

# Who's stealing from whom?



ALIGN BY DESIGN, PRECONFERENCE SESSION, RESNET 28 FEB 2019

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Speakers: Brendan Moore & Myron Katz *Myron (as Stan) & Brendan (as Ollie) perform a Laurel & Hardy skit.*

## Non-Verbal Staging

- 1) MYRON & BRENDAN STAND at the FRONT of the room. When AUDIENCE is seated and settling down, BRENDAN & MYRON LOOK at the audience and use the SHUSHING gesture (see slide) to get them to quiet down.
- 2) In UNISON, at a similar pace, they TURN & WALK towards the chairs on where their BOWLER HATS & JACKETS are located, at opposite ends.
- 3) They PUT ON their jackets & hats, now in character! (OLLIE'S BOWLER should be pushed back on his head a little; STAN'S is straight & level).
- 4) In UNISON, they WALK to the FRONT of the room (OLLIE is SMILING & kind of PRANCING or WADDLING (tbd); STAN is BENT FORWARD a little, SERIOUS & WORRIED as always).
- 1) At the FRONT of the room, they FACE the AUDIENCE, PAUSE for a beat , then TURN & FACE EACH OTHER.
- 2) OLLIE LIFTS his hat UP & DOWN on his head; Stan TIPS his hat to OLLIE.
- 3) They then LOCK ELBOWS & ROTATE in a CIRCLE coming back to their original positions.
- 4) They FACE the audience, OLLIE SMILING, STAN looking PERPLEXED & CONFUSED.

# Who's stealing from whom?



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*Ollie (looks at Stan): "Hey Stan, how ya doing?"*

*Stan: (looks up, perplexed, thinking about it; then, lips in straight line, scratches head characteristically, with raised, straight fingers in circle on his crown; then nods head up & down a bit, & looks at Ollie a little sadly)*

*"Oh, ya know (shrugs), Can't complain." "What about you, Ollie?"*

*Ollie: (considers it) "Hmmm..." (shrugs shoulders). "Pretty much the same."*

*Stan: (scratches head again, looking perplexed; stops scratching, looks up at Ollie)*

*"Ya know, Ollie, I was thinkin'..."*

*Ollie: (joking) "Ut oh." (then seriously) "OK, I'll bite"....."What up?"*

*Stan: (earnestly) "Well, ya know how Robin Hood steals from the rich and gives to the poor?"*

*Oliver: "Yeah, Stan."*

*Stan: "...And we all know that the rich get richer from stealing from the poor, right?"*

*Oliver: "I guess so, Stan."*

*Stan: "**Weeell....Why don't we just have the poor steal from the poor and eliminate the middle man!??**"*

*Ollie: (Considers it; a light bulb goes off; grabs his hat and slaps it against his hand). "By God, that's genius! Why didn't I think of that?"*

They LOOK at each other with RECOGNITION, then put their FINGERS to their MOUTHS in the SHUSSHING gesture.

*Stan & Ollie (together, to each other) "Shhhhhhhhhhh..." "Don't tell anyone."*

They FACE each other, TIP their hats to each other, LOCK ELBOWS & ROTATE positions., FACE the AUDIENCE.

They then give BIG SHRUGS as if to say – What was that about? (or, What can ya do about it?)

# Who's stealing from whom? ... and why it's not funny.



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Speaker: Myron Katz (as himself, serious & sincere, dropping Stan Laurel persona)

Hopefully this skit was funny but the message isn't funny at all.

We should **NOT** be encouraging the poor to steal from the poor, nor for **anyone** to steal from **anyone** for that matter.

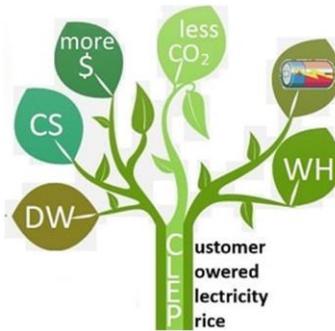
- But that's what's going on for electricity consumers **everyday!**
- They're shifting costs onto each other, and that's a lot like stealing!
- Who are the victims of these thefts? All ratepayers.
- But the **true** innocent victims are the poor...
- and **our Planet.**

We, the presenters of this Session, want you to know

- Just how big and pervasive this problem is,
- How to measure it,
- How to educate electricity customers and reward them for not doing it,
- AND, WHILE WE'RE AT IT
- How to provide many financial, reliability and environmental benefits for everyone.

# Align By Design: Customer Lowered Electricity Price (CLEP)

RESNET  
Pre-Conference  
500 Canal St.,  
Sheraton Hotel  
Sunday, February  
24<sup>th</sup>, 1-5 pm



Myron Katz, PhD  
Brendan Moore  
Thomas Milliner  
Richard Dupont  
Richard Troy  
Gary Klein  
Pres Kabacoff  
Mike Hopkins  
David Stets

ALIGN BY DESIGN, PRECONFERENCE SESSION, RESNET 28 FEB 2019

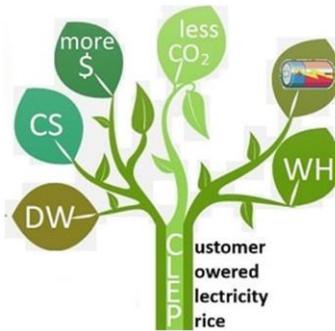
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Speaker: Brendan Moore  
Estimated Time: 8-10 min

- WELCOME to “Align by Design,” a workshop about the **innovative Rate Design** we call **CLEP – Customer Lowered Electricity Price!**
- I’m Brendan Moore, a faculty member at Tulane in applied computing systems, and an instructional designer at Ochsner Health System, I currently hold M.A. degrees in philosophy & IT management, and am current working on a combined M.S./PhD. in Engineering Management.
- We’re really excited to have some **VERY** knowledgeable **industry professionals** here to illustrate how CLEP works.
- Its inventor, Dr. Myron Katz, conceived CLEP to solve the problem of **shifting costs onto others** ----- How? By richly rewarding ratepayers who **OPT IN**
- Our 1<sup>st</sup> three talks describe how CLEP accomplishes this and why it’s **only now** possible.
- Our last 6 explain which appliances and technologies give us the most **bang for their buck**.
- The first few technologies have tiny first costs and are amazingly lucrative. For example, it hardly costs anything to program a Dishwasher to run at night!

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Speaker: Brendan Moore, Intro cont'd.

- Particularly exciting is how CLEP can help you create a **microgrid** in your home that drastically cuts costs & improves reliability – AT a profit to both the customer & the utility – and it lowers everyone's electricity price.
- Such a microgrid was proposed for the redevelopment plan of the abandoned, historic Charity Hospital in N.O.
- YOU'LL HEAR MORE ABOUT THAT LATER.
- When employed on a large SCALE, using the **current grid**, CLEP can dramatically slow down climate change --- WHILE also incentivizing clean energy.
- The great news is that CLEP can revolutionize utility economics and put the utility and the customer on the same side of the table for the first time!
- But, for this to occur, a utility company or regulator must first agree to launch CLEP as either a pilot program or an option for all customers.
- Dr. Katz first introduced CLEP to the New Orleans City Council utility committee in 2016, and has steadily educated them about its potential. Right now it's part of a rate case for which he has given testimony, and we have great hopes it will be adopted, if not in New Orleans, then in another, more forward-thinking city or state.

## CLEP measures Energy-Cost Shifts

Bill = kWh\*(cost-of-service + cost of energy)

Utilities must purchase kWh on demand

Cost-of-service = Average wholesale price

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Speaker: Brendan Moore, Intro cont'd.

Here's the short explanation of How CLEP works.

It provides a way to measure the cost-shifting burdens, then rewards ratepayers for avoiding both energy-cost shifts and demand-cost shifts.

To measure the energy-cost shift, keep in mind:

- 1) An electricity bill is calculated by multiplying "kWh purchased" by the sum of (cost-of-service + cost-of-energy).
- 2) Because electricity storage is still rare, customer purchases **always** affect cost-of-service and cost of energy
- 3) In fact, upon customer demand, utilities must either increase production or increase wholesale purchases.
- 4) The monthly, average wholesale price is what is called the cost-of energy.

## CLEP Measures Energy-Cost Shifts

Bill = kWh\*(cost-of-service + cost of energy)

Utilities must purchase kWh on demand

Cost-of service = Average wholesale price

If a wholesale *purchase* is *overpriced*, then  
cost-of-energy increases

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Speaker: Brendan Moore, Intro cont'd.

So how does CLEP measure Energy-Cost burden?

- How a customer shifts costs onto others depends on the **TIME** when the electricity is purchased.
- If that wholesale kWh purchase is overpriced, the average wholesale price of electricity increases.
- The key concept is that buying *too high* or selling *too low* will **always** increase the cost-of-energy and cause all bills to go up.
- Measuring demand-cost burden, or how High kW-demand at peak hours raises cost-of-service for all customers, is also a part of CLEP and will be explained in more detail later.

$$\text{CLEP} = \text{CLEP}_m + \sum \text{CLEP}_5$$



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Speaker: Brendan Moore, Intro cont'd.

CLEP's simple formula is  $\text{CLEP}_m + \sum \text{CLEP}_5$ .

CLEP5 is the Energy cost-shift, which was just explained, and pays every 5-minutes.

Much like the Net Energy Metering (NEM) tariff used by rooftop solar owners, CLEP is an **optional** electricity rate that will either pay a CLEP customer, or charge them if used incorrectly.

It doesn't *change* which rate governs your utility bill — It's an *additional* cashflow.

As explained in the next slide,

- CLEP<sub>m</sub> rewards customers for avoiding demand at peak times.
- CLEP<sub>5</sub> rewards customers for buying electricity when wholesale prices are low.
- Both CLEP<sub>5</sub> and CLEP<sub>m</sub> pay customers a full 95% of those values!!
- CLEP formulas have also been refined for Residential Customers, Commercial Customers and Community Solar farms.

CHANGE SLIDE

$$\text{CLEP} = \text{CLEP}_m + \sum \text{CLEP}_5$$



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Speaker: Brendan Moore, Intro cont'd.

- **CLEP<sub>m</sub>** is the monthly cashflow that provides a utility bill credit for delivering power, or a charge for demanding power, but it is only charged or paid during the utility's peak demand hours.
- The target **magnitude** of CLEP<sub>m</sub> is to generate a cashflow equal to the same average demand-charge that is levied on commercial customers, using \$s/KW-year as the unit.
- \$s/KW-year means twelve times the monthly charge per KW. For example, if the average demand charge is \$10/KW-month, this is equivalent to \$120/KW-year.
- By **PREDICATING** demand rewards on actions **ONLY** done during the utility's peak demand hours, these cashflows pay customers to avoid the utility's most expensive equipment upgrades, which are those for providing power during peak demand times.
- This reward is roughly twice as large as the cashflows from CLEP<sub>5</sub>.

CHANGE SLIDE

# CLEP is much more than a TOU Rate



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Speaker: Brendan Moore, Intro cont'd.

CLEP is much more than a time-of-use rate.

Time-of-use rates only measure purchases at most 3 times/day.  
They require much regulatory burden, and often give the wrong price signals.

CLEP is superior because its rates change dynamically 12 times an hour, track and match real-time wholesale prices, allow sales **to** as well as **from** the utility, and it charges for demand.

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[www.BuildingScienceInnovators.com/align-by-design.html](http://www.BuildingScienceInnovators.com/align-by-design.html)



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Speaker: Brendan Moore, Intro cont'd.

- Please Download the ALIGN BY DESIGN Set-up folder from the link on the screen ([www.BuildingScienceInnovators.com/align-by-design.html](http://www.BuildingScienceInnovators.com/align-by-design.html)), or get it from the jump-drive being passed around. It contains the workshop guidelines found on the table where you entered, as well as a host of useful documents, including a spreadsheet calculator.
- The link also accesses SPEAKER'S NOTES for every presentation. Look for the *EasyGenerator* link on that website page as well
- Access to the hotel's WIFI is found on the workshop printout. CODE: "slkuwrn23ds".
- *We did this so no one has to take notes during the presentation!*

CHANGE SLIDE

# Our Hands on Approach



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Speaker: Brendan Moore, Intro cont'd.

- There will be nine 10-minute talks with periodic Q & A sessions and 1 break. You can also send us questions later at the link.
- *Please experience our HANDS-ON Virtual application in the back of the room that allows you to simulate being a CLEP customer as well as compare your CLEP cashflow to non-CLEP customers, AND you may also add energy equipment from a short list of options.*
- You'll see how fast you can fully finance a \$10,000 whole-home battery.
- Can you do it in less than 7 years?
- And, you'll learn how to convert your energy bill into a profit, while lowering your neighbors' electricity price.

CHANGE SLIDE

# Our Hands on Approach



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Speaker: Brendan Moore, Intro cont'd.

- Today's workshop is being recorded. If you put your email on the sign-in sheet, we'll send you a link when we've posted the video.
- Lastly, we would very much appreciate hearing your thoughts on CLEP, and have provided a feedback page on the back table, which you can either leave with us or email to Myron.
- And now for our first presenter, Mr. Thomas Milliner, Esq, a New Orleans attorney who has represented the Alliance for Affordable Energy for several decades, advocating for progressive energy policy in Louisiana, and has worked with Dr. Myron Katz for several years on the development of CLEP. He will describe the problems associated with the one-size-fits-all model of rate design and how new developments in the energy world have made CLEP, a true market-based tariff (rate design), possible. The title of his talk is  
"How the New Utility Model Makes it Possible for Customers to Lower the Price of Electricity."

