

Smart Meter Impact: Enabling Smart Metering System for Consumption Optimisation and Demand Management



By Gregers Reimann

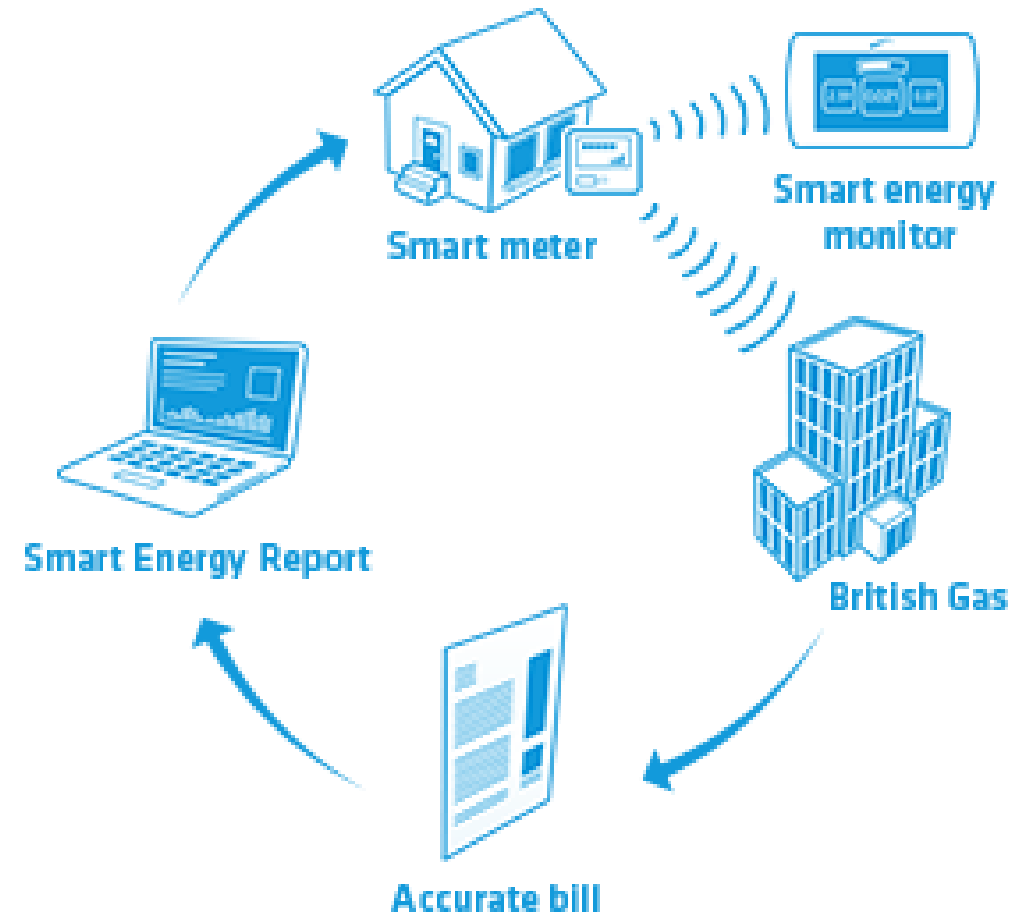
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<http://ien.com.my/news.html#smartmeters>

”Smart Meters”

Funny story from Malaysia ;-)

Cartoon of a real conversation

I had when explaining my job as Energy Efficiency Consultant



Courtesy of Gregers Reimann/IEN Consultants Sdn Bhd / Illustration by Rachel Chen Ruiqi

The Star newspaper, Malaysia, 16 August 2013

The Smart Meters are coming.....

TNB: Smart meters nationwide by 2021

Monday, April 3rd, 2017 at , Business | Corporate Malaysia



Tenaga Nasional Bhd (TNB) plans to install the advanced metering infrastructure (AMI) or smart meters in 8.3 million households across the country by 2021.

Malaysia's largest utility company will roll out the first phase of its AMI implementation to customers in Malacca at the end of this year before expanding it in phases.

The smart meters are electric-powered reading meters that allow daily electricity consumption to be recorded and converted into data which can be monitored by consumers.

TNB smart billing project senior manager Datin Siti Laila Sri Asih S Garieb said 300,000 households in Malacca will be involved in the AMI first phase roll-out.

