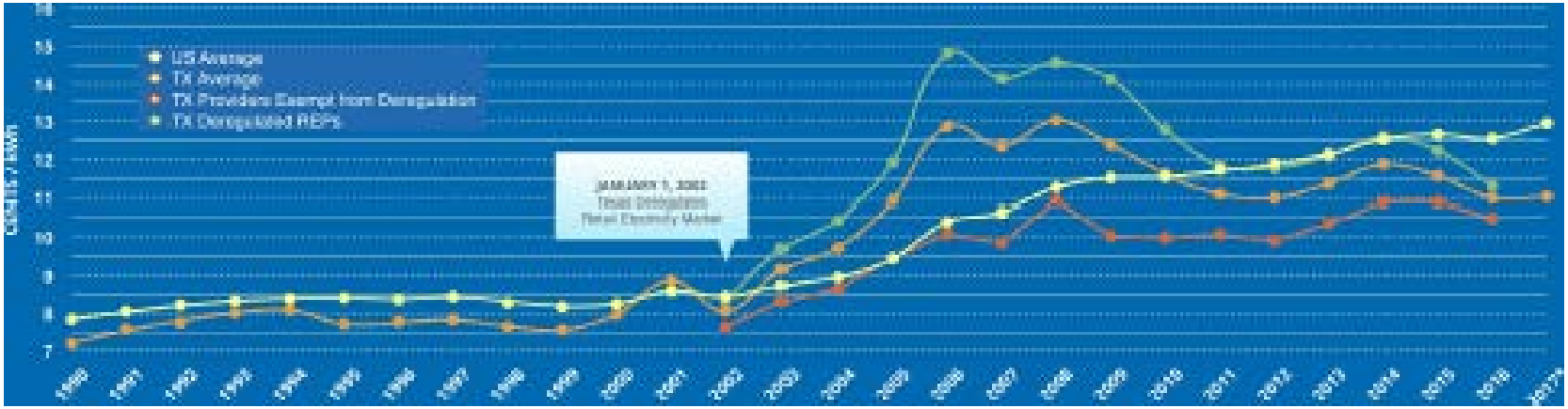


Chart fromTCAP, April 2018

T&D Pass-thru Charges

- Centerpoint 2003 on 1,000kWh bill **$24.61**
- Centerpoint 2018 on 1,000 kWh bill **$46.58**
- Oncor 2003 on 1,000kWh bill **$23.01**
- Oncor 2018 on 1,000 kWh bill **$38.86**

Data from Deregulated Electricity in Texas, A Market Annual, 2018 Edition by TCAP

Changes to Electricity Procurement

In the ‘old days’ schools received bills and paid them. If there was a cost increase, it had been approved by the PUC and the consumer could not do much more than complain while they wrote their check.

The new days represented an opportunity for consumers to select not only who they purchased their power from, but also the terms for their purchase:

- Emphasis on Renewables?
- Multi-year contracts?
- Market watch pricing?

Procurement at first?

Consumers had a choice as to how to purchase their electricity:

OPTION 1:

Use the Provider of Last Resort, which meant they basically did nothing and just paid whatever bill showed up.

Procurement at first?

OPTION 2:

Conduct a Request for Proposals

The Energy Management and Purchasing Departments cooperated to issue an RFP for electricity, evaluate the results and select a supplier and terms for their electricity purchase.

Procurement at first?

Benefits:

School districts knew how to issue RFPs.

Hindrances:

1. School Boards did not frequently give Energy Managers authority to contract the price
2. REPs did not make many efforts to comply with the requirements of the RFP.
3. REPs frequently placed restrictive timelines on the validity of the proposed pricing.

Consequently, it was difficult to compare apples and oranges.

What happened at first?

OPTION 3:

Use an Aggregator

Also a new player to the market, an Aggregator attempted to group consumers for a more favorable and simpler power purchase.