# Developments Make It Possible for Customers to Lower the Price of Electricity for Everyone

TOMMY MILLINER

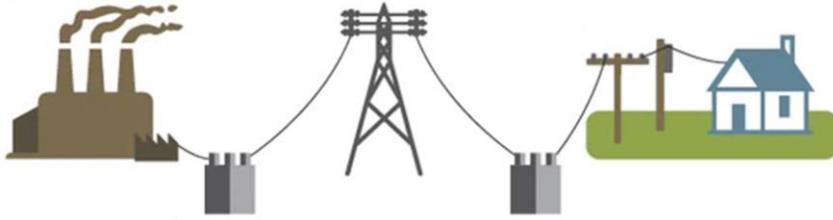
Revolutionary concept

Instead of relying on the utility or the regulators to somehow reduce the cost of electricity

It is now possible for customers to reduce the cost of electricity

Not just for themselves, but for everybody

## Old Central Power Plan Utility – Assumes Buildings Cannot Store or Provide Electricity



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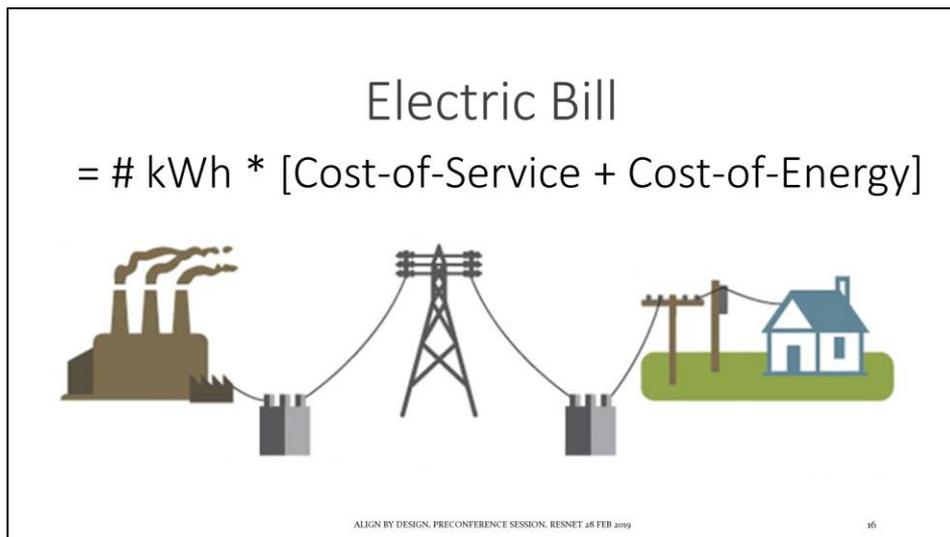
Let's look at the status quo first.

Creating electricity under 20th century technology required very high capital costs with a central power plant

which led to monopoly utility: Either government utility or private utility regulated by the govt.

to provide low priced, reliable electricity

Significantly, the Central Power Plant model assumes that individual buildings cannot provide or store electricity.



One size fits all Standard Electric Bill = # kWh \* [ Cost-of-Energy + Cost-of-Service ]

Cost of Service and CoS parameters are set every 3 years, maybe longer.

Now consumers get a Cost of Energy surcharge on their bill for energy purchased by the utility during the month, but this is an after-the-fact charge; the consumer does not know, or feel the monetary effect of purchases made at the specific time during the previous month. No price signal.

RATES UNDER OLD UTILITY MODEL  
DO NOT REFLECT THE ACTUAL  
COST OF ELECTRICITY PRODUCED  
AT THE TIME THAT THE  
ELECTRICITY IS USED BY THE  
CONSUMER.

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Rates reflect an average cost of electricity. Rates do not reflect that electricity costs vary greatly over the year and even over the course of a single day.

Because the consumer does not know, or feel the monetary effect of purchases made at the time the electricity is used, during the previous month,  
No incentive to reduce consumption during peak periods or change consumption to low periods, particularly nighttime.

**((If asked:** Cost of fuel, but for the difference between what got baked into rates as the predicted cost of fuel (which means variable cost of operation of all the power plants plus purchases) and actual cost of fuel, typically adjusted once or twice a year so that the mismatch between actual and predicted never gets too large, plus or minus.))

**((IF ASKED: Limited exception: Time of Use.**

Still only very limited average rates. A little bit better resolution, but still do not reflect economic reality.

TOU rates do not provide for sales to the utility.

**((IF ASKED: Limited exception: Net Metering))**

Putting energy back on grid, but has no relationship to the cost of creating electricity at the time that energy is being transferred from the consumer to the grid.

Effectively sold at retail price to the utility.

Now under attack by utilities who argue that net metered consumers are not paying their fair share of fixed costs. (not going into merits, just stating the argument).



Residents don't pay demand charges but peak demand is driven primarily in the south through air conditioning usage.

Even at peak periods, Mr. Customer is still charged at the average 10¢/kwh rate. This ignores that the actual costs borne by the utility is many multiples of that price. In effect, his consumption is being subsidized by other customers.

At the same peak time, his neighbor, Ms. Customer, is also being charged at the average rate, 10¢/kwh, when the actual cost is many multiples of that price. Her consumption is also being subsidized by other customers.

Because residential customers have no demand charges, they dump large **virtual demand charges** onto each other.

But demand charges are poor price signals.

Commercial rates include demand charges, but to little avail. The business' peak demand may not coincide with the utility peak demand. (Example: churches peak demand is on Sunday morning) No price signal given at the time energy is purchased. Little incentive to reduce rates at peak periods.

## Utility of the Future – Components

Distributed Energy Resources (DER)

Batteries and Thermal Storage

Smart Meters

Wholesale Marketplaces

Aggregation Services

Prosumers

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Changes in the energy industry that are leading to a new paradigm, call it the Utility of the Future

[List]

Let's examine these in detail.

Recent developments that will allow customers to lower the price of utility.

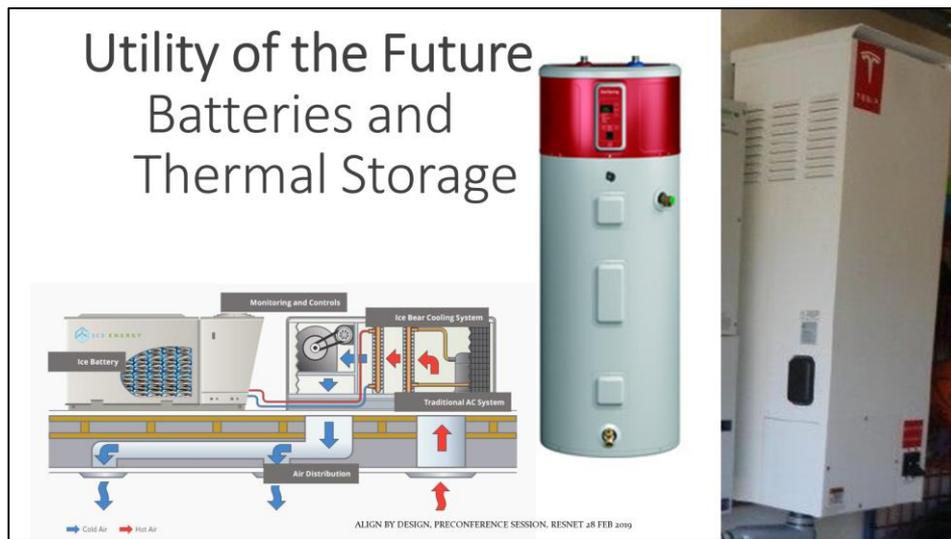


All Distributed Energy Resources encounter problems or are under compensated under the Old Utility One Size Fits All Model.

A HEAT PUMP water heater is 3 times as efficient as a standard electric. Energy Efficiency is a major resource, but implementation is always within a **zero-sum**, self-limiting situation because the payback is limited by previous investments and **cannot exceed the initial energy bill**.

Photo Voltaic solar comes in both Rooftop Solar and Community solar. Both have precarious cash flows because they tend to use Net Energy Metering which never pays back in \$. Under attack in many jurisdictions -- NEM's perceived subsidy , i.e., cost-shifting.

Wind Power is often sold at minus one cent / kWh because it often produces when there is little demand. It therefore depends upon the precarious Production Tax Credit which has a sunset provision that could kill the industry. Much cheaper than solar, but How to pay for it?



Batteries have a **resilience value** -- can provide power when the grid goes down -- particularly important in a hurricane prone city such as New Orleans.  
Batteries -- Still very expensive at present. Not encouraged under one size fits all utility bill.

Thermal energy storage (Ice-making AC equipment) is much cheaper than electric batteries but,  
(like batteries) very poorly financed by our rates which fail to exploit their ability to **reduce Peak demand.**

## Utility of the Future Smart Meters



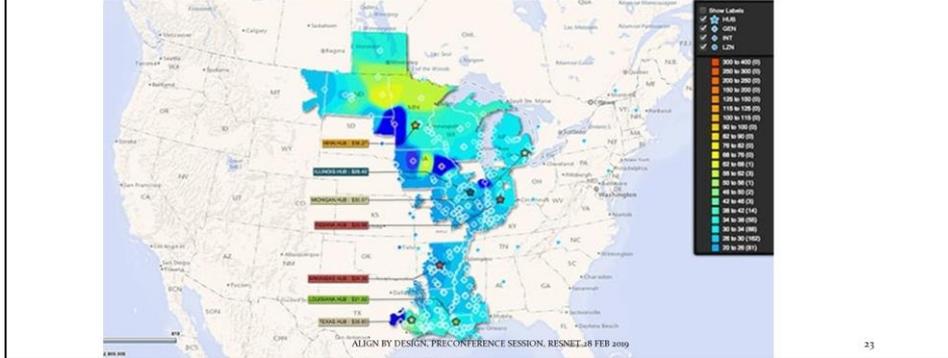
Roughly half of US customers have smart meters.  
Smart meters are coming to NOLA in a year or two.

Bidirectional - Allow for selling to the grid as well as purchasing from the utility  
And (unlike mechanical meters which turn backward) they record the **time of purchase and/or selling.**

2  
3

# Utility of the Future Wholesale Marketplaces

<https://api.misoenergy.org/MISORTWD/Impcontourmap.html>



Turning to Market developments – Wholesale Marketplaces

If I click on the

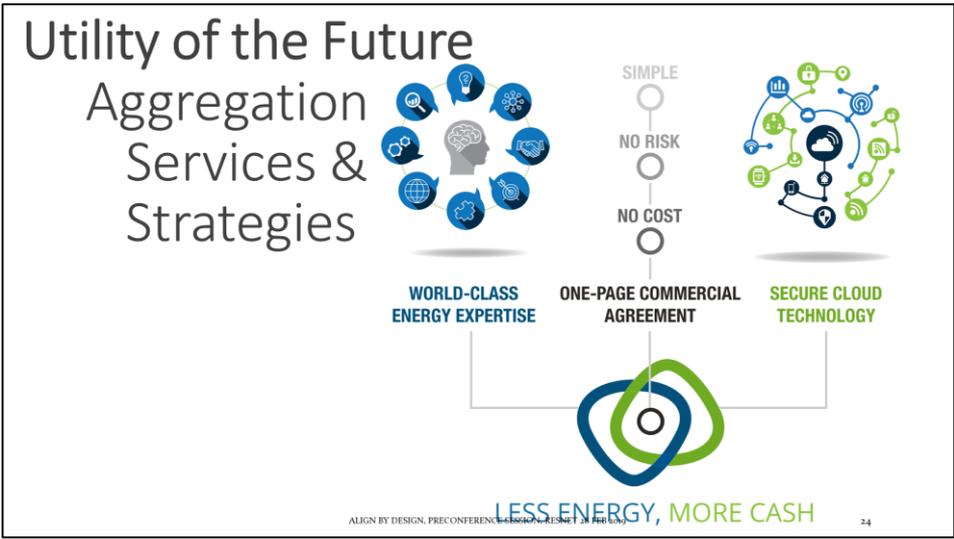
<https://api.misoenergy.org/MISORTWD/Impcontourmap.html>

link, we'll see the same map change colors rapidly but corresponding to every 5 minutes in the last 24 hours. They represent prices: BLUE is lower, RED is highest. The deepest blue in this picture, in this case in eastern South Dakota, correspond to nearly negative electricity prices because of large wind farms. Similar spots are found in east Texas and Iowa.

It's more fun to watch this video change dynamically and notice that on every day, the price drops to very low in the early am and more than doubles by mid to late afternoon.

But, under old school utility model “one size fits all” electric bills, there's no way a retail customer can take advantage of the price arbitrage from the great variation in prices.