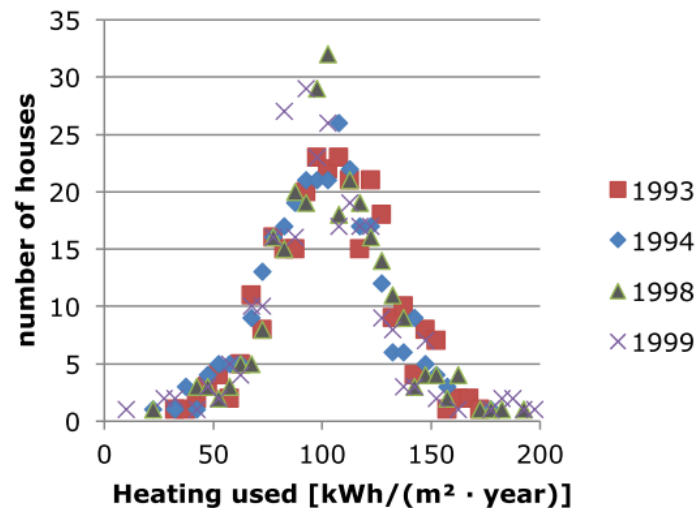
"Through our web portal, consumers will be able to monitor their daily electricity consumption every 30 minutes. Such monitoring will help them to better manage their electricity bills," she told the media at TNB media familiarisation programme in Malacca last week.

Siti Laila said the decision to move forward with the first phase of the smart meter programme came after the

Same same but different

Energy consumption comparison of 290 identical houses in Denmark

- Factor 20 difference in energy consumption
- No change over time



Slide credit: Bjarne W. Olesen | 2017-2018 ASHRAE President

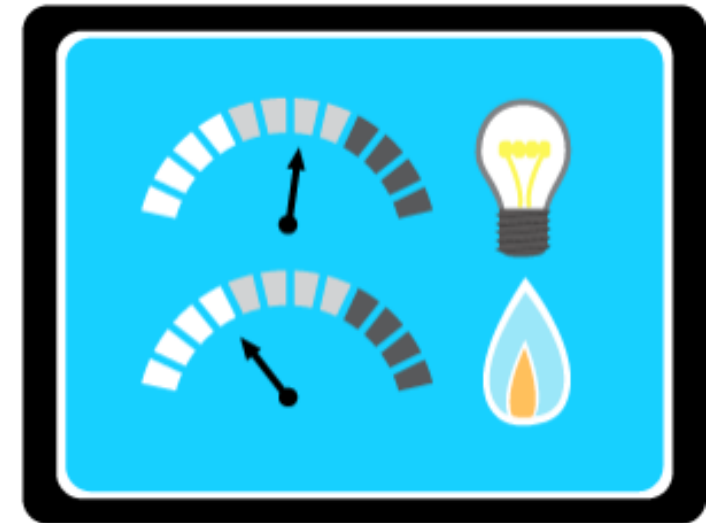
Are they
even aware
of the
differences?

Smart Meter: What is it?

DEFINITION OF A **BASIC SMART METER**

Smart Meter often refers to an electricity meter, but it also may mean a device measuring natural gas or water consumption

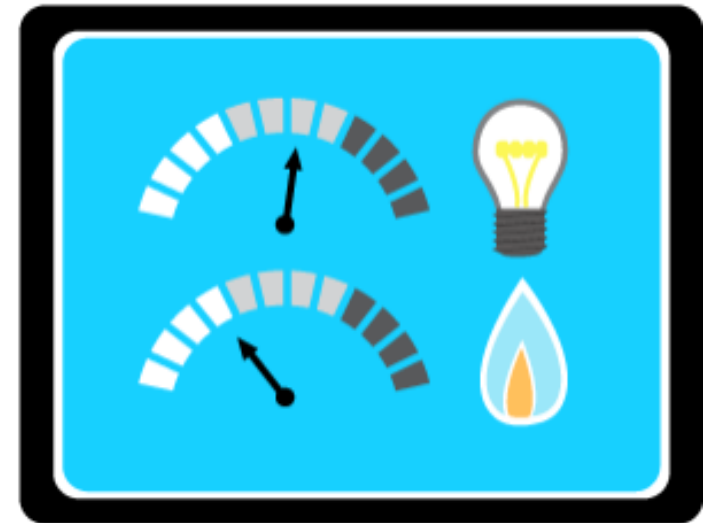
A **Smart Meter** is an electronic device that records consumption and communicates the information to the utility supplier for monitoring and billing. Smart meters typically record hourly or more frequently, and report at least daily.