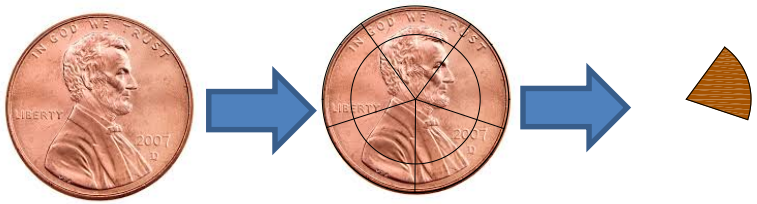
Sometimes the aggregation was based on a consumer's similar classification, e.g., Energy for Schools, and sometimes it was done to create the most advantageous load profile, e.g. a school with a movie theater.

Aggregators are often paid in mils…..

What is a mil?

In the energy market, a mil =

1/10 of a penny or $0.001



What is it worth to you?

What is a mil worth to you?

Let's assume that your facility consumes 34,000,000 kWh per year…..a mil is worth

The Electricity: Where does it come from?

- The Power Generation Company creates the electricity.
- The electricity is placed on the grid.
- The electricity is sold to the REP; then to the customer.
- The electricity is delivered to the customer by the T&D.
- The T&D ensures the reliability of the service; reads meters.
- REP handles customer service and utility billing.

The Market: What is affecting it?

- Shrinking generation capacity and reserve margin
  - May 2017 the reserve margin was 18.9%
  - Summer of 2018 the reserve margin fell to 6.7%
    - Closure of coal-fired plants
    - 1143 MW placed on extended outage
    - Three new gas-fired plants delayed completion beyond the summer of 2018
    - Delay or cancellation of several wind projects
- Texas weather – not getting any cooler
- Population growth – Texas's economy may be too attractive
- Natural gas prices

Procurement now

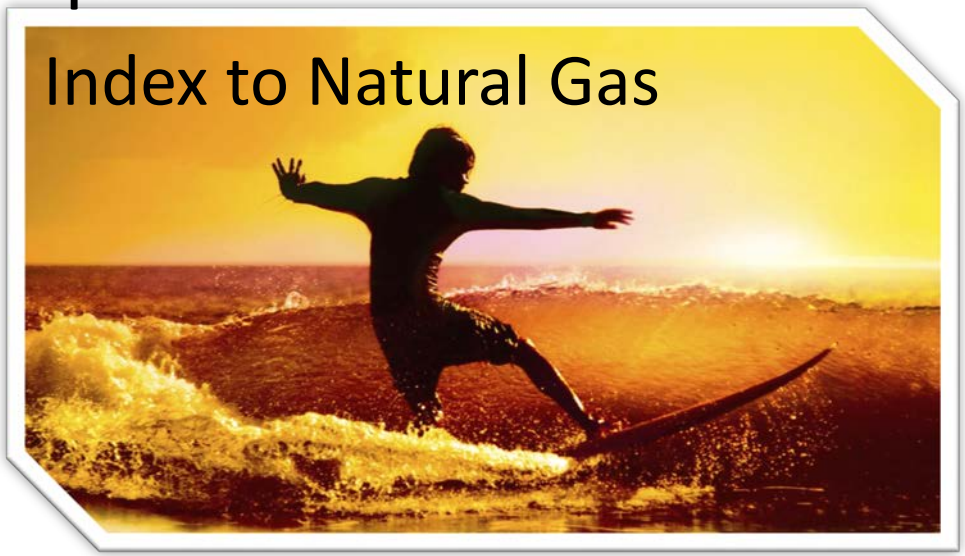
Requests for Proposal RFPs

Aggregator

Energy Auction

RFPs for Power

- Smaller consumers usually opt to seek a fixed price per kWh for some number of months
  - Easy predictable costs
  - Avoid future cost increases; miss out cost decreases
- Larger consumers can take advantage of other options such as Market Watch



Requires more resources from the Owner

"Ride the Wave"

RFPs for Power

- REP Fees:
  - Commodity charges (REP)
  - Taxes?
- ERCOT Fees
  - Congestion Management Charges (NODAL)
  - QSE fees (non-neg. scheduling fees)
  - Line Losses
- TDSP (Pass-thru charges)
- Taxes (Sales, PUC charges and Gross Receipts)

