

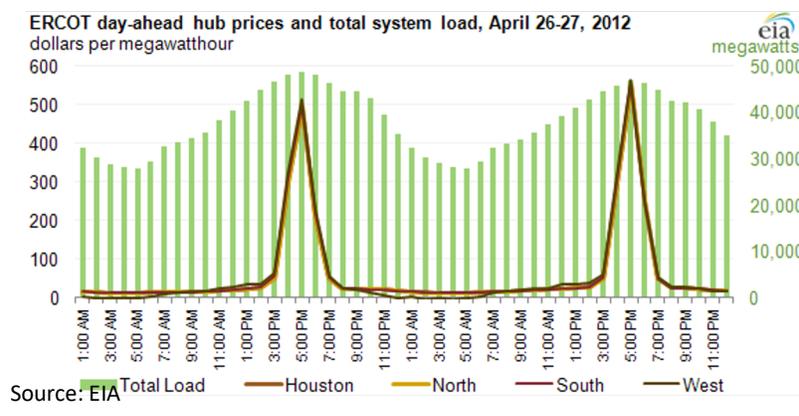
## California A Step Closer To “Prices-to-devices”

CEC’s MIDAS platform can be another game changer

For many decades, scholars and researchers working in the electricity sector have been talking, debating – and dreaming – about a distant future where individual electric devices – not just the meter – would be able to receive time- and location-specific price signals, enabling them to respond *automatically*. The idea of turning dumb devices into smart flexible ones and inelastic loads into flexible demand is not new. The electric vehicle, electric water heater or pool pump, for example, could automatically know when to consume or store electricity – when it is cheap and plentiful – without the customer ever moving a finger. This makes even more sense because we are moving towards a low carbon future where large percentage of generation will be from renewables, mostly solar and wind, which are variable. Wholesale prices will not only spike and plunge with regularity but there would be periods when prices would be nil – or occasionally negative.

Wouldn’t it be nice if devices could respond *on their own* to fluctuations in prices? The concept, sometimes referred to as “prices-to-devices” has been around for a while, but mostly as a *metaphor*.

ERCOT prices, like all other markets, spike, and dip with regularity



California’s electricity customers received an unexpected Christmas gift from the **California Energy Commission (CEC): Analysis of Potential Amendments to the Load Management Standards**, a report released on 22 Dec 2021. It is a true game changer. In a nutshell, it would establish a state-wide standardized protocol for communicating with virtually any smart/connected device in the state, making it possible –

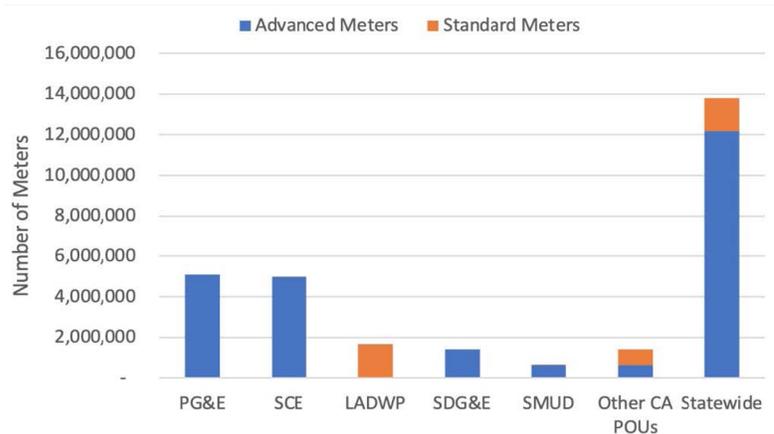
for the first time – for utilities to send price signals and manage loads, distributed generation, storage, electric vehicle charging and much more. Once implemented and operational, the scheme will enable what many had always wanted but were unable to do.

In a 11 Jan 2022 article in *CA Current* titled **Energy Agency May Turn Automation of Grid-Connected Devices into Reality**, CEC Commissioner **Andrew McAllister** told **Herman Trabish** that the agency was moving “... toward a customer-led power sector that would help balance the grid during times of stress,” noting that the proposed standard would “... begin the process of capturing **demand flexibility** from customers’ distributed energy resources – from electric vehicles to water heaters – through automated responses to real-time price signals.”

Big deal to brag about? Indeed.

