# *DUCK SEASON IS OPEN!*

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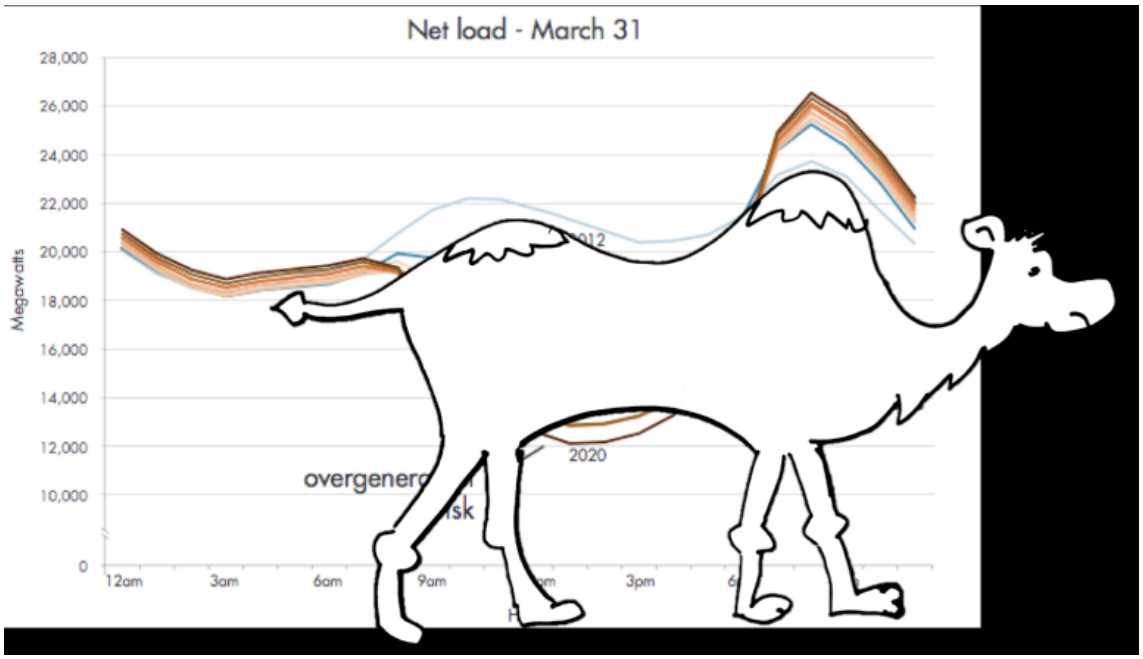
For many decades, ENERGY DEMAND followed an easily predictable pattern, with very little change in levels of demand.




The chart above shows the typical electric load of Independent System Operator - just think the grid, on an average spring day. It almost looked like a camel.This stable trend allowed electrical workers to become experts with sustaining a stable output of energy.