RFPs for Power

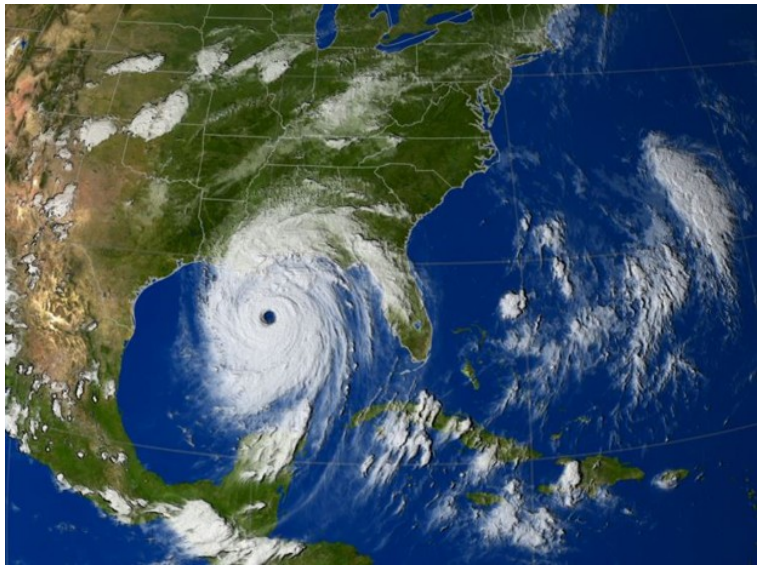
- Owner should understand and summarize their usage to communicate needs:
  - # of meters to be supplied
  - Historical energy consumed (kWh)
  - Current T&D Supplier(s)
- Other documents they may require:
  - Letter of Authorization to seek Historical usage
  - Letter of Interest to REP or Aggregator

Other considerations

- Bandwidth:
  - Also called Swing, Tolerance, or Collar
  - Limits quantity of electricity provided in base contract
    - Can penalize for too little or too much usage
  - Schools should have the leverage and ability to nominate a zero bandwidth contract
- Future facility additions or demolition
  - Allow for known future load changes

Other considerations

- Aggregation or Broker fees:
  - Ensure they are spelled out in the fee breakdown
- Force Majeure
  - Protect yourself from natural disasters and “Acts of God”



Other considerations

Customer Service:

- What are responsive hours operation?
- Is there an emergency contact?
- Will the REP assist with T&D questions?
- Is billing performed in-house or subcontracted?
- Is there an individual invoice per meter?
- Is there summary billing?
- Do the bills identify all data used in the billing?
- Are there early payment discounts?

Other considerations

Provider Capabilities and Experience:

- How long in business?
- Sales volumes?
- Does the REP use a financial or physical hedge?
- Current legal proceedings?
- What is the source of supply for the REP?
- Is the supply source diverse or centralized?
- References?

Typical RFP Format

I. Statement of Purpose
    I. What are your objectives
II. Description of Purchaser
    I. Describe your organization and facilities
III. Scope of Purchase
    I. # of facilities
    II. Historical consumption
    III. Desired contract terms

Typical RFP Format

IV. RFP Instructions
    i. Due Date for Responses
    ii. Pre-proposal Conference (if any)
    iii. Instructions and deadline for Questions
    iv. Submittal and Contact information
V. Terms and Conditions of Proposal
VI. Required Content
    i. Proposal Summary
    ii. Pricing Structure
        i. List of all pricing options
        ii. Description of Flexibility
    iii. Qualifications and Experience
    iv. Capabilities and Services
    v. Sample Contract
VII. Evaluation Process and Criteria
VIII. Required Forms (Felony Conviction / Conflict of Interest, etc.)

Aggregation

- May group customers based on common classification (schools, hospitals, etc.)
- May group customers based on load profile (school with a movie theater)
- Aggregators do most of the background work and provide ‘customer service’ to the consumer.

Aggregators, examples

- Texas Power Pool
- Texas General Land Office State Power Program
- Texas Coalition for Affordable Power
- Public Power Pool (P3)

Note:

It is not the intention of this presentation to promote any individual procurement method, philosophy or company; it is also not the intention of this presentation to denigrate any individual procurement method, philosophy or company.

This goal of this presentation is present non-biased facts about the current state of procurement.