The new standard will enable utilities to upload to a publicly accessible statewide rate database that can be used by large and small energy users, their agents or aggregators. As outlined in the CEC staff report, given the state’s existing investment in smart meters (chart on right) plus the available communications and automation technologies – broadly referred to as **digitalization** – customers and third-party aggregators can gain access to tariffs in real time, allowing them to take advantage of variable prices to optimize electricity usage and minimize economic and environmental impacts.

Put all those smart meters in California to good use



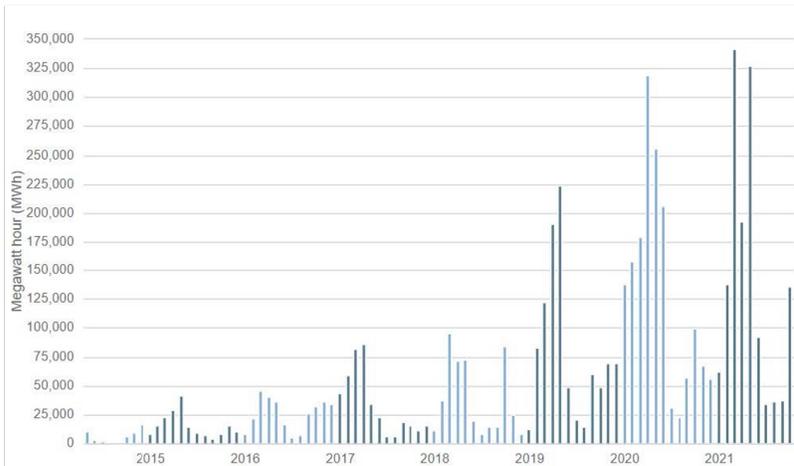
Source: Analysis of Potential Amendments to the Load Management Standards, Final Staff Report, California Energy Commission (CEC), 22 Dec 2021

As reported in *CA Current*, “Currently, there are a number of companies that aggregate customers’ two-way power flows and sell it to utilities and the grid operator, but the market potential is far larger.” Commenting on the potential, **Sanem Sergici**, a Principal at **The Brattle Group**, said the CEC initiative could be “a game changer” by leading to “prices-to-devices” solutions that allow complex rates to be applied by customer devices in almost real-time.”

Today’s utility-led load management programs, where and if they exist at all, are mostly narrowly focused on peak load reductions, and are seriously handicapped because they lack “**granular time and location-dependent (price) signals**,” according to the Staff Report. The proposed scheme delivers granular price signals to each smart devices allowing them to be programmed for automated response. As more customers install solar panels, invest in storage, and acquire electric vehicles, the scale of opportunities to monitor and manage behind-the-meter assets simply becomes too big to ignore.

Getting correct prices to devices in real time is critical for several reasons including the high and rising percentage of renewable resources being added to the system to meet the state’s ambitious carbon neutrality goals by 2045. With so much variable renewable generation, **California’s independent System Operator** (CAISO) frequently experiences periods of feast and famine, for example, on sunny days when solar generation from both utility-scale and distributed solar exceeds demand resulting in **curtailments** – a phenomenon that has been on the rise in recent years (visual).

CAISO renewable curtailments on the rise, 2015-2021 data in MWhs



Source: Analysis of Potential Amendments to the Load Management Standards, CEC, 22 Dec 2021

At the same time, the *excess* solar generation from 1.3 million solar roofs – that is generation exceeding household demand – overwhelms the local distribution networks in areas with high percentage of solar roofs.

With over 1 million **electric vehicles** (EVs) on its roads, this excess generation can be profitably stored. By the end of the decade, some 7.5 million EVs are expected in California alone. In aggregate, their batteries represent massive storage capacity. But getting the

price signals to each and every EV charging point – there are over 43,000 public EV charging stations in the US, nearly 6,200 in California – and to incentivize the drivers to take advantage of low (or negative) prices while avoiding the high peak time prices can be much easier with the proposed protocols.

Another reason why this is a big deal is that **variable pricing** has been rare for several reasons including the fact that most consumers are not equipped to take advantage of them – today’s dumb appliances do not automatically respond to price signals. In most cases they must be programmed and/or manually adjusted, which means many customers do not bother. All this can change since every device will be able to receive the correct price signal in near-real time. Overnight variable pricing will become the *norm* rather than the *exception*.

The Staff Report notes that

“The goal of the proposed (scheme) ... is to form the foundation for a statewide system that automates the publication of time- and location-dependent signals that can be used by end-use automation technologies to provide real-time load flexibility on the electric grid. The combination of statewide signals and robust responsive automation markets proposed herein will enable customer-supported load management on a mass-market scale.”