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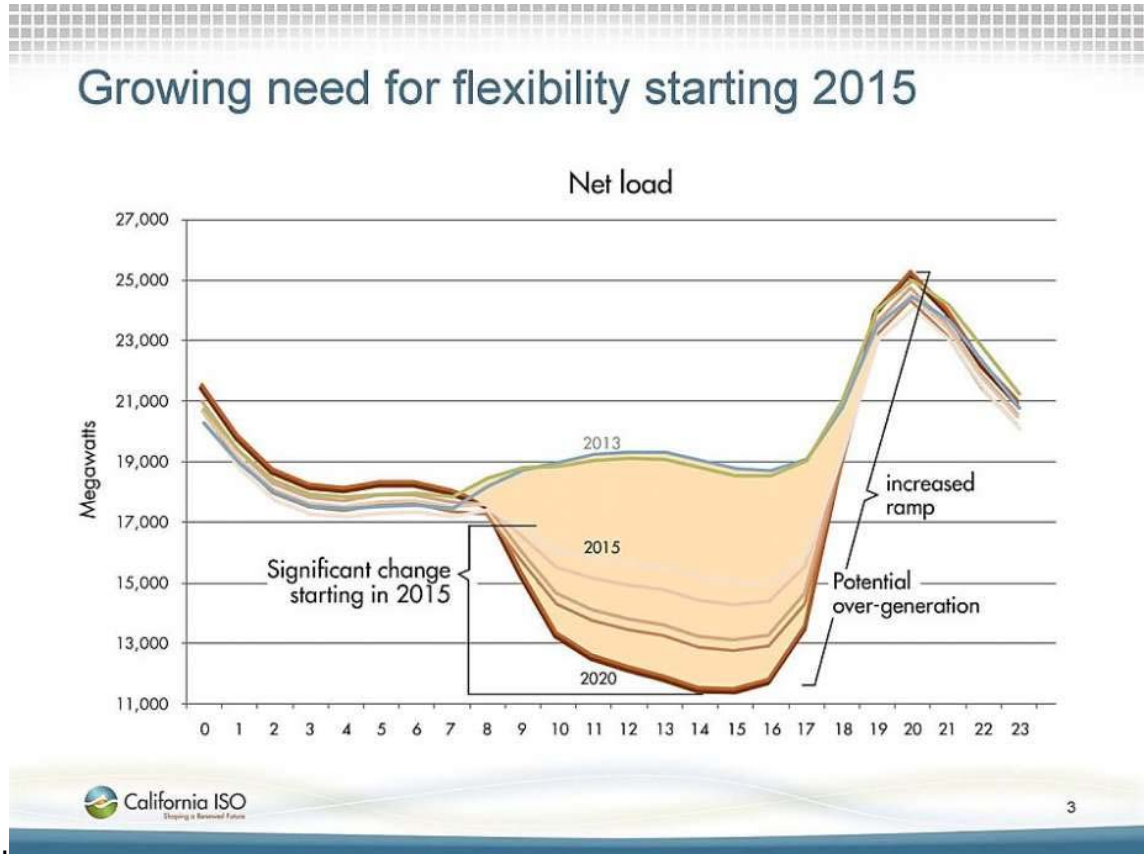
The development of renewable energy and energy efficiency marked "a new era of energy exploration" in the United States.

On February 24, 2009, President Obama called for doubling renewable energy within the following three years.

By the first quarter of 2011, renewable energy reached a major milestone, when it contributed 11.7 % of total national energy production.

Suddenly,a new image was starting to show up on ENERGY DEMAND charts. Itreally has played a major role in changing energy regulatory landscape since it was discovered in 2013.

The Duck Curve!




The difference between the Duck Curve and a “regular load” chart is that the duck curve shows two high points of demand and one very low point of demand, with the ramp up in between being extremely sharp. It looks like a duck!

So, again it’s the very same graph of power production over the course of a day, but now it incorporated the timing imbalance between peak demand and renewable energy production. Put simply, the duck curve is the graphic representation of the impact of higher levels of wind and solar output reducing demand on the grid during the day and now resulting in a high peak load in mid to late evening.

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To meet the baseline requirement, or “baseload”, utilities run BIG power plants fueled by nuclear or coal, around the clock. These plants are expensive to completely startup/shutdown and are more effective in ramping up or down.Then there’s the “peak load,” which is satisfied by “Peaker power plants”. These plants typically run on Natural Gas or hydro electric and are more expensive to run.

Obviously, the problem with the duck curve lies in the belly of the duck. In some areas, demand becomes so low that grid operators are forced to turn off the peaker power plants and ramp down the baseline power plants. Then, just a few hours later, they all have to get ramped up again with little to no warning.

During those sudden and steep changes in demand, Grid operators and regulators struggle to maintain stability and efficiency by turning power plants on and off, causing instability in the power supply, large expense to taxpayers, and pollution to the environment.