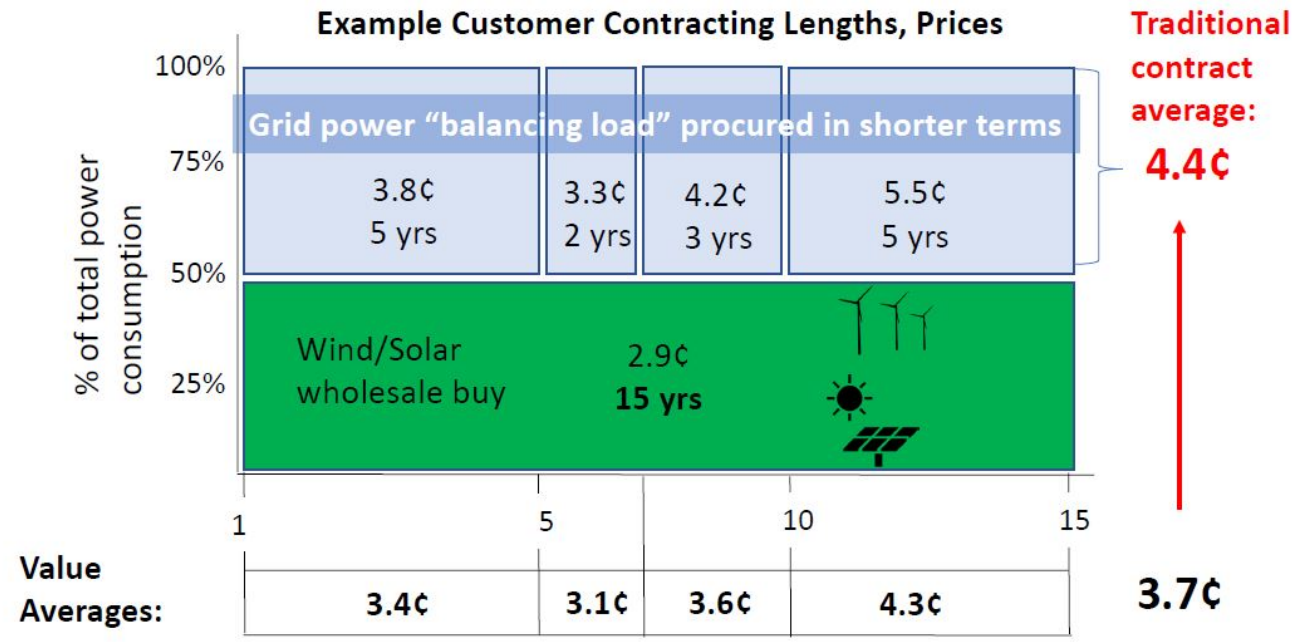
Texas Power Pool

- Aggregation for up to 50% of a user's load with wholesale renewable power; the balance with traditional power
- Optional add-ons for on-site Solar or Demand Response
- Contracts through the State Comptroller's Office Smart Buy Contract 961-M2
- Available to municipalities, ISDs, utility districts, state agencies, water authorities in both competitive and non-competitive areas
- Can be used with existing and future REP contracts

Texas Power Pool

Texas Power Pool contracting structure example

Benefits: Longer-term, low-cost renewables reduce average price along with pricing volatility



75 million annual kWh = $8M savings over 15 years

Note: All prices are retail and for example purposes only; savings are non-discounted over time

Slide borrowed from Texas Power Pool presentation January 17, 2019

Tx Power Pool – How they are paid

Fees: Transparent and lowest in industry

You never pay TEA directly. All fees are built into your rate and paid through the service provider you select. Fee is the same, regardless of contract length.

