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Energy Storage for Renewable Integration

COMMENTS TO IEPR WORKSHOP OF APRIL 28, 2011

By

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GREAT WORKSHOP

- An interesting and informative Workshop.
- Clearly illustrates the complexity of the subject.
- Needs some simplifying approach.
- But in my opinion “we may not see the forest for the trees.”

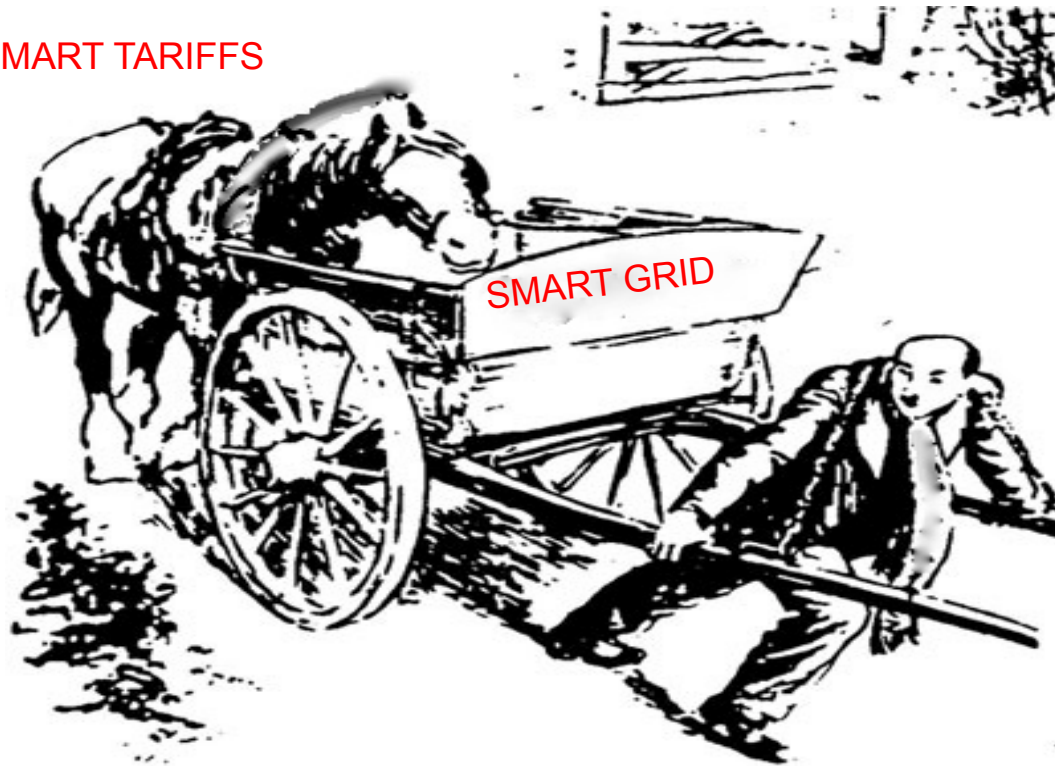
WHAT IS MISSING?

- We are prospecting for gold without a gold price.
- Except for a few comments most of the workshop concentrated on the various methods of mining, digging, production, location, costs and what financial support or programs are needed but all omitted the most important item of prospecting:

WHAT IS THE GOLDPRICE?

THE CART IS BEFORE THE HORSE

SMART TARIFFS



CEC, CPUC

MY PERSONAL BACKGROUND AND PHILOSOPHY

- Totally Independent Consulting Engineer
- Expert in Thermal Energy Storage (TES) since the “hay days” in late 1980s
- A lone voice as the *Moses* of TES preaching:
 - The First Commandment of TES:
Thou shall have a rate schedule that makes TES economically feasible.

With my comments I am trying to show the necessary approach to benefit us all, the State, society and create the smart grid. I also expanded the first commandment of TES to encompass electrical energy storage as a whole with:

*The First Law of Energy
Storage Dynamics*

ENERGY STORAGE MUST BE SEPARATED INTO TWO CATEGORIES

- * Upstream of meter:
Utility size storage
- * Downstream of meter:
Smaller systems
- * Common denominator:
For both the utilities control the tariffs

DIFFERENTIATE BETWEEN TWO TYPES OF ENERGY STORAGE

- **POWER STORAGE:**

Short bursts of energy fed to the grid to take care of “anti-spikes” or negative spikes become more frequent due to sudden ramping down due to wind and or solar power supply variation.

- **ENERGY STORAGE:**

Energy provided for a few hours to peak shave during high demand periods

POWER STORAGE:

- Batteries with high power delivery
- Hydro pump storage
- Fly wheels

ENERGY STORAGE TYPE 1

PERMANENT LOAD SHIFT (PLS)

UTILITY SIDE OF METER

- Provide power for extended time during peak demand periods and recharge during off peak periods
- Batteries less power (KW) output but capable to sustain for longer periods (KWH)
- Hydro pump storage
- Fly wheels

ENERGY STORAGE TYPE 2

ACTUALLY REDUCE CONSUMPTION
DOWNSTREAM OF METER

- Energy conservation measures reduce load during on peak periods.
- Demand Response reduces power consumption when demand peaking occurs.
- Thermal energy storage (TES) allows to take chiller load off line that would otherwise be there.

WHAT DO THEY ALL HAVE IN COMMON?