Smart Meter: What is it?

DEFINITION OF AN **ADVANCED SMART METER**

Advanced Smart Meters enable two-way communication between the meter and the central system. Such an advanced metering infrastructure (AMI) differs from automatic meter reading (AMR) in that it enables two-way communication between the meter and the supplier. This allows the consumer/utility to take advantage of lower off-peak time tariffs, and selling energy (e.g. renewable electricity) back to the grid with net metering, detect a service outage, detect "unauthorized" use of electricity and remotely shut it off, and remotely change the meter's billing plans from credit to prepay, as well as, from flat-rate to multi-tariff.



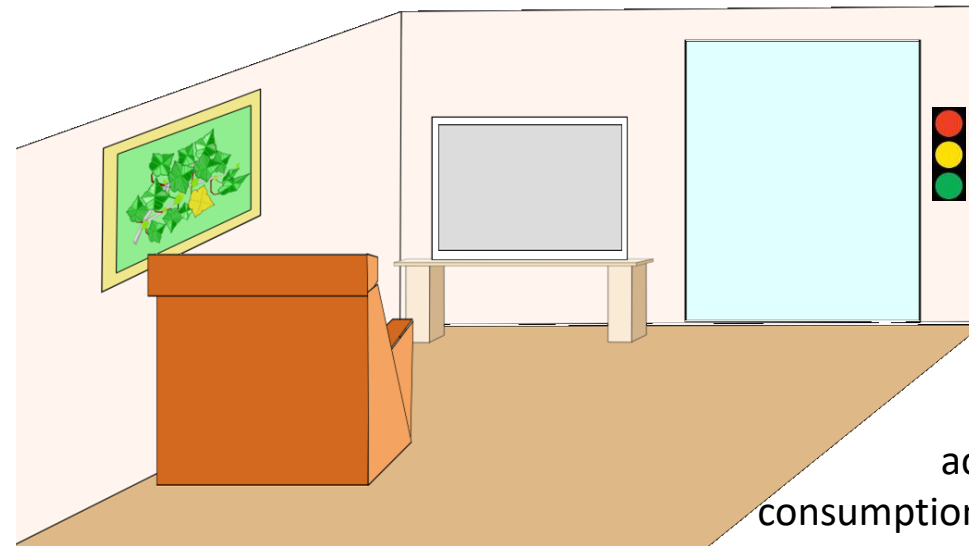
Simple example of “Smart Meter” display

Free solar power home indicator, residential apartment project in India



Solar energy shared in equally between the apartments, i.e. each apartment got the same monthly free solar electricity quota

Simple Solar Energy Quota LED display prominently place on the wall of the living room in each apartment



RED – quota exceeded
YELLOW – borderline
GREEN – within quota

FINDING:
Residents would actively try to keep their consumption within the free quota

What motivate people to change habits?