Matrix for electricity commodity procurement, deregulated areas

TEA 2017 – 2020 PRICES	Total Annual Consumption for Agency Deregulated Meters (MWh/yr)							
Number of Agency Meters	0 - 10,000	10,001 - 20,000	20,001 - 50,000	50,001 - 100,000	100,001 - 250,000	250,001 - 500,000	500,001 - 750,000	750,000 +
1 - 10	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$8,000
11 - 50	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$10,000
51 - 100	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$12,000
101 - 250	$12,000	$12,000	$12,000	$12,000	$12,000	$12,000	$12,000	$12,000
251 - 500	$14,000	$14,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000
501 - 1,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$18,000
1,000 - 5,000	$16,000	$18,000	$18,000	$18,000	$18,000	$18,000	$18,000	$20,000
5,001 - 10,000	$18,000	$18,000	$18,000	$18,000	$18,000	$18,000	$18,000	$20,000
10,000+	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000

Demand Response

TEA is paid 3.5% of gross payout directly by the demand response provider.

Renewable energy contracts, on or off-site

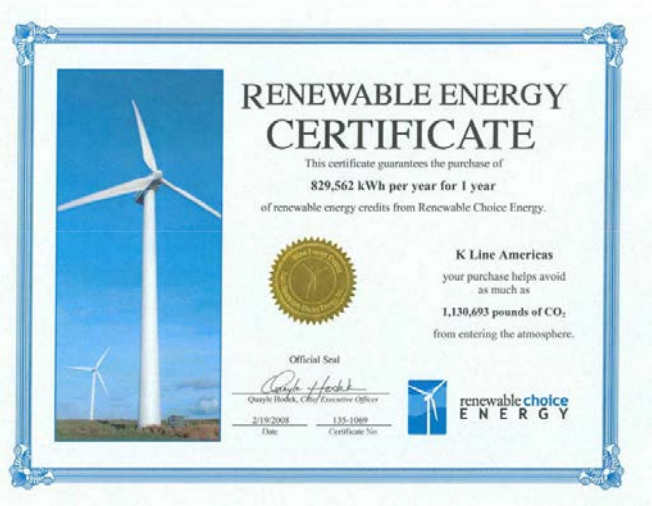
TEA is paid a fee of 1.5 cents per DC watt of installed generated capacity by the renewable energy developer. A portion of this fee is paid to TEA after successful negotiation of the contract and the remainder after power flow begins.

Slide borrowed from Texas Power Pool presentation January 17, 2019

Tx Power Pool

Emphasizes that you are directly buying renewable power and not participating in the REC process.

RECs (Renewable Energy Certificates) are an incentive whereby electricity end-users to sell certificates to their UTILITY in order for the UTILITY to demonstrate to authorities that they have EITHER produced renewable electricity themselves, or they have paid someone else that is producing renewable electricity (wind or solar) so they can count that production for their own credit to their renewable energy requirements.



RECs continued

1 REC = a nominated amount of electricity, usually 1 MWh

They allow an end-user to claim that their power came from a renewable source

The EPA recommends that you buy RECs that are certified and verified in order to prove that the power actually was produced through a renewable resource (implication?)

Texas GLO State Power Program

- Operated by Cavallo Energy Texas, a subsidiary of Calpine
- Available to ISDs, Cities, Counties, State Agencies, Hospital Districts, Colleges and Universities, Taxing Entities
- Manage the switching, billing, remittance, processing reporting and other customer services on behalf of the Tx General Land Office

Texas Coalition for Affordable Power (TCAP)

- A non-profit political subdivision corporation that aggregates member power needs in order to negotiate better prices for their members
- One of the larger aggregators with over 150 members and purchasing 1.4 billion kWh annually
- The philosophy is that bigger must be better
- Customers must pay a one time membership fee
- Also have their traditional monthly electric bill with aggregation adders

Energy Auctions

- Also called reverse auctions
- Customer typically partners with a reverse auction firm and advertises a date for the auction
- Customer watch the results of the auction while competing bids are offered (incrementally decreasing) until such time that the customer accepts a particular result or time expires for the auction.

Reverse Auctions

- There are multitudes of opinions regarding energy auctions to be found on the internet (much of which is from competing auction firms) about the validity of some data offered through an auction.
- Smaller consumers may especially want to research the advantages and disadvantages that this type of procurement method may or may not offer them.

Behavior Modification

Texas Accredited Energy Manager (ATEM) Training Curriculum

THREE COMPLEMENTARY AVENUES LEAD TO ENERGY SAVINGS

1. Raising awareness among faculty, staff, and students
2. Managing building operations
3. Upgrading mechanical equipment and controls

THREE COMPLEMENTARY AVENUES LEAD TO ENERGY SAVINGS

The first two are behavior-based and can be implemented without capital investment. Behavior-based strategies offer a rewarding pathway for energy conservation.