We need a way in which customers can buy low & sell high every day

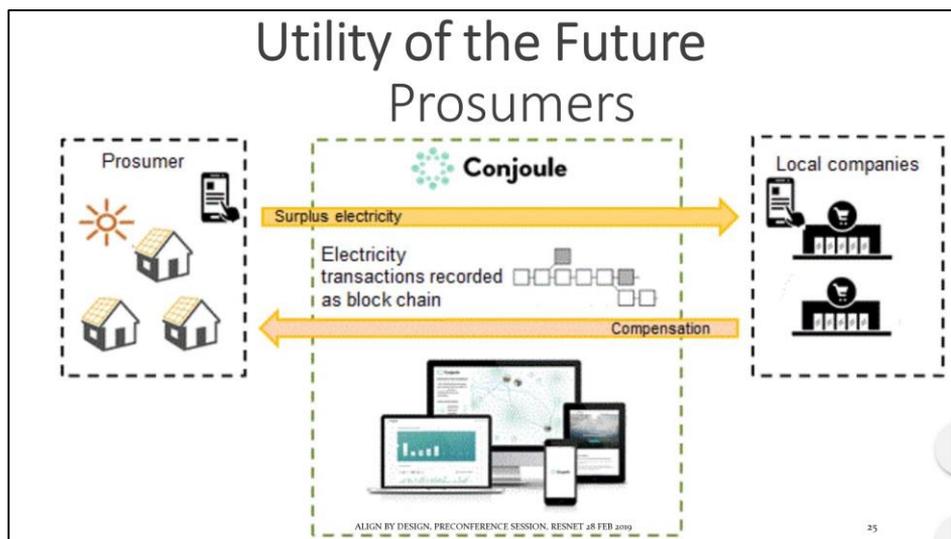


Another marketplace change is the emergence of aggregation services: This graphic comes from [www.Voltus.com](http://www.Voltus.com) which aggregates customers to choose an interruptible rate.

This is an example of EXPLOITING an existing rate within a rate structure which is good, but not very rich, because the economic opportunities are small, and the bank of customers exposed to such rates is small and does not apply at all to residential customers.

As you will see later CLEP a rate that can apply to all customers.

An aggregator who applies CLEP will be able to work with all residential customers and commercial customers and Unleash a great potential of making small changes that can add up to big savings over a large pool of customers.



Prosumers are people who produce as well as consume a product – here, the product is energy.

Individual household or business.

Under CLEP, which provides price signals at the time that electricity is either consumed, or produced, customers will be incentivized to produce, as well as consume, electricity.

Customers will find new ways (think software, hardware and aggregation service providers for now) to provide that value at increasingly lower costs to themselves and thereby make a profit for themselves and the companies who innovate or provide these technologies.

And – at the same time – lower the price for everyone else.

## How Can Customers Lower the Price of Electricity?

*Same question:* How Do We Stop  
Shifting of Costs onto Others?

*Answer:* to both questions: By  
paying customers at the same  
value as the avoided cost.

Were it possible to pay customers for providing this service almost precisely at ***the same value of the cost shift avoided*** and do this in a steady enough fashion to provide reliable and predictable annual cashflows, this should create a mass market sufficient to support businesses to jump in and finance the deepest investments in DER – all of which can be expected to happen at the normal speed of innovation, namely: quite rapidly and at no cost to ratepayers.

## How To Get To The Utility of the Future?



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So the fundamental problem with Old School Utility Model is the lack of price signals. Lack of price signals means that there is no incentive to purchase wind power at night and store it for sale to the grid at peak times.

Old School Utility Model has no adequate means of financing Rooftop Solar or Community Solar.

Old School Utility Model has no means of adequately financing batteries – batteries provide important public service during grid outages

Now, we think that CLEP solves the core problem with the Old School Utility Model by providing price signals to customers which will enable them to monetize and thereby minimize shifting energy and demand costs onto others. And this arbitrage of the variation in energy costs will provide predictable annual cashflows sufficient to support the deepest investments in DER.

# CLEPm Reward\$ to Arrest Demand Cost-Shifting

Myron Katz, PhD

[www.BuildingScienceInnovators.com](http://www.BuildingScienceInnovators.com)

Customer Lowered Electricity Price, [CLEP], is much more than a very dynamic *time-of-use* rate.

- Primarily because of CLEPm...
- No Slouch already, CLEP5 is a far richer cash flow than standard TOU rates.
- But, CLEPm usually pays more than twice as well as CLEP5 does annually.

Only charge for average,  
near-coincident demand,  
i.e., near our utility's peaks  
*say* May – September,  
weekdays, 2 to 7 PM

- However, the most expensive effect on a utility's construction and maintenance budget is about generating, transmitting and distributing power during the utility's annual peak demand.
- The most reliable and consistent measure of demand from a building that can affect the utility's peak is "average building demand during utility peak hours.
- A very good starting guess with extremely high confidence for the date and time of a utility's peak demand will occur is within the 5 months a year with closest to highest AC usage for most buildings, let's choose May through September and weekdays between 2 and 7 PM.

# Peak Utility Demand Times

= THE hours which will, with 99% probability, contain utility's peak.

Regulator sets PUDT to last year's hours that exhibit 80% of peak ...

To produce a *reasonably contiguous* set of at least 500 hours a year.

- PUDT means "Peak Utility Peak Demand Times"
- THE hours where the utility's annual peak demand times will occur.
- Reset annually by the Utility Regulator so that they are "reasonably" "contiguous" within a year and the Regulator is 99% certain that they will contain THE PEAK HOURS next year.
- chosen to include all hours that are within 80% of last year's annual peak.
- chosen to include at least 500 hours a year.
- initially for New Orleans at: 2PM - 7PM, weekdays, May through September.
- PUDT will be different for different utilities and will even change for New Orleans from year to year because of changing climate and decreases in the peak demand over time.

$d$  = average demand during the roughly 500 hours in PUDT.

At first, let's set PUDT as May – September, weekdays, 2 to 7PM

- There are about 550 of these hours in a year ...
- if we assume they all fall within the five months, May through September, weekdays, and between 2 and 7 PM.
- $d$  = average building demand during near utility peak hours, i.e., for this whole 5-month period.

AC-dominated, average demand is roughly = 1/2 building peak demand.

=>

$\$50 * d$  paid five times/y is roughly =  $\$120/\text{KW-y}$

- Because New Orleans has an AC-dominated peak demand,
- AC's are usually off about 1/2 of each hour they operate,
- a building's peak demand in 15 minutes is twice as large as it's average demand in any hour.
- E.G., a commercial building with a 10 KW AC.
- Will operate for 15 minutes in a row, every month in the winter.
- => it will pay  $\$100 / \text{month}$  for demand, every month.
- => annual demand charge for this business =  $12 * \$100 = \$1200$ . => the charge is  $\$120/\text{KW-y}$ .
- Because **d** is the AVERAGE demand which is 1/2 as high, this same business were a CLEP customer, it would pay  $\$50 * 5 = \$250$  each of five months =>  $\$1250/\text{KW year}$ .. The REAL CLEP bill will be  $\$1250$ .

$$\text{CLEPm} = \$50 * d$$

is *a far better* monthly  
business demand **charge** if  
only applied in  
May – September

The difference between 5 times CLEPm and the old way to measure demand, measures the **total annual burden of shifting demand costs** onto other customers.

Note that \$120/kW-y is negligibly different from 5 x \$50/2 per kW.

*Reference Demand* =  $d_R$  =  
demand a customer *should* have.

RESNET has a definition for homes.

I know of no way to calculate a  
*reference demand* for other  
customers.

- We are the RESNET conference.
- Decades ago the founders and technical teams of RESNET pondered how to **RATE** a home.
- Their genius idea was to define a custom, REFERENCE HOME for every home.
- CLEP uses RESNET's REFERENCE HOME to provide a REFERENCE DEMAND.
- CLEPm is designed to proportionally REWARD customers for demanding less power from his/her than the RESNET standard Reference demand during PUDT.

Because residences have a  
*reference* demand  $d_R > 0$ ,

set their demand **reward** at  
 $CLEP_m = \$50 * (d_R - d)$

- Because businesses operate in too much variety of conditions, there is no yardstick for “Reference Demand” For businesses set  $d_R = 0$ .
- However, the mere existence of RESNET, says that there is a “REFERENCE” home for every home.. Against which a home can be rated. Using the same home, we can ascertain a standard demand for that home.
- Alternatively, when thousands of smart meters are deployed in a community, there should be enough comparable homes to measure the standard demand instead of calculating that value.
- There is another reason to use comparable homes to set the standard demand:
- as more homes succeed in lowering their actual demand during peak hours, whether by shifting to other hours, by rooftop solar, or via energy efficiency, the updated reference demand will drop and thereby cause economic pressure on all CLEP customers to keep up in order to sustain their previous CLEP cash flow.

CLEPm's **charges** and **rewards**

*lower* bills if **d** is low enough, and

raise energy bills, if **d** is too high.

- If we assume that the reference demand for a particular residence is 5 KW, and that home experiences 4 KW of demand when **d** is measured, that meter reading will **lower** that customer's bill by  $5 \times \$50 * (5 - 4) = \$250/y$ .
- If the same customer were a business, the demand charge would **rise** by \$1000/y

Pay administrative costs and share savings with non-participants by setting  $q = 95\%$  and reset  $CLEP_m = q * CLEP_m$ .

$$\text{CLEP}_m = q * \$50 * (d_R - d)$$

Note that this definition works for businesses and residences.  
Just set  $d_R = 0$  for businesses and then we have a seamless transition between homes and businesses.

### CLEP for Community Solar

$CLEP = CLEP_m + \sum CLEP_5$  where

$$CLEP_m = q * \$50 * (0 - d)$$

Because Community Solar always produces a negative demand,  $d$  is always negative, and

$$CLEP_m = q * \$50 * (0 - d) > 0$$

Note that this definition works for businesses and residences.

Just set  $d_R = 0$  for businesses and then we have a seamless transition between homes and businesses.

$$\text{CLEP}_m = 95\% * \$50 * (d_R - d)$$

- Note that this definition works for businesses, residences and Community Solar.
- Just set  $d_R = 0$  for businesses and then we have a seamless transition between homes and businesses.

CLEP5 Reward\$ to Arrest  
Energy Cost-Shifting

Myron Katz, PhD

[www.BuildingScienceInnovators.com](http://www.BuildingScienceInnovators.com)

## CLEP5 measures Energy-Cost Shifts

Bill = kWh\*(cost-of-service + cost of energy)

Utilities must purchase kWh on demand.

*cost-of-energy* = average wholesale price

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- Provides a way to measure these burdens, CLEP rewards ratepayers accordingly for avoiding both **energy-cost shifts** and **demand-cost shifts**.
- We can measure **energy-cost shift**, if we keep these things in mind:
- An electric bill is calculated by multiplying "**kWh purchased**" by the sum of (**cost-of-service + cost-of-energy**), **Because storage is rare,**
- Customers purchases **always** affect the **cost-of-service** and the **cost of energy**
- **In fact, on Customer demand,**
- Utilities **must either** increase electricity production, or augment wholesale purchases, and
- The **monthly, average, wholesale price** is called the **cost-of energy**.

## CLEP5 measures Energy-Cost Shifts

Bill = kWh\*(cost-of-service + cost-of-energy)

Utilities must purchase kWh on demand

*cost-of-energy* = average wholesale price

If a wholesale *purchase* is *overpriced*, then  
*cost-of-energy* increases

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- This is how CLEP measures the **energy-cost burden** a customer shifts onto others – depending as it does, on the **TIME** of electricity purchases,
- If that **purchase** (in kWh) is **overpriced**, AVG wholesale electricity price increases;
- The **key concept** here is that **buying** energy **too high** or **selling** it **too low** will always **increase** the **cost-of-energy** and cause ratepayer **bills** to go up.
- Measuring the **demand-cost burden**, i.e., how **High demand** (in kW) at peak hour can **RAISE cost-of-service** for all customers is also a part of CLEP but that is not easily enough explained to fit in this introductory talk. That will be explained in more detail during later presentations... **Just hold onto your BOWLER hat.**

## Why CLEP5?

Time independent electricity pricing =>  
dumps demand at any time

Energy Efficiency helps... but is not the  
best solution

Net Zero Homes hardly helps.

Lowering CoE requires raising EE of  
electricity generation.

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- Without incentives or time-dependent metering, customers will “dump energy consumption onto the electricity grid” at any time.
- More EE homes will dump onto others less, but improved energy efficiency alone will not guarantee against either pushing energy or demand costs onto others.
- Lowering the CoE is mostly about raising the average efficiency of the electricity generation industry which uses (burns) primary energy? (think fossil fuels) to make electricity.
- A fast way to raise the average efficiency, i.e., lower the average fossil fuel burden of the generators in your wholesale market, is to increase the percent of renewable energy in the system.

## Why CLEP5?

Most easily done by increasing % of renewable energy.

*Primary-Energy Conservation by Renewable Energy* is its name.

Not happening fast enough.

Rooftop Solar monetized by Net Energy Metering does not lower CoE.

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- A fast way to raise the average efficiency, i.e., lower the average fossil fuel burden of the generators in your wholesale market, is to increase the percent of renewable energy in the system.
- I call this Primary Energy Conservation? by renewable energy? This is already REALLY happening, but not fast enough.
- But Rooftop Solar monetized by NEM does not lower the CoE
- But, the fastest and cheapest way to lower CoE for your utility is by fully exploiting the wholesale market: by day trading: by pushing all/most purchases to times of lowest wholesale prices.
- I call this Primary Energy Conservation? by timing? Show picture of Adobe home.

## Why CLEP5?

The fastest way is by *Day-Trading*:  
push all purchases to lowest times.  
That is what CLEP5 is all about.