How?

“With the utilization of communications and automated control technologies, customers can shift the timing of electric services to take advantage of cleaner and cheaper electricity without sacrificing comfort or quality of service. Buildings and water can be **precooled** or **preheated**. **Batteries** and **electric vehicles** can be charged sooner or later than otherwise scheduled. Consumers can set **dishwashing, laundry**, and many other services to be automatically scheduled based on the electricity cost or greenhouse gas content.”

What’s stopping us from taking advantage of these opportunities today?

“Advanced meters, communications, and automation technologies make this possible today. However,

standards do not currently exist for customer devices and automation services to access utility rate information in a consistent and standardized way.”

**California utilities, how many are there and who regulates them?**

Type of LSE	Number Operating in California	Governing Body
California Investor-Owned Utilities	6	CPUC
Community Choice Aggregators	22	Board of Directors
Publicly Owned Utilities	47	Board of Directors
Rural Electric Cooperatives	4	Board of Directors
Energy Service Providers	15	Board of Directors

Source: Analysis of Potential Amendments to the Load Management Standards, CEC, 22 Dec 2021

There are, of course, multitude of other complications including the fact that there are more than 70 “utilities” in the state (Table above), each with its own tariffs and communication protocols. As of August 2021, California had

- 6 investor-owned utilities (IOUs) regulated by the CPUC;
- 47 **publicly- or municipally-owned utilities (POUs)**; and
- 22 **customer choice aggregators (CCAs)** – their numbers and the number of customers they serve continues to increase.

The POUs and CCAs are “overseen” by independent governing boards – not regulated by the CPUC – who set/approve retail electricity rates for their customers. The IOU rates are determined by the CPUC. With so many entities each with multiples of tariffs getting prices-to-devices is complicated.

The CEC staff report notes

“Each of California’s more than 70 utilities and community choice aggregators offer their own load management programs. Customers interested in signing up for programs are presented with a cornucopia of offerings with an array of incentives, options, and requirements. The participation decision requires time for research and consideration of these options.”

The CEC’s proposed scheme relies on existing technology and infrastructure, already in place, most notably **Advanced Metering Infrastructure** or AMI.

In 2009, PG&E, SCE, SDG&E, and SMUD began rolling out their smart metering programs and some have introduced **time-varying rates** for customers who want them but the uptake has been modest at best. By 2013, these 4 utilities had installed over 12 million electric interval meters, enabling TOU and dynamic rates for nearly 100% of their customers. Currently, roughly 90% of California customers have the advanced metering required for time-varying rates (Chart on page 5). The Los Angeles-based municipal LADWP is the only one that does not yet have widespread AMI but is expected to do so within the decade.

Another complicating factor is coordination among and communication between the stakeholders, which means that the CEC has to work closely with the regulator, the **California Public Utilities Commission** – who must approve the rates for the IOUs – the **California Independent System Operator** – who manages the grid – the 3 large **investor-owned utilities** – who collectively read the great majority of the meters in the state and bill and collect from the customers – **publicly owned utilities** – who set their own

prices and self-regulate – **community choice aggregators** – who are virtual retailers – plus an assortment of **automation** and **storage equipment manufacturers**, and many other stakeholders.

The good news is that during the CEC’s proceedings there was surprising consensus among virtually *all* the stakeholders on the need for a standardized statewide real-time signaling system. Such unanimity is rare among such a heterogeneous group.

**Enel X North America**, among the world’s largest **demand response** (DR) providers, while supportive of the idea, said it favored even more detailed/granular price signals and said the CEC should consider including rates for **exported energy**, such as those applicable to **Net Energy Metering**, as well as “non-price” signals like data from the state’s **Avoided Cost Calculator**. Others asked for a **proof-of-concept** demonstration ahead of a statewide implementation and/or suggested gradual implementation or did not want the scheme to be mandatory. The CEC, after all, is *not* a regulatory body and has no authority to “mandate” anything other than setting standards; the CPUC can regulate if need be.

Once implemented, the scheme, called the **Market Informed Demand Automation Server** or MIDAS, “... will enable automation markets to coalesce around agreed upon principles and technologies for demand flexibility,” according to the CEC. MIDAS (visual next page) will be maintained by the CEC with help from participating California utilities, offering customers and automation service providers the essential price signals needed to “... link flexible loads to a machine-readable database of rates and other grid signals to automate demand flexibility.” At least, that is the current plan.