These strategies are both accessible and relatively inexpensive to implement, and yet they are capable of yielding significant results.

Behavior Modification Program Benefits

- Reduce utility consumption
- Reduce utility cost
- Reduce green house gas production
- Changes culture of energy and water use both at school and at home

Characteristics of Effective BMod Programs Organizational Level

- Support from Executive Leadership
- Designated Energy Manager
- Building Level Program Leadership
- Staff and Student Engagement

Characteristics of Effective Programs Organizational Level

- Data and Feedback
- Progress Reports
- Program Communication
- Awards and Honors

Characteristics of Effective Programs Facility Level

- Determine who is on the team
- Gather Information
- Identify Priorities
- Energy Checkups and Patrols

Characteristics of Effective Programs Facility Level

- Clear Conservation Action Steps
- Competitions
- Prompts and Reminders
- Recognize and Reward

Large SE Texas ISD
Behavior Modification Program

- Pilot program at seven campuses in 2013, reduced consumption by 17% in the first year
- Expanded program to all 78 campuses, reduced consumption by 7% compared to baseline in the second year
- District brought the program in house under Energy Management in the third year and saved 2% across the District compared to baseline

Behavior Modification Program Resources

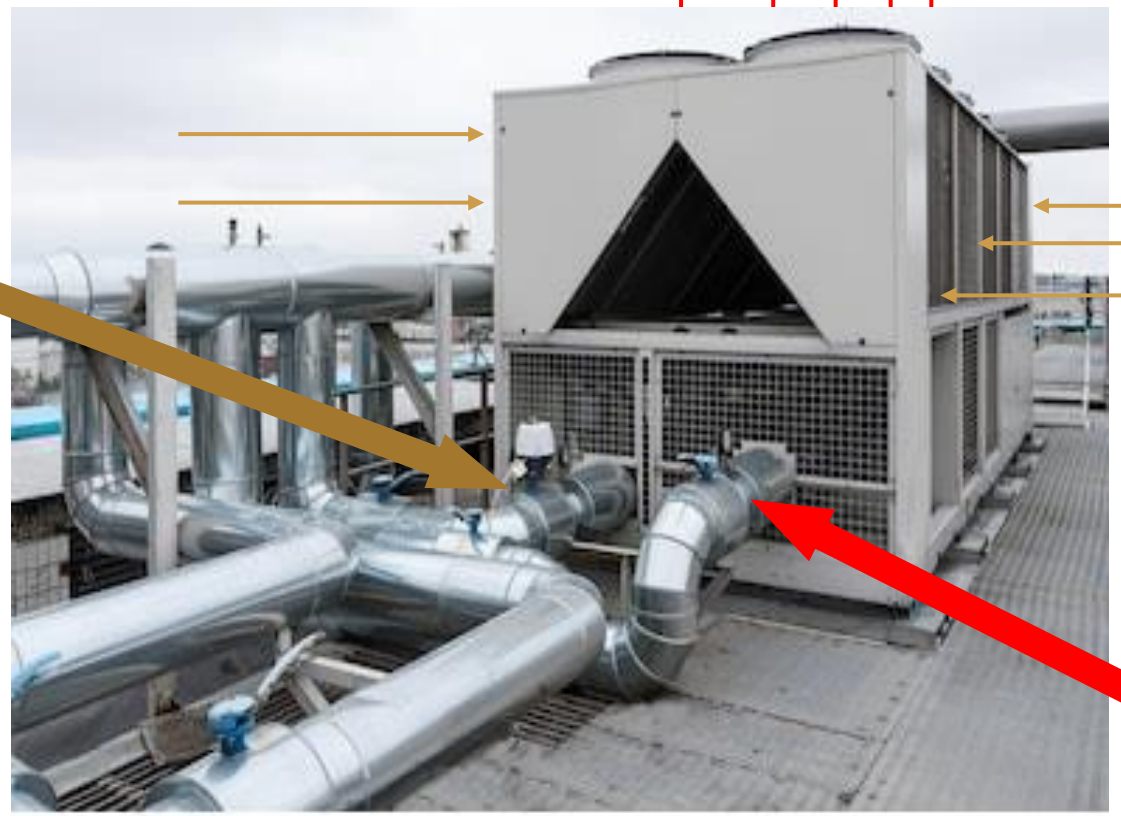
- Watt Watchers of Texas
- State Energy Conservation Office
- Texas School Districts
- Environmental Protection Agency

Behavior Modification Program

Questions

Fun with Chillers

Chillers -What do they do?