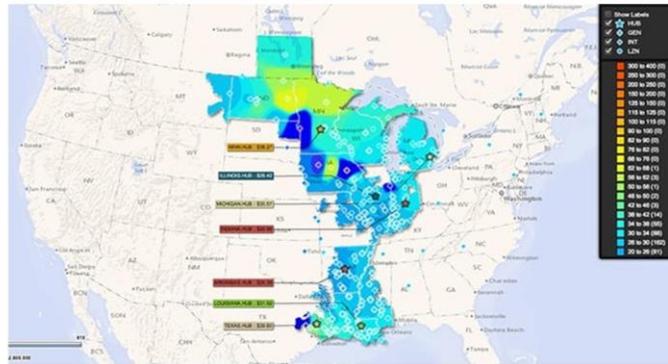
How often?

How about every 5 minutes?

- But, the fastest and cheapest way to lower CoE for your utility is by fully exploiting the wholesale market: by day trading: by pushing all/most purchases to times of lowest wholesale prices.
- I call this Primary Energy Conservation? by timing? Show picture of Adobe home.

# MISO our Wholesale Marketplace

<https://api.misoenergy.org/MISORTWD/Impcontourmap.html>



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- If I click on the <https://api.misoenergy.org/MISORTWD/Impcontourmap.html> link,
- we'll see the same map change colors rapidly but corresponding to every 5 minutes in the last 24 hours. They represent prices: BLUE is lower, RED is highest.
- The deepest blue in this picture, in this case in eastern South Dakota, correspond to nearly negative electricity prices.
- Probably because of large wind farms. Similar spots are found in east Texas and Iowa. It's more fun to watch this video change dynamically and notice that on every day, the price drops to very low in the early am and more than doubles by mid to late afternoon.
- We need a way in which customers can buy low & sell high every day

$CLEP5 = n * (CoE - w)$  is the right **reward**  
to avoid 5-min of Energy Cost-Shifting

CoE = monthly average wholesale price

w = instantaneous wholesale price  
during each 5-minute, MISO time interval

n = # of kWh consumed during that  
5-minute period

- Because CoE is a major part of all customers' bills, when CoE goes up so do all electricity bills and this happens proportionally: more when it is larger.
- When a customer buys electricity when it is higher than average she/he raises this burden in the form of a cost of energy increase for everyone.
- Conversely, if (s)he buys it when it cheaper than average, just the opposite happens.
- CLEP5 exactly measures the contribution to CoE from either action.
- To best extinguish energy cost-shifting we should pay CLEP customers almost all of CLEP5 and do this every five minutes.

## Maximizing $\Sigma$ CLEP5 during a month best lowers CoE

There are roughly  $12 * 24 * 30 =$   
 $\sim 8600$  five-minute periods/month

If you're a CLEP customer, increasing  
 $\Sigma$  CLEP5 pays you real money.

But how to do this?

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- This is easier to understand than to do.
- One way get anal, change you lifestyle, watch the MISO wholesale market place all the time and turn off and on most everything you use. NOT RECOMMENDED!
- Another way is to be satisfied with very easy effects, for example setting your programmable dishwasher to only operate at night. Will save you at least \$50/y.
- We will show you lots of ways: None will compromise your lifestyle. Each pay for themselves very quickly.. Quicker than many/most Energy Efficiency upgrades.
- To get the last drop of \$ from CLEP, you need an Aggregator.
- No CLEP aggregators exist now... but that's only because CLEP has never been adopted anywhere.



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**SURPRISE!**  
The best and cheapest way to both maximize  $\Sigma$ CELP5 and lower your carbon footprint is to deeply invest in thermal and electric storage.

- Because electricity made from renewable energy uses no fuel, it costs much less to make.
- Therefore: just minimizing  $\Sigma$  CLEP5 will automatically and perhaps optimally lower the carbon footprint of the average kWh consumed by your utility.
- Because Wind power is far cheaper than solar, Whole home batteries, electric cars and thermal storage are our best investments for both goals.
- Show video of MISO's Realtime 5-minute LMP contour map AGAIN?

To pay its administration costs and share the residual cashflow with other customers:

Redefine CLEP5 as follows:

$$\text{CLEP5} = 95\% * n * (\text{CoE} - w)$$

- Our best guess is that the utility's administration costs for CLEP should be quite small since most of this is already within the AMI, the automated metering infrastructure of Smart Meters.
- CLEP5 is impossible without Smart Meters or some other similar technology. Thus CLEP helps to finance Smart Meters.
- We "rekon" that this 5% discount from fully rewarding a CLEP customer for lowering CoE, allows a small %, say 2% to share with all customers and 3% to pay utility's costs to administer CLEP5.

## CLEP for Community Solar

redefines CLEP5, to  $CLEP5 = n * w$ ,

$$CLEP = CLEP_m + \sum CLEP5$$

- at the end of my Previous talk: CLEP<sub>m</sub> Rewards to Arrest Demand Cost-Shifting, that CLEP<sub>m</sub> is the same as always, but with the Reference Demand = 0.
- The **only real novelty** in CLEP for Community Solar is **redefining CLEP5**.
- CLEP applied to Community Solar is not like Net Energy Metering is applied to CS.
- There is no “stored for future, unused kWh’s”.
- The customer receives the benefit in net CASH or \$ discount on the bill.
- CLEP for Community Solar
  - improves the CLEP<sub>m</sub> for that home,
  - has no effect on the number kWh’s consumed at the home, and
  - is the paid the actual wholesale price for all energy put on the grid.

# CLEP's Impacts on your Entergy Bill

## A Summary of the Economics of 7 Key, CLEP-funded Retrofits

Rick Dupont

## Assumptions Perspective

- Team Input
- 5-Minute Increment Pricing (CLEP5)
- Time-Dependent Appliance Loads
- Dynamic Pricing

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### Slide 2 –A Contractor’s Perspective

Here you see a typical interaction between the contractor and the developer or designer. “You want What?” This was often times me resisting the desire or interest expressed by the client.

**Desire** – The contractor wants to build what he understands and to make a profit. Also, if he is a negotiating contractor, he wants a repeat client. What he does not desire is to mess up installing something he does not understand or know how to service.

**Education** – Most contractors employ estimators and PM’s who come out of CM schools or up thru the tradesman ranks. Due to shortages in labor, many are hiring folks with non-technical backgrounds to fill positions. This does not help you when you explain what you are trying to construct.

**Green Community** – Most contractors see this community as tree huggers who promise unrealistic performance and underestimate the cost impact to the project to implement the technology.

**Challenges** – Convincing the contractor and the client of the enhanced value these technologies will bring to the project thru consumer (buyer) perceived differentiation and that the benefits can be objectively measured thru a cost benefit financial analysis.

**Engagement** – If the contractor is not bought in, he/she may advise the client at every opportunity to chop out the costly “Green” components that do not add SF or rental/sales revenue.

Once bought in thru being educated and understanding the value, he may, like I did, work closely with folks like Myron, Pres and others to advance these sustainable concepts on the 3 levels Pres discussed: Energy Efficiency, Load Shifting, and Resiliency.

As Pres indicated, the primary area every designer, and contractor can get on

board with is energy efficiency, the 2nd is load shift, and the 3<sup>rd</sup> is resiliency.

## Model Home – Consumption

- 1500 SF
- Peak date – August 14, 2018
- Energy Consumed – 70 kWh
- Reference Home's Demand – 5.0 kW
- Pricing - \$0.11/kWh => \$7.70 peak day
- Cooling Energy – May-Sept, i.e., 3720 kWh/y
- Non-Cooling Energy – 9782 kWh/y
- Annual ENO Cost - \$1500/y

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## Trend Summary

Resnet Pre-Conference													
Trend Summary of Sample Home													
		Square Ft. 1,500											
		Base Ref *											
		A	B	C	D	E	F	G	H	I	J	K	M
		CLEP											
		CLEP											
		CLEP											
		CLEP											
		CLEP											
		CLEP											
		CLEP											
Line		Base	None	DW	HW	HHW	DX AC	Ice AC	Batt	E Car	Other	CLEP	CLEP
1	Kwhr - Peak Day		69.80	69.80	69.80	60.50		55.50	55.50	67.50			67.50
2	Base												
3	CLEP s												
4	CLEP m												
5	Demand												
6	Daily Total												
7	Avg Monthly Bill												
8	Avg Annual Bill												
9	(Annual Bill) - (Base Bill)												
10	Cost of Gas Saved												
11	Annual Total Expense/Income												
12	Avg Monthly Bill - Base												
13	Cost of Gas Saved per month												
14	Monthly increase (-) or income (+)												

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# Demonstration/Discussion of CLEP Simulation Software

Richard Troy, Science Tools

Myron Katz

## CLEP & the Future of Water Heating

Gary Klein, President

Gary Klein and Associates, Inc.

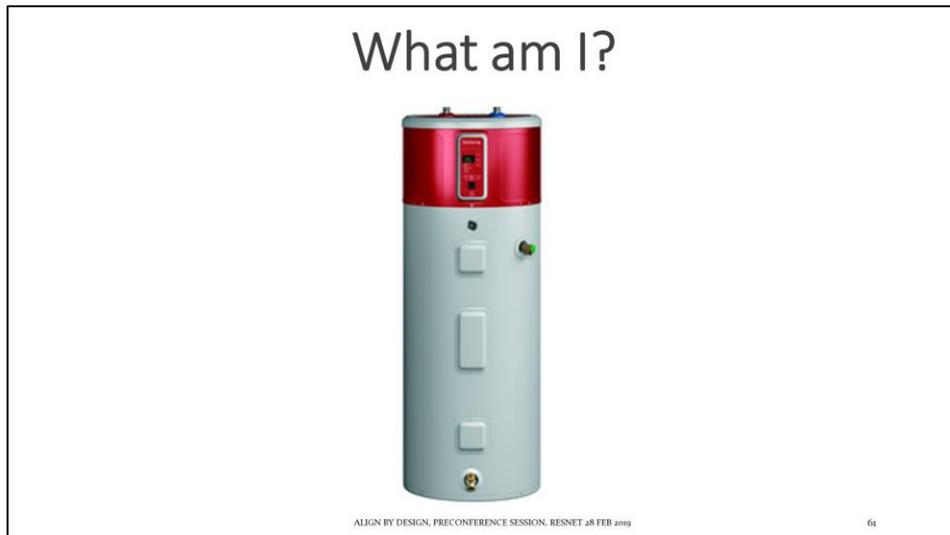
Rancho Cordova, Ca 95742

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916-549-7080

Gary Klein, President of Gary Klein & Associates, Inc. has been intimately involved in energy efficiency and renewable energy since 1974. One fifth of his career was spent in the Kingdom of Lesotho, the rest in the United States. Mr. Klein has a passion for hot water: getting into it, getting out of it and efficiently delivering it to meet customer's needs. After serving 19 years with the California Energy Commission, he has provided consulting on sustainability since 2008, with an emphasis on the water-energy-carbon connection. Mr. Klein received a BA from Cornell University in 1975 with an Independent Major in Technology and Society with an emphasis on energy conservation and renewable energy.

The International Association of Plumber and Mechanical Officials (IAPMO) recognized his efforts in 2014 presenting him their Green Professional of the Year award. In 2015 the Department of Energy awarded him the Jeffrey A. Johnson Award for Excellence in the Advancement of Building Energy Codes.



I want to engage people with the presentation.

Am expecting them to chime in and propose a few ideas, hopefully all that I have thought of, but there is a slide for anything else.

It takes energy to heat water, it must come from somewhere. You can reduce the amount that needs to be heated, but at some point you need Primary Energy to heat the water.

There are three types of electric water heaters: resistance storage, resistance tankless and heat pump storage. You need a storage water heater to take advantage of CLEP.

A heat pump water heater can use half to one fourth the energy of a traditional electric resistance storage water heater. Assuming the same sources of electricity, the carbon footprint reduction is proportional to the reduction in primary energy use.



Being a battery is something very much needed by the grid.

Even today with a relatively small amount of renewable energy in the system. Batteries become more important as the percentage of intermittent renewable sources increases. In fact, we should incent the addition of batteries at least as much as the addition of renewables.

Water heaters can be connected to the grid to absorb excess energy whenever it is available and thereby minimize the draw during periods of grid peakiness. They become a thermal battery. The ideal load from the perspective of the grid is flat and batteries can help get close to this ideal.

Most of the benefit accrues to the grid, so they should pay the same rates they do for other forms of grid management.

From the perspective of a customer utilizing CLEP, a storage water heater can use Primary Energy when electricity is inexpensive and store hot water for use whenever the customer wants it, including periods when electricity is expensive.

An electric resistance heater with a timer that allows heating only during off-peak hours would be useful for a CLEP customer. If you already have such a water heater, adding the timer is inexpensive and can lower your costs significantly, particularly if your normal use periods occur during periods of expensive electricity.

Being a battery is an ancillary benefit, both to the electricity utility and to the consumer. The value is high, but it is rarely included in the "cost benefit" calculations.

As a thermal battery it has two ways to potentially save you money and lower your carbon footprint: 1) buy electricity when it is cheaper than it will be when you shower, and 2) avoid adding to the utility's cost to provide all the energy and equipment needed to

meet peak power demands...

So here is a question for the audience: Which of these two do you think is more expensive and therefore SHOULD in some perfect world be compensated MORE for by an innovative rate design?

## Sometimes I am a De-humidifier



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Electric heat pump water heaters can remove moisture from the air they use to heat water.

New Orleans has a fair amount of humidity and also a need for cooler, drier air inside the home. A practically perfect match!

Select water heaters that can draw warm moist air into the heat pump and exhaust cooler, drier air into the home.