Each rate will have a **Rate Identification Number** (RIN) in a standard machine-readable format and be publicly accessible through an **application programming interface** (API). The platform will include interoperability via wi-fi or radio signals and will be linked to CAISO’s emergency conservation **Flex Alerts** which are invoked when supply outages are imminent during emergencies.

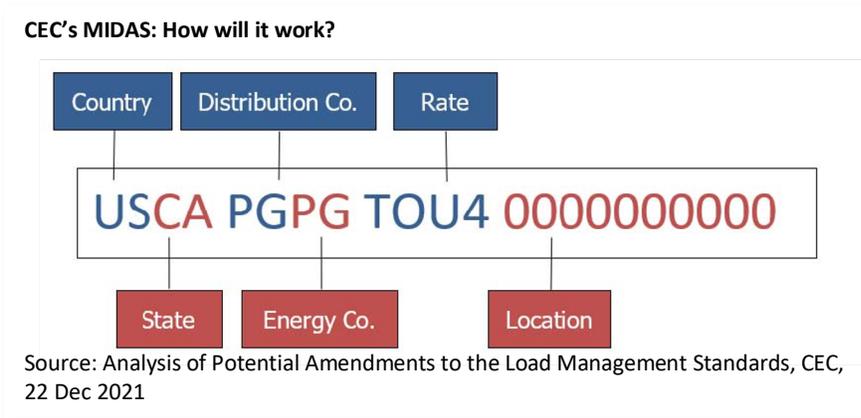
To make it happen, the CEC has proposed that the big utilities covering large service territories in California, namely

- Pacific Gas & Electric Company;
- Southern California Edison;
- San Diego Gas & Electric Company;
- Los Angeles Department of Water and Power;
- Sacramento Municipal Utility District; and
- The Community Choice Aggregators (CCAs) who “virtually” serve customers within the IOU service boundaries

To do the following:

- Develop retail electricity rates that change at least hourly to reflect **locational marginal costs**, allowing customers and their agents or aggregators with options for automating response to hourly and sub-hourly price signals;
- Update the time-dependent rates in the MIDAS database whenever a rate is changed or modified allowing third-party service providers to help customers respond to prices, to CAISO **Flex Alerts** – during supply shortages – and/or provide emission signals – for example permitting customers with demand flexibility to switch off when the grid is supplied from carbon-heavy exports from out of state;

- Implement a single statewide standard method for providing automation service providers with access to their customers’ rate information to optimize consumption patterns and bill savings; and
- Develop a list of cost-effective automated price response programs for each sector and engage in customer education and outreach programs.



Utilities must reevaluate existing programs and consider new ones to take advantage of the economic and organizational efficiencies provided by MIDAS and engage in outreach and public education programs since most customers are unaware of variable price signals or price-responsive automation technologies and services.

How much would MIDAS cost and what are its expected benefits?

According to the CEC, the proposed amendments are technologically feasible and are estimated to cost \$24 million in **net present value** (NPV) over a 15-year period. The benefits are estimated at more than \$267 million over the same period, savings that can be shared among the utilities and customers.

McAllister conceded to *CA Current* that similar platforms have been proposed in other states, notably **New York**, but boasted, “We are breaking new ground that could benefit others by enabling automated responses to price signals.”

As he sees it, “... high flexibility potential from thermostats, water heaters, pool pumps, and EV charging could be incorporated in the first uses of the load management platform, followed by “... other connected loads like large appliances and home gateways for broadband.”

If California succeeds in this endeavor, other states and countries are likely to lean from the experience. The problems addressed by MIDAS are universal. Frustrated by many failures, **Thomas Edison** is quoted saying “Results! Why, man, I have gotten a lot of results. I know several thousand things that won’t work.” The same may be said about prices-to-devices where many attempts to make it work have not materialized, but perhaps MIDAS will make it a reality at last. ■

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### *EEnergy Informer*

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February 2022, Vol. 32, No. 2

ISSN: 1084-0419

<http://www.eenergyinformer.com>

*EEnergy Informer* is an independent newsletter providing news, analysis, and commentary on the global electric power sector.

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Published monthly in electronic format.

Annual subscription rates in USD:

Regular	\$450
Discounted	\$300
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Unlimited site license	\$1,800