Chillers - Is one better than the others?

- Compressor
  - Types:
    - Scroll
    - Screw
    - Centrifugal
- Air cooled
- Water cooled

Cooling Tower

- Variable Pump VS Variable Fan
- Bypass

Chiller Chart

Air Cooled			
Scroll	15 - 200 Tons	10 - 10.4 EER	14 - 16 IPLV
Screw	150 - 500 Tons	10 - 11.6 EER	14 - 19.8 IPLV
Mag Centrifugal	60 - 440 Tons	10.1 EER	19 - 20.7 IPLV

Water Cooled			
Scroll	50 - 200 Tons	12.8 - 14 EER	19.9 - 25 IPLV
VSD Screw	12 - 300 Tons	.7 - .6KW/ton	.6 - .42 IPLV KW/ton
VSD Centrifugal	180 - 6000 Tons	.5 - .576 KW/ton	.29 - .5 IPLV KW/ton

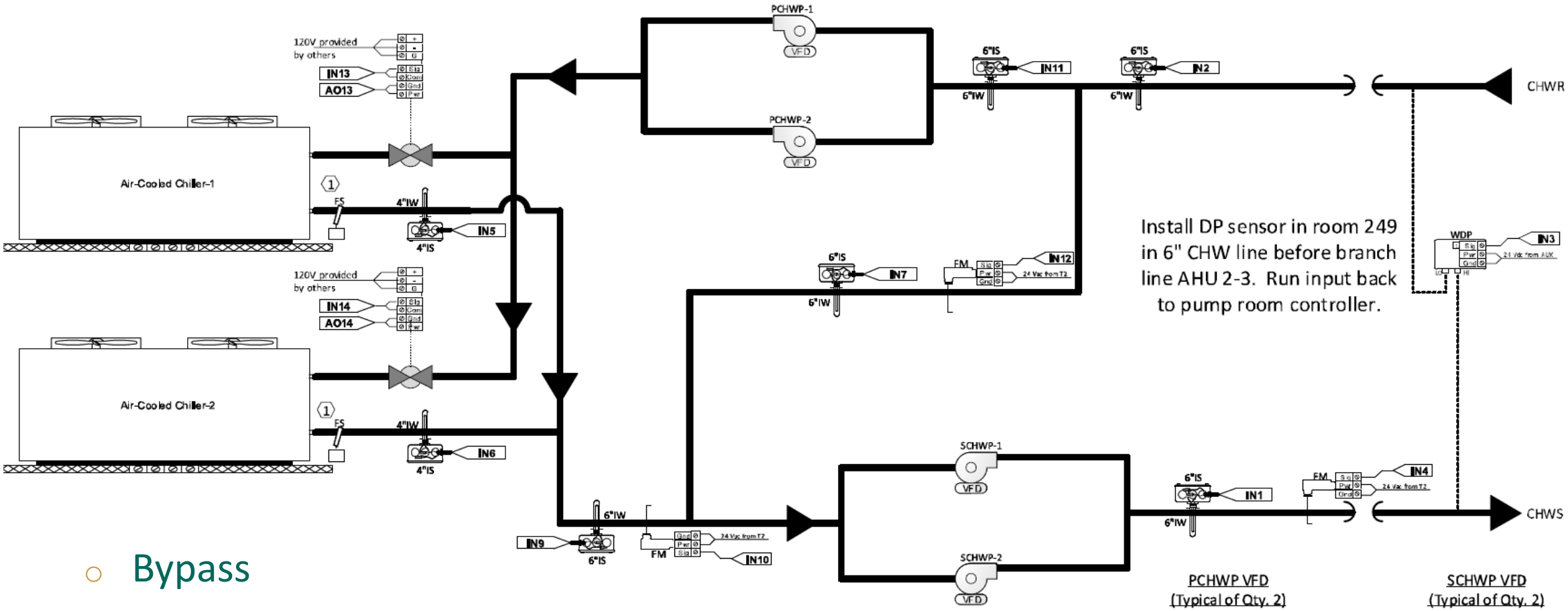
CHILLERS

- Chiller evolution
  - Variable speed
  - Mag bearing
  - Heat pump
  - Quieter
  - Can now handle different flows and temperatures

CHILLERS

- Minimal third party control
- Staging
  - Increment decrement
  - Pony chillers – is this always a good idea?

CHILLERS



- Bypass
- Valves
- Dedicated vs parallel pumps

Questions ?

WATER

HEADLINES

AUSTIN, TEXAS, COULD RUN OUT OF WATER AMID FLOODS

CNN

THE WATER CRISES AREN'T COMING - THEY'RE HERE.

Esquire

TWO-THIRDS OF THE WORLD FACES SEVERE WATER SHORTAGES

The New York Times

HEADLINES

ALL AROUND THE US, RISKS OF A WATER CRISIS ARE MUCH BIGGER THAN PEOPLE REALIZE

- BUSINESS INSIDER

BOONE PICKENS WANTS TO SELL YOU HIS WATER

- TEXAS MONTHLY

THE UNITED STATES USES LESS WATER TODAY THAN IT DID IN 1980

- BUSINESS INSIDER

USES FOR WATER

DOMESTIC

Drinking, Restrooms, Kitchens, Cleaning

HVAC SYSTEMS

IRRIGATION

Landscape, Athletic fields

SAVING METHODS

- Benchmark
- Use water saving appliances and plumbing fixtures
- Repair leaks and faulty equipment
- Monitor irrigation system with sensors, timing, and system maintenance


NATRAN
GREEN PEST CONTROL
TIPS ON WATER CONSERVATION