A duct is likely to be needed on at least one side of the heater.

Want to select quiet heaters or install them in places where the noise isn't objectionable. They are all getting quieter.

Being a dehumidifier is another ancillary benefit. This ancillary benefit, which comes along with a heat pump water heater, can be almost as big in NOLA than the primary purpose of the water heater in the summer because: in the summer we don't need hot water nearly as much, but we definitely need cooler and drier air.

## Anything Else?



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This slide is here in case the audience comes up with something not already in this slide deck.

Recommend adding participant ideas into the deck as we identify them.

Keep the Anything Else? slide just in case.

## Sometimes I am a Water Heater



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Being a water heater is in many ways a by-product of being a battery or a dehumidifier.

The heated water is there to provide the service of hot water, not so much the water itself.

People want 1) hot water now and 2) never run out in their shower.

The first part is about the distance or volume relationship between the water heater and the plumbing fixtures and appliances. The details for this are covered in another session.

The second part is about the capacity and heat rate of the water heater. If you have a very small tank (internal volume), you need a large, modulating source of heat. If you have a very large tank, you need a small fixed source of heat. The optimum is somewhere in the middle. If the heat rate meets the hot water portion of a shower, it is very close!

## Why Can't I be All of These?



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Why not?

Heat pump water heaters can help cool your home and allow you to purchase electricity whenever it is inexpensive while allowing you to use hot water when you want to. They also cost much less to operate, because they are more efficient.

However, the first costs are relatively expensive and few consumers choose to take advantage of the future benefit stream. If you were able to have a CLEP rate structure, the economics would be much more attractive.

Both the the consumer, who would be able to share in more parts of value to the utility and to the utility who would not need to so deeply subsidize their installation.

# The Charity Energy Proposal

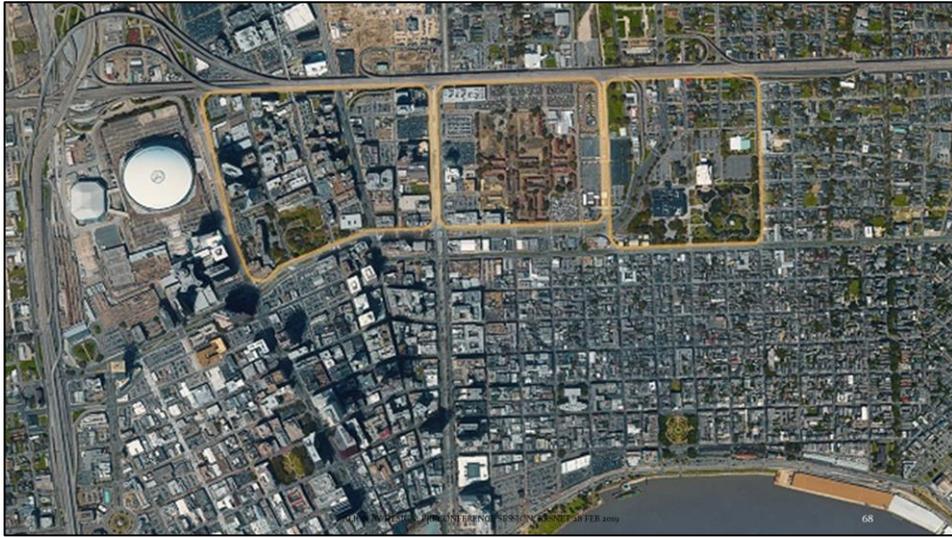
Pres Kabacoff

Executive Chairman of the Board

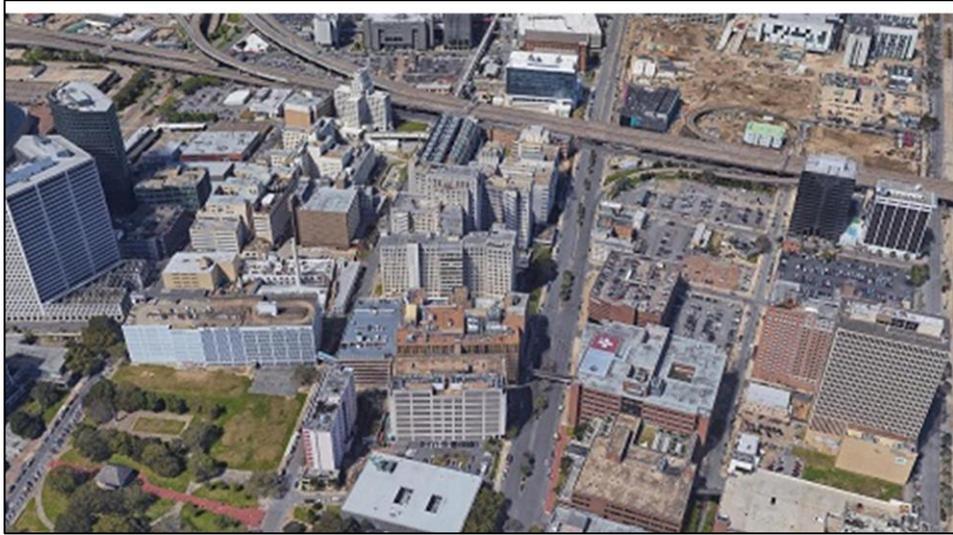
HRI Properties

HRI Properties (HRI) is a full service, vision/mission driven, national real estate company. Its vision is to “Elevate the Urban Experience” and the mission is to “Revitalize cities, by creating diverse, vibrant and sustainable communities.” HRI has completed 90 buildings in cities across America, \$3B of development with 2500 employees and revitalized seven neighborhoods in New Orleans where it is headquartered.

HRI responded to an RFP to redevelop the former Charity Hospital building and to help revitalize the neighboring community, much of which is blighted and abandoned. The overarching goal was to transform the center city positively impacting the social, cultural and economic health of New Orleans.



The vision was to catalyze a place where people want to work, live, play and visit and makes possible an Innovation District (ID) that has the potential to produce 17,000 new jobs with a \$9.5 billion financial impact. IDs arise in small geographic areas within cities where research universities, medical institutions and companies cluster and connect with start-ups, accelerators, and incubators. IDs represent a new geography of economic development, shifting away from previously isolated suburban research parks towards amenity-rich, hyper-connected areas in a city's core. It requires personal networks and trust built by connecting diverse and talented people in a small geographic area. IDs increase innovation, efficiency and productivity. ID's enable participating individuals and companies to become competitive, nationally and globally.



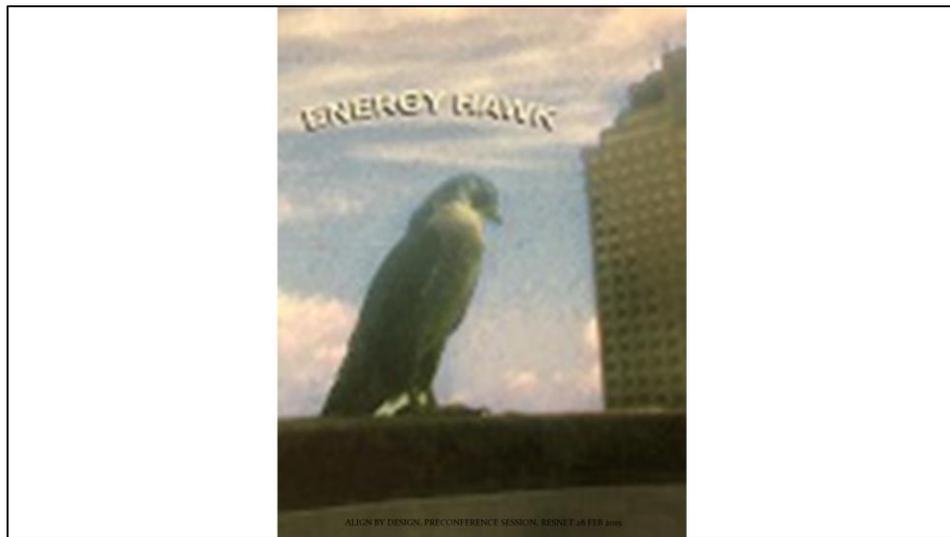
What makes an ID possible in Spirit of Charity District is the co-location of two major medical teaching universities, LSU and Tulane and world class hospitals, UMC and VA all adjacent to a robust city center. The current blighted area occupied by Charity deprives the city of a place in which to locate an ID. An ID requires in our judgment revitalizing Charity, tearing down the old, abandoned VA and replacing with a park, and creating a destination retail center that creates the kind of place where a people want to live, work, play and visit, as well as to connect, communicate and interact.





Progressive energy policy has long been a civic interest of mine. In response to the City of New Orleans' 2005 biblical event, Katrina, my wife, a healer put together a salon of eclectic thinkers in the arts, sciences, education, and other disciplines to look for solutions to address issues confronting our City where almost every neighborhood and some 200,000 houses had been under water. One of the salon members, a nuclear physicist, introduced to the Salon the subject, now referred to as climate change or global warming caused by ever increasing carbon into the atmosphere. I read everything I could find on the subject. New Orleans has more to fear than almost any city in the world the consequences of rising sea levels. The city is the canary in the coal mine: below sea level, subsiding at almost the same rate sea levels are rising and is losing to the Gulf of Mexico its hurricane protection marshland at a rate of a football field an hour.

The Salon encouraged me to present to our City Council progressive energy policy proposals. At the hearing in 2007, the Council asked me to chair a broad-based Energy Policy Task force. One of its members Dr Myron Katz who will present to you today I enlisted to lead the progressive energy team for the recent Charity proposal. The Task Force met for six months and submitted its report to the City Council entitling it the "Energy Hawk".



During one of the Task Force meetings at HRI's office on the 20th floor, a peregrine falcon, the fastest flying bird in the world, alighted on a parapet wall visible to all from the conference room window. It watched our deliberations with what appeared to be great interest for over a quarter of an hour and before flying away we photographed it. Unfortunately, most of the Task Force proposals were thwarted by the influence City's monopoly utility company and the Council's own advisors. Change comes slowly and like America's withdrawal from the Paris Accord we can go backwards.

At HRI Properties, we have utilized the best of the building practices relating to design, insulation, A/C and lighting systems, etc. However, Dr Katz convinced me if we really want to be progressive and impactful in our Spirit of Charity RFP response we need to propose more than just building efficiencies and add a focus on a model that shifts energy demand from peak times a day to non-peak times (ie, the middle of the night) and to have the Spirit of Charity District become a micro-grid. With this model, the consumer will have direct access to the market for electricity for consumption and generation. You will hear from expert presenters today what it takes to get this done. Mike Hopkins, formally the CEO of Ice Energy will describe the advantages of nighttime ice making equipment which eliminates the high cost of operating traditional condensing units during peak times during the day. You will also hear about resiliency, via micro-grids and battery storage. Batteries, like a generator can provide back up when the grid is down but also an opportunity to create a source revenue obtained by selling power in excess of what is needed to the electrical grid at peak times when utility companies are paying the highest wholesale prices. This revenue stream according to Johnson Controls can be utilized to fund the ice machines, batteries, etc.

This overcomes the challenge I always face as a developer of financing progressive energy saving technologies. Traditional lenders will not finance progressive energy features and equipment despite the claim the debt will be amortized by reducing or eliminating the energy cost line item. So, to make a load shifting/time of day proposal financeable, our City Council, the utility Regulator, must approve in an upcoming Rate

Case, what you will hear about today from a panel of experts a “Customer Lower Electrical Pricing” (CLEP) model. Many of today’s presenters were also members of our Energy team in the Spirit of Charity RFP. That team included, among others Mike Hopkins then with Ice Energy, electrical and mechanical contractors, building consultants scientists and financiers (Johnson Control) They convinced me if the City Council in its Rate Case approves the CLEP model it will allow the Spirit of Charity Micro-grid essentially to buy power at 1 cent KWh instead of 5 cents in the middle of the night from wind farms in Iowa. Success at the Council fuels the entire endeavor.

## Proforma Energy Analysis of Charity Proposal

*Business as Usual:* it will have to pay \$1,000,000 per year to ENO

*\$Premium investments* to improve "energy-efficiency" lowers that bill to roughly \$400,000 / year.

*Microgrid empowering investments* to quite fully exploit CLEP's cashflows provide excellent reliability and changes the real cashflow to roughly **negative** \$600,000 / year.

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Our team has a proforma cost analysis for the projected energy bill of the 1,000,000 sq ft, revitalized, Charity Hospital building in three ways:

i. ***Business as Usual:*** it will have to pay \$1,000,000 per year to ENO.

But, in the case of a CLEP PILOT only applied to Charity or CLEP generally available to all ENO customers:

ii. ***\$Premium investments*** to improve "energy-efficiency" lowers that bill to roughly \$400,000 / year. With

- self-shading, super-insulated and very tight windows,
- heat pump water heaters,
- outstanding insulation in walls
- deep dehumidifying, zone-controlled, high-efficiency AC, etc,

iii. ***Microgrid empowering investments*** to quite fully exploit CLEP's cashflows provide excellent reliability and changes the real cashflow to roughly **negative** \$600,000 / year.

iv. The micro grid includes remote controlled consumption/production of

- Heat pump water heaters,
- Ice Making AC,
- 10 MWH battery,
- 100 car Electric Vehicle parking, charging and discharging structure.

Distilling this to plain terms at the scale of a single-family residence: our goal is to reduce the average residential bill of \$1,000/year to a negative cost of \$600/year, i.e., actual income, with the added benefit of exceptionally reliable power during ENO's power interruptions.