While not meeting peak load is a problem, equally as concerning is the problem with overgeneration conditions. When supply of power exceeds demand, and without intervention, generators and certain motors connected to the grid will increase rotational speed, which can cause lots of damage.

To avoid this, system operators MUST carefully balance supply with demand, by increasing and reducing output. Doing this with the conventional generation fleet and considering the duck curve, it is becoming an impossible task.

Discovery of this imbalancesimmediately showed Public Utilities companies that the historically running the power plantsto “meet the predictable demand load” is no longer there.

Thus, global industries’ focus MUST be shifted intothe development of new fast-reacting resources or into the direction of procurement of energy storages.

The “sloweddistributions” energy resources (like batteries or energy storages) should be a good strategy to implement, however, in my opinion the real success can be achieved once we get full participation of ALL energy users toward a common goal.

Some of the ideas that are already engaged are:

- Installing more dispatchable generationlike interconnections between states.
- Energy Storage:
    - Pumped-storage hydroelectricity.
    - Battery storage power stations.
    - Solar thermal energy with Thermal energy storage
    - Ice storage air conditioning.
    - Use of batteries in electric vehicles for temporary storage.
- Energy Demand management:
    - Transitioning to more efficient lighting systems, such as LED lighting.
    - Time of-use-pricing
    - Smart grid technology
    - Air conditioning is about half of the US peak demand, so changing this from an as-used load to a scheduled and controlled load is a huge opportunity.
    - It basically amounts to finding lots of little ways that customers can shift their demand, aggregating all those customers together, and treating the sum of their demand-shifting capacity as dispatchable power.

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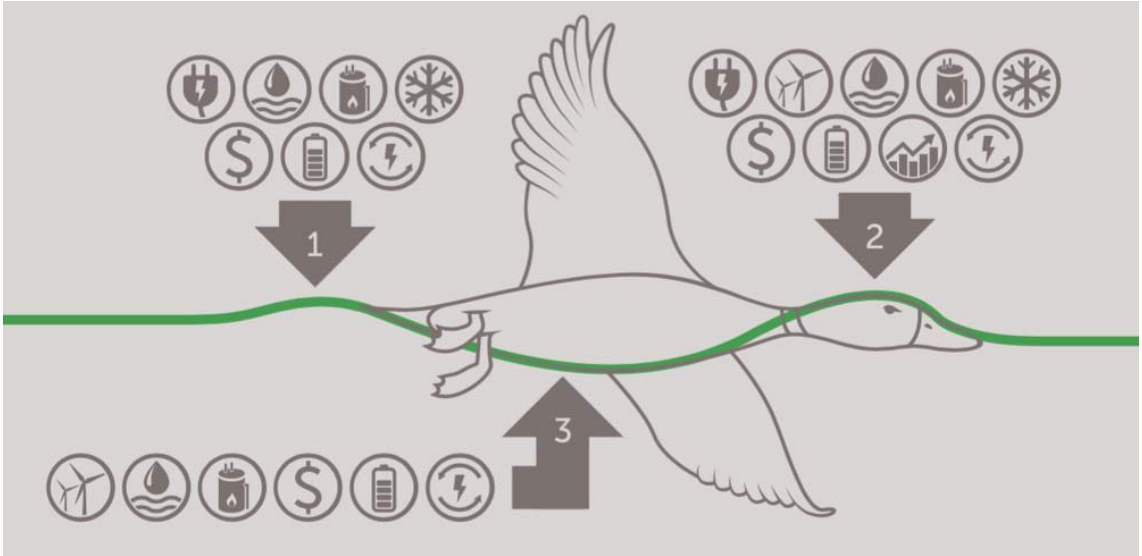


***LET'S WORK TOGETHER ON FLATTENING THE DUCK!***

***REFERENCES:***

/1/ Jordan Wirfs-Brock,"IE Questions: Why Is California Trying To Behead The Duck?", Inside Energy, October 2, 2014, www.insideenergy.org

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