Use a water efficient flush toilet.
Find and repair leaks.
Take a quick shower.
Convert to water and energy saving faucets.
Avoid wasting running water as possible.
Use an energy efficient washing machine.
Water plants during the coolest part of day.
Clean driveways and sidewalks with a broom instead of hose.

RESOURCES

Texas Energy Managers Association

Texas Water Conservation Standards

https://comptroller.texas.gov/programs/seco/code/water.php

ENERGY AUDITS 101

APPROACHES

Couch Potato Approach

Covert Ops Approach

Friends and Family Approach

COUCH POTATO

- Review bills for errors
- Create operating procedures/guidelines
- Increase energy awareness

COVERT OPS APPROACH

- Reduce outdoor lighting hours of operation
- Reduce HVAC operating hours
- Utilize setback/unoccupied temperatures
- Use recommended chilled water temps
- Turn off lights in unoccupied spaces
- De-lamp vending machines
- Enable sleep mode on computers
- Use temperature set points

FRIENDS AND FAMILY APPROACH

- Enlist help of custodial & maintenance staff
- Share usage and cost data with principals
- Use only task lighting when possible
- Enable sleep mode on computers
- Turn off office equipment not in use
- Consolidate after school activities
- Reduce number of summer campuses
- Discourage use of personal appliances
- Have custodians turn off lights
- Implement Watt Watchers

WALK-THROUGHS

DOORS OPEN

OUTDOOR LIGHTS ON IN DAYTIME

DAYLIGHTING AVAILABLE & LIGHTS ON

LIGHTS ON & CLASSROOM UNOCCUPIED

THERMOSTAT NEAR HEAT EMITTING DEVICE

TEMPERATURE SETPOINT IMPROPER TOO HOT OR TOO COLD

COMPUTERS ON AFTER HOURS/ NOT PROGRAMMED FOR SLEEP MODE

VENDING MACHINES NOT DE-LAMPED

LIGHTS ON & UNOCCUPIED

STAGE LIGHTS ON & NO DRAMA ACTIVITIES

AHU FAN MOTOR BELT LOOSE

Questions?