## The CLIMATE HEALING aspects of HRI's Charity Hospital redevelopment plans

Employ CLEP which automatically lowers the carbon footprint of both the building it serves and for the whole community

because CLEP pays us to buy the cheapest electricity in MISO

cheapest electricity is often provided by Wind Energy at night

The price is low because the market demand is low at that time

By increasing our demand at that time two great things will happen

1: the owners of those farms will make more \$

2: then they will build more wind farms even faster

Sustainability driven by market forces! What's better than that?

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**Whenever a utility customer properly employs CLEP, i.e., to lower his bill or indeed to make this bill more into a greater payment from the Utility to the customer, this action will automatically lower the carbon footprint of both the building it serves and for the whole community. This happens mainly because CLEP pays us to buy the cheapest electricity in MISO and the cheapest electricity in MISO's wholesale market place is often provided by Wind Energy at night. Remember that dynamic display of rapidly changing wholes prices displayed an hour ago, when Tommy Milliner, our 2nd presenter spoke? Do you remember the deep blue regions that kept popping up in the very early morning hours. That was probably caused by Wind Farms in Iowa... who often sell their electricity a MINUS one cent / Kilo Watt Hour. This clean energy is almost always there in abundance at night. The price is low because the market demand is low at that time. By increasing our demand at that time two great things will happen: the owners of those farms will make more \$ and then they will build more wind farms even faster. Now that's sustainability driven by market forces! What's better than that? Charity would have moved at least 12 MWH a day through those wind farms.**

**Hopefully, the powers that be at RESNET will be similarly persuaded and its endorsement will help the New Orleans City to approve the CLEP/Microgrid model in the Rate Case. This approach enables renewables at larger and faster levels, energy storage and moves us from fossil fuels and the old central plant model.**

# Questions?

# Mike Hopkins Video

Please watch this video.

<https://www.dropbox.com/sh/v2h6n2x4lo8pv0n/AAB5w7dWFRtJ0YTm9kaJ7riBa?dl=0>

# CLEP's Impact on Construction

RICK DUPONT, P.E.

## **Slide 1 – Introduction**

Background of 40 years of design and construction experience

From the beginning – Interest in energy efficiency and performance

Was integral in the Charity Hospital proposal by HRI as I had done several budget runs on converting the Hospital and worked with my previous employer to help them create both the \$200 million dollar conversion budget and the \$40 million dollar sustainable budget Pres talked about. We worked closely with Mike Hopkins and JP Hymel and Dan Swope of Johnson Controls and in that collaboration we all felt secure that if the City of NO implemented CLEP then these technologies could be financed and incorporated into this new community concept.

## Contractors Perspective

- Desire
- Education
- Green Community
- Challenges
- Engagement



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YOU WANT WHAT?

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### Slide 2 –A Contractor’s Perspective

Here you see a typical interaction between the contractor and the developer or designer. “You want What?” This was often times me resisting the desire or interest expressed by the client.

**Desire** – The contractor wants to build what he understands and to make a profit. Also, if he is a negotiating contractor, he wants a repeat client. What he does not desire is to mess up installing something he does not understand or know how to service.

**Education** – Most contractors employ estimators and PM’s who come out of CM schools or up thru the tradesman ranks. Due to shortages in labor, many are hiring folks with non-technical backgrounds to fill positions. This does not help you when you explain what you are trying to construct.

**Green Community** – Most contractors see this community as tree huggers who promise unrealistic performance and underestimate the cost impact to the project to implement the technology.

**Challenges** – Convincing the contractor and the client of the enhanced value these technologies will bring to the project thru consumer (buyer) perceived differentiation and that the benefits can be objectively measured thru a cost benefit financial analysis.

**Engagement** – If the contractor is not bought in, he/she may advise the client at every opportunity to chop out the costly “Green” components that do not add SF or rental/sales revenue.

Once bought in thru being educated and understanding the value, he may, like I did, work closely with folks like Myron, Pres and others to advance these sustainable concepts on the 3 levels Pres discussed: Energy Efficiency, Load Shifting, and Resiliency.

As Pres indicated, the primary area every designer, and contractor can get on

board with is energy efficiency, the 2nd is load shift, and the 3<sup>rd</sup> is resiliency.



### Slide 3 – This is a team sport – Let me introduce you to the Players

#### **Consumers (catcher) – Affordable Technology that makes life easier**

Consumers drive demand. They want everything faster, better, easier, to control their environment, and at the least cost. Many will buy technology that puts them in debt to have the gratification of the newest thing or have more control. This is who the developer is trying to gauge and it changes from generation to generation.

#### **Contractors – (batter) Technology Laggards –**

This group wants a home run. They generally want to build what he/she knows how to build. There is an old saying, be a settler, not a pioneer. Pioneers have a short lifespan. Construction is fraught with so many opportunities for financial loss that most GC's will resist new ideas and may price the ideas unreasonably high out of fear of uncertainty. If you win over the contractor (who will ultimately be responsible for the successful implementation of your concept), you can generally get the developer and lender on board. I suggest you view this as an opportunity to vet your idea rather than as an obstacle to success. This resistance often times produces a better result in the end in both quality and budget.

**AHJ – Umpire – Technology Neutral**, He/she verifies everyone playing by the rules. Code compliance and enforcement.

#### **Developers – (first base coach) Technology Neutral, Budget Driven.**

He wants his contractor to cover all the bases. Most developers are profit motivated. Their interest is in developing a project that meets the pro-forma goals with as little downside risk and as much up side potential as possible. They generally want as many technology items as possible in the budget that will attract the consumer, not cause a backside maintenance cost

escalation, and meet the expected performance goals of the consumer.

### **Architect and Designers – (Pitcher and his base men) – Technology Leaders**

This group obviously includes the architects, engineers, and specialty experts. But there are a whole new class of designers offering input today: The Resnet folks, energy raters, Solar and Battery design build subcontractors, etc. They are the visionaries of what is possible. Their biggest challenge is listening. Listening to the owner's budget, and the contractor's estimate of cost to implement. Also listening for underlying resistance by the owner or contractor that may be founded in ignorance of new developments or recent cost reductions in the field.

### **Lenders – 3<sup>rd</sup> Base Umpire - Financeable –**

They will generally look to the developer to gauge the risk and obtain the necessary guarantees or risk reducers to ensure the lender's capital is preserved.

**Future Buyer - Watching your team produce –** Every developer evaluates his/her exit strategy. Keep as a legacy project or flip in 5 years, 7 years, etc. Will this technology enhance that potential for success? Will this technology hinder the projects economic stabilization period.

## The Hurdles

- Financeable
- Cost
- Revenue
- Return
- Payback Period
- Life Expectancy
- Design/Systems

Which one is your client?



### Slide 4 – The Hurdles – Which runner is your client?

**Financeable** – Will someone loan the developer the money to incorporate these technology enhancements?

**Cost** – Are costs stabilized and known or is this a bleeding edge technology?

**Revenue** – What is the source of revenue? Included in the rent? Will the developer have to compete at a disadvantage on rent rates, is it part of a utility bill? How do we bill it, and how do we ensure a continuous stream of cashflow?

**Payback Period** – Preferably 5 to 7 years.

**Return** – Will the projected revenue pay a healthy return on investment?

**Life Expectancy** – Will this technology last well past the payback period so that a buyer will buy the recurring revenue stream?

**Design/Systems** – Without overcoming these hurdles, you won't get to the point of incorporating your technologies.

# Transforming Energy

- CLEP
- Empowered Consumer
- Peak Demand Load Shift
- Scale up production
- Government Policies




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## Slide 5 – Transforming Energy

**CLEP** – May have as much impact on Consumer use of electricity and the grid as the iPhone had on how people communicate.

This rate structure meets all of the needs to be able to demonstrate a predictable revenue stream and to provide a means of charging and collecting those revenues through existing infrastructure (the utility) without undue burden to the developer, the utility, or the consumer.

As Pres indicated, and Mike Hopkins confirmed. With CLEP we had confidence from Johnson Controls that they could obtain financing to install Solar, Ice Cooling Systems, Batteries, and high-speed Broadband. Energy efficiency designs are generally not needing additional financing because the code drives most of those requirements. Mike advised that most of the ice cooling ac systems being installed in CA are being subsidized by the utilities to shave peak demand load to avoid building additional power plants.

### **Empowered Consumer**

Providing the consumer with a tool to buy and sell power at the MISO rate and to purchase power from anywhere on the national grid. This empowerment will connect the producers more directly with the consumer.

### **Peak Demand Load Shift –**

Benefit 1 – Savings thru energy arbitrage. Buying a low price at night, and consuming less power when energy prices are high.

Benefit 2 – This demand shift is rewarded by CLEP in the financing model for shifting power demand. For this reason, the computer will monitor the cooling capacity of the ice storage, and determine the optimal period to start ice cooling so that it can maximize the reduction of power consumption from the grid.

### **Scale production of devices –**

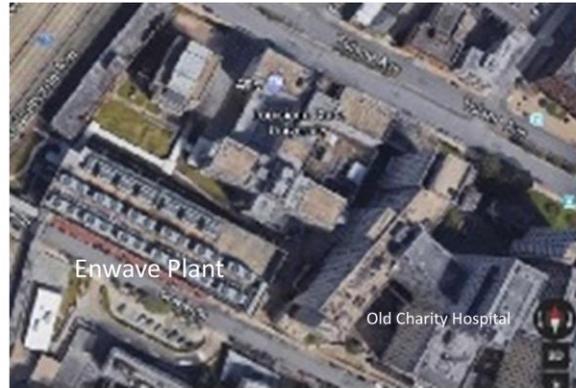
Devices and systems are now commercially available that are

difficult to finance for the consumer. CLEP will change the economics.

### **Government Policies**

Government tax credits, and other grants have accelerated these industries significantly in the last decade. These won't be around forever and if real cost can be processed at a granular level then the consumer will drive energy reductions.

## Enwave – (Entergy Thermal)

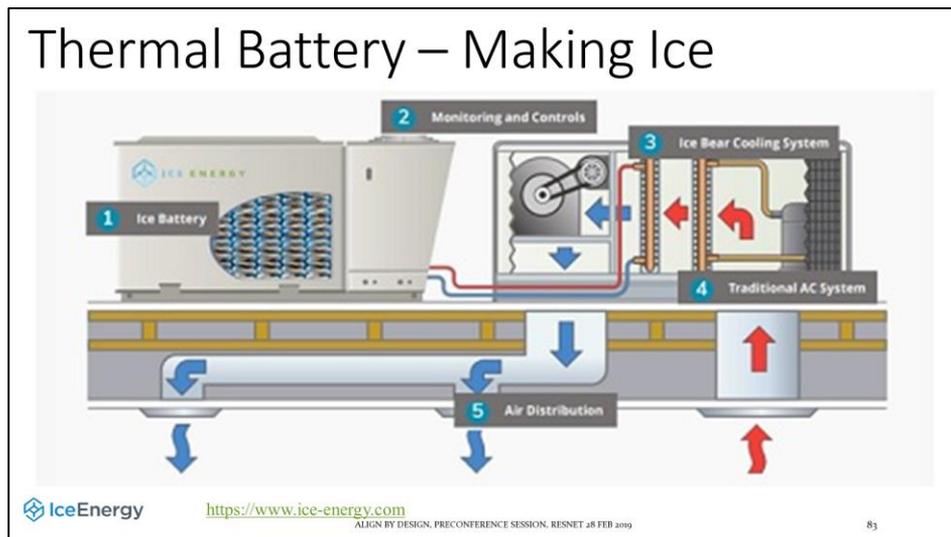


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### **Slide 6 – Thermal Load Shift with cold Water**

Enwave , originally the Entergy Thermal Energy Plant – located right next to Charity Hospital was constructed by my previous employer to create super cooled water at night with a chilled water plant and provide daytime chilled water to the central plants of the medical corridor. This was done in anticipation that the city was going to allow the utility to purchase power based on the wholesale price at night. The city did not implement that policy which set progress backward. That did not happen and it forced Entergy to buy the power at regular pricing. Later, Entergy was successful in getting the city to allow Entergy to become part of MISO which allowed for the off-peak power rates. This is a classic example of government attempting to create a certain outcome thru regulation and industry finding a way to accomplish what makes ultimate better economic sense in spite of original linear thinking.



### Slide 7 Thermal Battery - Making Ice

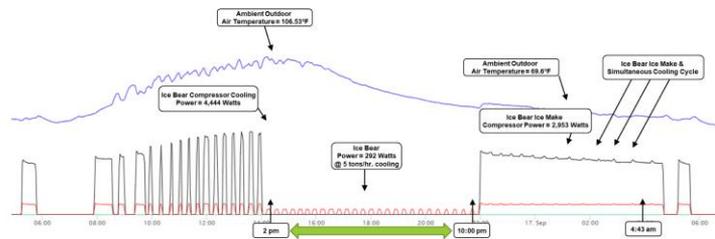
It takes considerably more energy to change the state of water to ice. This means that ice can store a great deal more energy than cold water. However, for technology to be economical, there needs to be a way that the final cost of cooling water down to ice, and then thawing out daily is less to the consumer of the energy than conventional refrigerant systems that run their compressors during the heat of the day.