- They all depend on a tariff to be economically feasible. Without a tariff that promises to reduce cost there is no reason to invest in any of these measures.
- The uncertainty (market risk) that exists is caused by tariffs not reflecting the true cost of electricity in real time and the lack of reliability of the tariffs.

WHO CONTROLS THE TARIFFS?

- The utilities of course. The utilities create rate schedules that satisfy their needs and the CPUC approves them.
- The history of rate structures over the last decade shows a clear trend to reduce the on-off peak cost difference per KWH and reduce high on-peak demand costs by adding a non-time related demand charge and now lately even another "muddying the waters charge" called "*capacity reservation charge*"

MARKET RISK

- For any investment the first question is what kind of profit lies ahead to make it worth while pursuing.
- If one has to start off by negotiating with a utility and there after the project is totally dependent on the goodwill of the utility it is tough to get enthusiastic.
- Down stream of the meter it is risky if one is confronted with the changes that have occurred and are occurring to the rates which are controlled by the utilities.

WHAT WAS THE RESULT?

- For the past 15 years TES, one of the most effective methods of peak shaving or permanent load shift (PLS) has been difficult to economically justify. The rates more and more diluted the savings potential over the years.
- However, Demand Response is the favorite of the utilities.

WHY?

- Demand Response lowers the demand when it suits the utilities. The actual revenue loss due to the reduction of demand is limited to the difference between the normal peak day and the critical peak day.
- When a consumer finds out that this demand response shift could actually be done all year round (PLS) then the user is penalized as the rebate is calculated on the difference between the previous 5 workdays and the actual load shifted during the event.

WHAT IS THE ANSWER?

- Put the horse before the cart.
- The tariffs must pull and influence the usage of electricity.
- If we were charged according to what an actual KWH costs in real time consumers would respond immediately. The load shape of the grid would flatten out considerably.
- For storage to be an investment, the rates must be reliable, and reasonably predictable which they would be if based on actual costs.
- At the moment the utilities rule the rate game.

THE FIRST LAW OF ENERGY STORAGE DYNAMICS

SMART METER + SMART TARIFFS

=

SMART GRID

SMART METERS

- Did we buy them to eliminate the meter readers?
- Did we buy them so that consumers understand their consumption and analyze when their refrigerator cycles on and off?
- California spend \$5 billion on smart meters.

LET'S USE SMART METERS FOR WHAT THEY WERE DESIGNED FOR

- Introduce Real Time Pricing (RTP).
- Depending on what the grid needs, the interval period can be one hour or 30 minutes or even 15 minutes.
- The day ahead price can easily be predicted and made public.

WHAT WOULD HAPPEN?

- Consumers would voluntarily become the best demand reducing agents.
- Within months Wal-Mart and Radio Shack would offer plug-ins to cut off power during high price periods to refrigerators, washing machines, any non-essential appliances, water heaters, pool pumps, thermostat settings would come down, perhaps even off, consumers would be the most watchful energy conservationists during peak periods.
- The overall monthly bill for consumers should not vary too much as consumers will benefit from cheap power as well and try to use of it as much as possible.

WHAT ELSE WOULD HAPPEN?

- Rate payer lobby lawyers would get into action and try to ensure that this idea will be refuted. However, no more costly rate negotiation sessions would be required. This would eliminate many special interests and lobbying efforts to reduce commodity costs.
- No politician would survive an election supporting such measures. But who knows, the voters may like the idea that we all pay the same for electricity.
- But for the cases where personal hardships occur or where some elderly people can't live without their air conditioning, well then let the republicans develop some voucher system and the democrats can develop an “electric care” program to assist these special circumstances and get voters approval.

OTHER BARRIERS

- **INTEREST GROUPS:** You can go to any workshop, hearings or round table discussions, and hear the same stories, over and over usually told by lawyers representing the various interest groups:
- **INDUSTRY AND COMMERCE:** Let's get going ASAP.
- **UTILITIES:** No targets, let's study this to death to successfully postpone the issue.
- **ENVIRONMENTALISTS:** We agree with everything as long as you do not harm a fly.
- **RATE PAYERS:** Do not propose any incentives or rebate programs because it increases tariffs.

THE BOTTOM LINE IS

- The grid should not be influenced by socio-political issues or special interest groups. We must separate the tariff charged of this commodity from any other influence except for what the commodity really costs.
- If in the future the renewables influence the load shape of the grid, RTP will automatically adjust and so will the consumer.
- Nobody gets cheaper gas at the pump because he/she is an AARP member or farmer and all these different “special” cases propagated by special interests.

THE CART WILL FOLLOW THE HORSE

- All energy storage technologies should fall under the same rules and will develop according to their competitiveness. The market will determine the value of each application whether it has 30 different components or less.
- It was mentioned at the workshop that “New York” has developed specific tariffs for storage applications and that California is lagging behind. May be we can learn from them.
- One more thing: One tariff for all different storage technologies. There is no reason why one technology should get special treatment. If a technology is too expensive then spend on research to get it competitive.

POSSIBILITY THAT IT MAY WORK

- If we had RTP or some form of Dynamic Pricing that reflects RTP it could be just possible that no programs, incentives or rebates are necessary to boost a certain application or technology.
- This would blissfully eliminate a lot of special interests and lobbying efforts to save money for all.

CALIFORNIA

EUREKA