It can be argued that it will take more total energy to cool this way. However, with CLEP, the consumer will pay less for the consumption of more power, and it will benefit in-grid fellow consumers whether or not they have the same system, and it will provide a demand for off peak power that would otherwise go to waste. Though the individual consumer may consume more power locally, the impact on the grid will be to reduce overall power peak demands and thus energy demand by leveling out production with demand.

If you look up Ice Energy you can find a short 3 min video explaining their concept. <https://www.ice-energy.com>

# Actual Ice Bear in 24 Hr Cycle

## Colton California – 9/16/2018



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### Slide 8 – the 24 hour profile

You can not see the detail on this page, but you can see the pattern. We will provide the slide deck for you after the conference. Please note that the early part of the day the AC is cooling using the outdoor condensing coil. Then during peak load time the Ice Battery kicks in and the only energy consumed is a small circulating pump. Later, once the battery is exhausted, the AC condensing coil kicks in until night time. At night the refrigeration cycle starts, and the condensing unit does not shut off until complete. This reduces on/off cycles which consume power and shorten equipment life.

## 5 Ton Residential Analysis

Scope of Supply	New Home 16 SEER Compressor	Light Commercial with Solar PV Ice Bear Unit	New Home Ice Bear Unit
Retail price of 5 ton AC Compressor/Ice Bear 20 unit	\$ 3,500	\$ 17,000	\$ 17,000
Less Self Generation Incentive Program Rebate	\$ -	\$ (6,735)	\$ (6,735)
Less Solar/Energy Storage ITC (30% of installed cost after SGIP)	\$ -	\$ (7,121)	\$ (7,121)
Less Federal AC Tax Code 179 Depreciation (21% Of after SGIP and ITC)	\$ -	\$ (660)	\$ -
<b>Net incremental cost after SGIP and ITC</b>	<b>\$ 3,500</b>	<b>\$ 2,484</b>	<b>\$ 3,145</b>
Annual Home Owner Utility Bill Savings (SCE website calculator)	Baseline	\$ 1,570	\$ 1,570
Home Owner 20 Yr. Savings (assumes 5% utility rate increase per year)	\$ -	\$ 51,914	\$ 51,914
Payback	Baseline	< 1.6 years	< 2 years
ROI (Yrs)	Baseline	1.58	2.00

\* Federal tax depreciation applies to businesses owning Ice Bears



### Slide 9 – the Economics

This table shows that Ice Energy in CA has prepared economics tables for clients showing the cost of the system less utility rebates, and tax credits for a net cost per user of about \$3000 and a 2 year payback in reduced billings. This analysis does not consider CLEP advantages. It is strictly energy cost.

## Success

- Lower Cost
- Positive Environmental Impact
- Improved Resiliency
- Better Constructed Environment



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### Slide 10 – Success

**Lower overall cost** – Long term in performance and energy.

**Positive Environmental Impact** – Less energy used or wasted reduces carbon emissions.

**Resiliency** – Thermal and Electrical Storage systems such as Ice, Batteries, and Solar reduce dependency on connecting to the Grid.

**Better Built Environment** – Improves worker productivity, reduces stress, reduces illness, and enhances aesthetics.

The technology is here.

The technology comes with a premium.

The way power is delivered and consumed does not match other means of service today. Today we pay more for overnight delivery, we pay more for 1<sup>st</sup> class, if you book non-refundable you get a discount.

Power should be the same. The old model was intended to provide power to all at the same unit price. Technology was unavailable to monitor, measure, and charge instantaneously. Now with computers, broadband, and the array of technological advances at our doorstep, power should be available at the consumer level to be procured, used, and fed back to the grid at a level of granularity that is now possible, affordable, and will happen.

Once CLEP is approved, then it will be feasible to implement these progressive energy tools.

## Financing Electric Batteries & Reliability at a Profit Using CLEP

Myron Katz, PhD

The full story is found in the CLEP testimony at

[www.BuildingScienceInnovators.com](http://www.BuildingScienceInnovators.com)

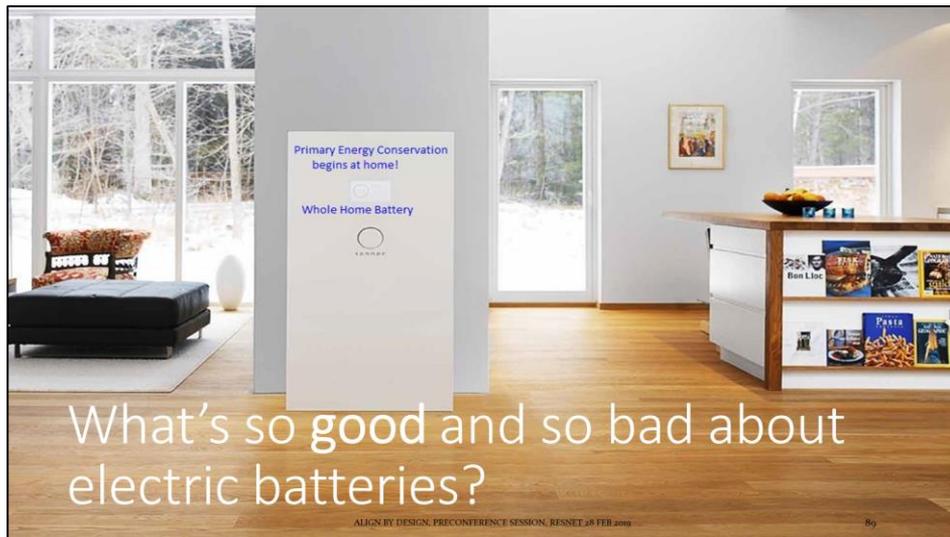
- **Regarding Financing**
- Let's clear about this, if you finance **anything**, it means that you assert that you will payoff the initial investment and then continue to receive a benefit.
- What I'm talking about is all of:
  - How can you use CLEP to more rapidly payoff the initial battery investment?
  - What is the annual cashflow that CLEP provides to a battery owner?
  - I present four alternative strategies to do this.
- **Regarding Reliability**
- This is not such an obvious goal:
  - What is it?
  - What is it's annual economic value?

# Financing Electric Batteries & Reliability at a Profit using CLEP

by Myron Katz, PhD

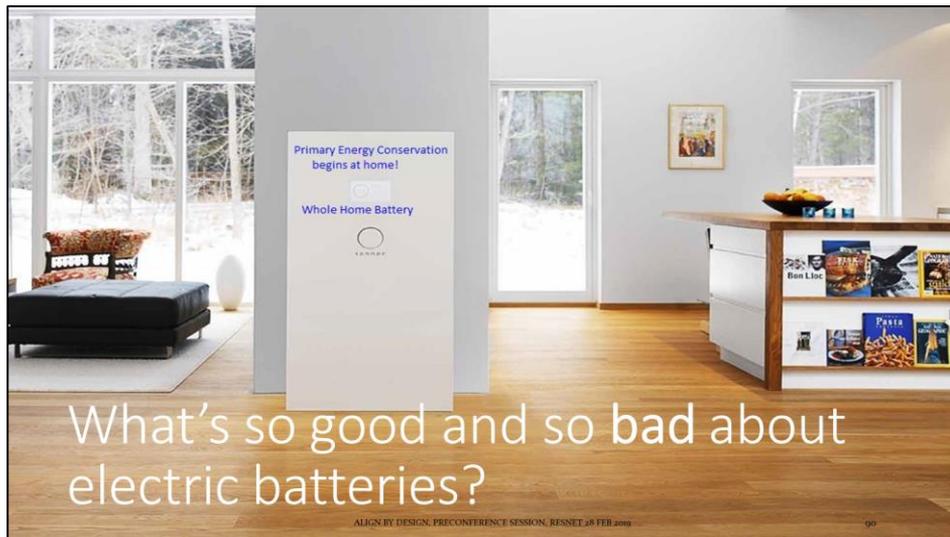


- the **Synergies that promote this DUAL subject** assert that these
- should be discussed in one presentation,
- strongly assert that the best place of batteries is **in buildings**.
- **Batteries belong in buildings because Reliability is worth more than the grid operators think.**



## GOOD

- From a Utility's perspective there are 20 services that electric batteries provide: including: Black Start, and Frequency Regulation
- Consider telling Susan Guidry's unintentional humorous assertions : “
- This NOPS option that does not have BlackStart capability, is a non-starter”
- Reliability and resilience.
- Can provide Primary Energy Conservation by timing
- Unlike electric generators, they can help pay for themselves.
- Commercial value of electricity reliability > \$2000/y.
- Residential value of electricity reliability > \$500/y.
- Saves lives.
- Avoids extremely costly “inconvenience” evacuations.
- Because of cellphones, most people understand & are aware of the common economic issues of batteries.



## BAD

- Does not improve Energy Efficiency.
- Can't easily be "refueled" when their energy store is exhausted. But perhaps, using electric vehicles they actually can.
- How do you pay for them?
- Batteries need proper care, can be easily abused and almost all need to be replaced in years to decades – just like cars.



Reliability is continued full functionality in the face of attacks that can degrade this goal.

Resilience is degraded functionality that preserves some but not all critical loads.

- Commercial value of electricity reliability > \$2000/y.
- Residential value of electricity reliability > \$500/y.
- Saves lives.
- Avoids extremely costly “inconvenience” evacuations.
- Keeps business running even if somewhat limited if it has passed into resilience mode.



- I define
- A whole-home battery as right sized if it
  - Is just big enough and powered correctly to be able to
  - store all energy needed to completely run a home for 20 hours
  - after charging for 4 hours.



- THIS IS NOT A BATTERY TECHNOLOGY TALK.
- In 2016, my research indicated that Sonnen's 12 kWh battery system, cost \$10,000, was warranted for 10 years at 3 deep cycles per day.
- Deep cycles meant full discharge from 100% to 0%.
- Safer technology than Li-ion. It uses Li-Fe.
- bundled with in my opinion the best inverted manufacturer Outback which makes a "pure sine wave".
- The inverted was rated at 8 kW.
- The technology included smart hardware and
- high quality, preprogrammed transitions from reliability to resilience.

## Using CLEP, a 12 kWh Home Battery generates > \$600 annually.

Store 360 kWh/month or 4300 kWh/year  
CLEP5 pays  $4300 * \$0.02 = \$86/\text{year}$   
12 kWhs spread over five hours => 2.4 kW  
CLEPm income is  $2.4 * \$50 * 5 = \$600/\text{year}$



- With a 12-kWh whole-home battery, a customer can store approximately 360 kWh/month or 4300 kWh/year.
- If all the battery does is buy for later consumption on the same day, CLEP5 pays  $4300 * \$0.02 = \$86/\text{year}$ .
- Note that those 12 kWhs will spread over five hours at an average rate of 2.4 kW. Thus, the CLEPm income is  $2.4 * \$50 * 5 = \$600/\text{year}$



**CASE 1:** CLEP alone doesn't finance a Whole Home Battery, but with the "value of reliability" we can get there.

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- Residential Reliability was measured by PEPCO in 2011 to be over \$500 per-residence.
- **THEREFORE:**
- $\$600 + \$500 > 10\%$  of the first cost of a battery that has a 10 year warranty.

**CASE 2:** If our utility puts a whole-home battery in each of 1000 homes, CLEP income balances the books & provides utility profits but causes no cost-shifting onto others.

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- Exhibit 1 in the Testimony I filed on Feb 1 in the ENO rate case reproduced the same spreadsheet filed in the 2016 ENO IRP. It contends that a 1000-home battery installation, pays back via four cashflows: sales profit, depreciation, CLEP income and return on investment while the utility enjoys a 37% profit all of this with a zero contribution to the cost of service.
- TRANSLATION:
  - utility makes a small profit:
  - participants get great improvements in reliability, and
  - no costs are shifted to non-participants.

CLEP Battery Pilot Cashflow Over 10 years													First & last years are 6 months long	
Sold Units	Year	1	2	3	4	5	6	7	8	9	10	11	SUMS	
Total # of Units Sold		600												
Mid-Year Convention		300												
Cumulative # Units Sold		300	600	600	600	600	600	600	600	600	600	600		
# Sold under Direct Control		200	400	400	400	400	400	400	400	400	400	200		
<b>DOLLARS</b>														
<b>Sales</b>														
Retail Revenue		\$10,920,000											\$10,920,000	
Wholesale Costs of sold units		\$8,400,000											\$8,400,000	
Sales Tax		\$840,000											\$840,000	
Bill Credit for Control by Utility		\$285,000	\$570,000	\$570,000	\$570,000	\$570,000	\$570,000	\$570,000	\$570,000	\$570,000	\$570,000	\$285,000	\$5,700,000	
Power Supply benefit from control		\$300,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$300,000	\$6,000,000	
<b>Leased Units</b>														
Total # Units Leased		400	400	400	400	400	400	400	400	400	400	400		
Mid-Year Convention		200	400	400	400	400	400	400	400	400	400	200		
<b>DOLLARS</b>														
Undepreciated Leased Assets		\$3,080,000	\$,852,000	5,236,000	4,620,000	4,004,000	3,388,000	2,772,000	2,156,000	1,540,000	\$924,000	\$308,000	\$0	
Lease Revenue		\$105,600	\$211,200	\$211,200	\$211,200	\$211,200	\$211,200	\$211,200	\$211,200	\$211,200	\$211,200	\$105,600	\$2,112,000	
Power Supply benefit from control		\$300,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$300,000	\$6,000,000	
Depreciation		\$308,000	\$616,000	\$616,000	\$616,000	\$616,000	\$616,000	\$616,000	\$616,000	\$616,000	\$616,000	\$308,000	\$6,160,000	
Return on Rate Base		\$338,800	\$643,720	\$575,960	\$508,200	\$440,440	\$372,680	\$304,920	\$237,160	\$169,400	\$169,400	\$33,880	\$3,726,800	
Marketing		\$5,000												
Other O&M		\$100,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$200,000	
Contribution to Cost of Service		\$1,348,800	\$428,520	\$360,760	\$293,000	\$225,240	\$157,480	\$89,720	\$21,960	\$45,800	\$113,560	\$68,720	\$200	

**CASE 3:** Small businesses can finance batteries using only Chap 179 of IRS code.

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- Exhibit 2 of the same testimony points out that the Trump federal tax law of 2017,
- allows a small business to
- qualify for a 130+ % tax credit in the first year. to
- buy a device to store a primary product of petroleum, and
- Because petroleum is used to directly make electricity,
- an electric battery should qualify.

## What are Section 179 Deductions?

Section 179 of the IRS Code was enacted to help small businesses by allowing them to take a depreciation deduction for certain assets (capital expenditures) in one year ...” Page 38 of Testimony.

**CASE 4:** Every resident can fully finance an electric battery with CLEP if incorporated with water heater and ice-making AC upgrades. Payback 4 years

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- Given the cashflows provided in
  - Gary's presentation for buying and for programming a new heat pump water heater and in
  - Rick's presentation for buying and for programming an ice-making AC,
  - these pay for themselves so rapidly that if
  - coupled with an electric battery install,
  - this ensemble pays for itself in less than 7 years.
- Why is this amazing?
- Normally, subsequent energy efficiency retrofits are seldom more economical in the presence of previous retrofits.
- That is the case because EE retrofits must be financed out of limited energy bill savings, but CLEP does not have this limitation.

In any of the last three ways, the improved reliability and resilience benefits of electric batteries cost consumers less than nothing; that is: at a profit.

# CLEP and the Future of Electric Vehicles

David Stets, Co-lead  
Sierra Club's  
Clean Transportation for All

Sierra Club is the most enduring and influential grassroots environmental organization in the United States having 3.5 million members and supporters.

Founded in 1892, the Sierra Club has grown and evolved dramatically during its more than 125 years of existence. During that time the Club has played an important role in influencing conservation policy and environmental history.

For the last two years I have been co-lead for the Sierra Club's Clean Transportation for All Campaign which is working to ensure that we all benefit from a 21st century clean transportation system with access to cars, trucks, and buses that rely on little to no oil at all and to clean public transit -- and other local clean transportation solutions.

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## Electric Vehicle

Why own an EV?

My EV: 2014 Nissan Leaf 24kW

battery, bi-directional,

32A/6 kWh charger

2-3 hrs per charge, 63-108 kWh mo., \$2.42 per 100 miles, 2018-3,812 M, \$92

Home storage battery backup

CLEP => reduced cost , keeps income



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After driving several Prius since 2007 I purchased a 2014 Nissan Leaf in November 2016. Why, because it was better for the environment. An off-lease EV was affordable, And the operating cost is extremely low. I'm retired. And, It's convenient to charge at home. I found out it was very quiet and great to listen to jazz while driving.

My Leaf has a 24 kW battery with a connector for a 220 volt, 32 A, 6 kWh charger ( I didn't need a DCFC connector). Rated for 84 miles of travel, which is extended by regenerative braking in ECO mode (10-15%) and as high as 30% in B mode city driving. Nissan has been building EVs since World War II devastated transportation in Japan.

Charging takes 2 to 3 hrs every 3 to 4 days. I try to charge on a sunny day and put sunshine (from my solar panels) in my car. 100 miles of driving cost me \$2.42 averaging \$92 per month. Most trips are within 15 non-interstate miles. (My charger tracks all activity.)

I was planning on using my Leafs bi-directional capabilities to store my excess solar output in the event Net Metering changes to avoided cost.

With CLEP using my car as a battery since I don't have to travel during peak demand hours. And, charging during early morning hours. I can generate extra income without incurring additional monthly cost. As I used to say it goes straight to the bottom line.

## Light Vehicles

local & hybrid 9-58 miles, 9-30 kWh

local +150 miles, 40 kWh, Bi-directional  
testing in Europe

Ldst 238-310 miles, 60-100 kWh

Pick-ups 400+ miles

Now lets talk about the ever growing models and battery options.

The first group I identify as local EV and Plug-in hybrid. Their batteries provide travel for from 9 (Prius Prime) to 58 (Volt) miles and have batteries of 9 to 30 kWh.

The Nissan Leaf has a space to itself now providing travel of 150 miles with a 40 kWh battery. Nissan has been working on bidirectional connectivity beyond their car and the grid or AC device for several years in Europe.

Tesla made the long range EV a reality providing a range of 238 to 310 miles with 60 to 100 kWh batteries. Many other manufactures are aiming at this range for their new models.

There are a few pick-ups coming that are aiming at 400 plus miles of range. Pickups have been a very profitable model for US automakers.

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## Heavy Duty Vehicles

Delivery vans 186 miles 40 kWh

Semi-trucks 300-500 miles

Busses 68-426 miles 94-660 kWh

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Several manufacturers are providing or planning delivery vans with around 186 miles with 40 kW batteries. Even the US Post Office is planning on having a fleet.

Again several large truck manufacturers are following Tesla into supplying semi-trucks with between 300 and 500 miles of range. Several are on the street but they are being quiet about specifications.

Many bus manufacturers in China, Europe and the US are pursuing the lucrative bus market with mileage of 68 to 660 miles and batteries between 94 and 660 kW. Shreveport has gotten their first six Protera **electric busses**. California's Air Resources Board adopted the zero-emission bus rule that will ensure that all transit agency buses in the state (13,000 in all) will be electric by 2040.

Trash trucks in Europe are going electric too. Several models are under going street testing now.

## Chargers

L1, 15A, 40 miles overnight, office/home \$400

L2 (16/24/32A), 25 miles an hour,  
home/stores \$400-650

L2 V2G, home/office, Reverse Power Flow. Reduce demand charges  
CLEP:

DCFC, 80% in 30-40 min, Interstate/high end locations \$\$\$\$\$

UK 2017 Chargepoint, Reverse Power Flow V2G+ testing \$10k



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Every EV needs a charger or two. I mostly use my home charger but have had occasion to use one at a car dealers, universities and Whole Foods.

A level 1 (L1) charger uses a dedicated 110 V, 15 A circuit at your home or office and provides 40 miles of charge overnight. L1 chargers are standard with EVs. Great if your staying over at Mom and Dads.

Level 2 chargers use a dedicated 220 V circuit at with either 16/24/32 A circuit. These can provide 25 miles of range per hour and can often be programmed when to charge your car. An important development will be Vehicle to Grid for home or office now only available in the next type of charger.

DC fast chargers (DCFC) can charge you car batteries to 80% of capacity in 30 to 40 minutes (or less) and are used for interstate travel and high end destinations. These units can run up to \$15K and require exception from commercial demand charges.

In the UK in 2017 Chargepoint started testing reverse power flow (V2G) DCFC at 130 locations. This capability could help companies manage their power to reduce demand charges which can exceed usage charges. They also (VVO) contribute or absorb reactive power (kvar). And I want V2G for my house too.

# CLEP and the Future of Community Solar

David Stets  
Retired Owner of  
Richmond BySolar

No comments, just top slide

## The road traveled

First solar 1984  
Richmond Bysolar 2007  
Heatstore (STES) 2011  
First PV AC in VA 2012  
DOE/Sunshot/NABCEP 2013  
Gentilly 2016 net-zero home



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This has been over a thirty year journey that I'm glad I took.

It began when I added 120 gallon solar hot water system to my house in Virginia in 1984 because I never had hot water after all the girls showered and washed their long hair. After that I had all the free hot water I wanted 10 months out of the year. I was 36.

After twenty years in the computer industry and two of my own computer companies, I decided to get outside. I started Richmond Bysolar in 2007 after 6 months of schooling with the guys that wrote the books on solar. Early work was mostly solar hot water. PV panels were \$10 a watt, try to figure the payback on that.

Events lead me to fund R&D at Virginia Commonwealth University using TRINSYS to develop the Virginia Heatstore which was designed to replace gas heating of public housing. It heated our Virginia house for three years free.

A year later and we were the first solar company in Virginia to install the new PV AC panels and sixth in the US.

The following year I was certified by DOE Solarshot as a solar instructor and I got around to NABCEP certifications.

Following my wife's retirement and her first grandchild being born in New Orleans we came to New Orleans, purchased a 60 yr old home in Gentilly and proceeded to make it Net Zero. All electric, fully insulated, with Energy Star appliances, 6 kW solar (22 panels), & a 4.5 COP ductless heat pump.

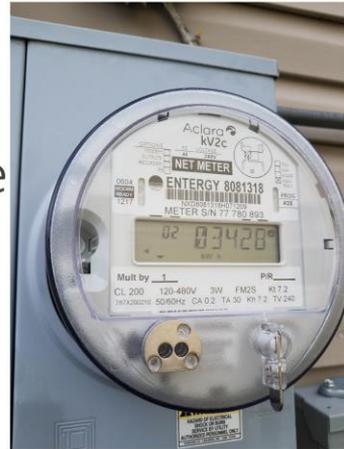
## Parameters

Good sun – irradiance

What size

Incentives, RPS

Net metering



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In the US our worst solar irradiance area is Maine which is better the best area in Germany. The US has between 8.5 - .5 and we have between 5.5 and 4.5 here, that's good (Plaquemines, Lafourche, Orleans, St. Bernard, & Terrebonne). Better than VA we had 4.0.

System max size is regulated 25 kW for residential, 300 kW (1k panels) for commercial and agricultural, residential avg is 4-10 kW (16-40 panels).

The lucrative solar incentives were spent by Governor Jindal, so they stopped. Louisiana has no Renewable Portfolio standard (RPS, another incentive).

Which leaves us only with Net metering (NEM) which started in 1983, now 43 states plus DC have Net Metering.

The result of incentives are Hawaii 2% solar, CA .7% solar, with an average US of 0.5% (SEIA). Long way to get to 100% renewables.

Community Solar is the path to 100% renewable by anytime in my life time.

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# Why we need Community Solar

## Problems

### Only 20% have access to Solar for Residential & Commercial

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The average residential roof install needs 600 sq ft for a 6 kW system of 20+ panels. This size system can be leased for \$50 a month with no money down.

Commercial solar flat roofs – favorite places have been courthouses, Walmart (200/4177-5%), Costco, Macys, IKEA, CA Wineries, Malls (roof underutilized asset). They are saving money.

National Renewable Energy Laboratory (NREL) says 20% of homes can do solar. My experience has been close 25%.

Problems: 54% of properties in Orleans Parish are rental properties which are hard to get owners and tenants to do solar. Other major problem are roof shading by trees, direction of roof, old roof shingles, dormers on south side of roof, travel to sites & safety on site. I used to feel like I was selling roofs in Virginia. Here most roofs were replaced after Katrina.

Utilities think like railroads and are dinosaurs. Were all too young to remember when the railroads ran the country. To me the electric and gas industry does everything they can to make a case against renewable energy.

# Community Solar

42 States have CS

No LA & very limited NOLA CS

Virtual net metering isn't good enough

Needs 3 Acres for 100 homes

Issues abound in Fixed, tracker &

Security

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There are 42 states with at least one CS on-line, with 1,294 megawatts installed through 2Q18, over 200K homes. (SEIA)

There are currently no statewide community solar policies in Louisiana. Utilities and developers may offer community solar programs according to NREL but most think LPSC won't agree.

NOLA- CS program that the council passed last year offers cents per kWh to subscribers (buy all/sell all - simple bookkeeping). It's miserably low compensation, but it's a start.

Virtual (NEM) net metering (incentive) is billing for community solar.

CS needs 3 A for 100 homes. About 37 city lots.

City lot size 3500 sq ft around, power for 7-8 houses

Fixed tilt vs trackers, Entergy solar field at Chef Menteur Hwy by industrial canal 1.3 gW with .3 mW battery

Security, needs varies per location Entergy is enclosed in high cyclone fence, State park is on the ground behind ranger station. What would be required on lots in 9<sup>th</sup> ward?

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## Energy Economics

3% of bill if Middle Income

20-30% for Low Income

Heat ? , eat ? or meds?

CS & CLEP => 3-week payback

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Average elect cost is 3% of income for middle income family (median Income 37K)

Average elect cost can be 20-30% of low income family. (22K 60% of median)

Cost of utility bills can lead to situation of do you heat, eat or buy medicine.

Energy savings can be life changing for low income families.

With CLEP and CS low income residents potential gain is 3 to 4 weeks paychecks.

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## Community Solar Sites

Old power plants

Abandoned commercial bldgs

Business parks

County/Parish airports

President Carter's 2017 Ranch

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Old power plants, undeveloped land, vacant lots, 9th ward, emanate domain?

Old power plant sites have electric infrastructure

Abandoned commercial buildings have electric infrastructure

Business Parks has electric infrastructure

Unusable lots in 9<sup>th</sup> ward, emanate domain?

County/Parish airports: Cleco Power looking at small airport site near Albita Springs.

President Carter's ranch. In 2017 10A – 1.3 MW, 3,852 solar panel lease for ½ of power for Plains, GA pop 683. (He Created DOE)