Understanding
behavioral
science

Alex Laskey: How behavioral science can lower your energy bill

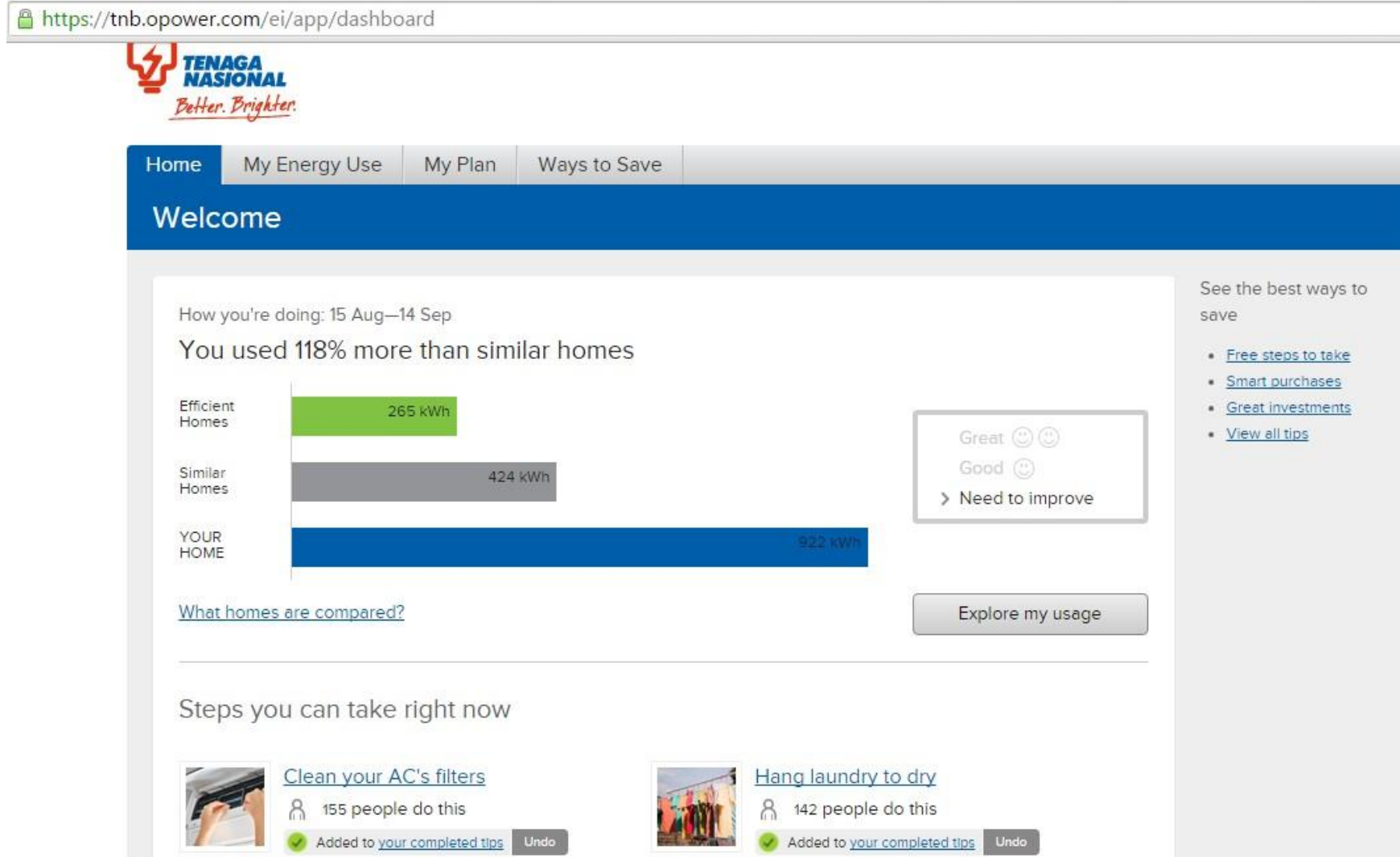
96,575 views

1.5K 45 SHARE SAVE ...

Play video: <https://youtu.be/4cJ08wOqloc>

Home Energy Report

by Malaysian power utility TNB



Conclusion on Successful Implementation of Smart Meters

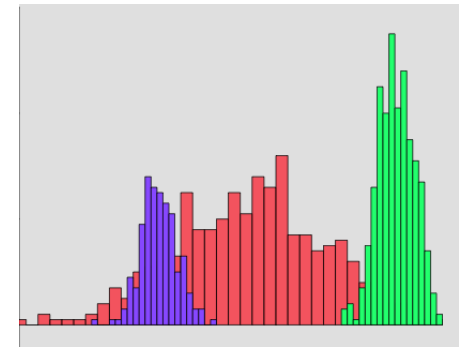
"To realise potential feedback-induced savings, advanced meters [smart meters] must be used in conjunction with in-home (or on-line) displays and well-designed programmes that successfully inform, engage, empower and motivate people."

**American Council for
an Energy-Efficient
Economy (2011)**



RED – quota exceeded
YELLOW – borderline
GREEN – within quota

and/or more advanced
computer displays



Smart Meter

- Uses the European Open smart grid protocol (OSGP)
- Ability to reduce electric load
- Ability to disconnect-reconnect remotely
- Ability to interface to gas meter
- Ability to interface to water meter



Smart Meter Consumer Display



Cost Benefit Concern for Smart Meters

- Mixed results as savings do not always out-weight the extra cost

Annual meter charge increases with smart meter costs in 2010 and projections to 2017 (\$)

Australia

Distributor	2005	2006	2007	2008	2009	2010	2011	2012	2013	2015	2016 2017
SP AusNet	17.49	17.49	17.49	17.49	17.49	86.1	93.83	101.02	108.75	117.08	126.04
United Energy Distribution	6.60	6.60	6.60	6.60	6.60	69.21	89.18	99.57	107.62	116.33	125.73
Jemena Electricity Networks	12.87	12.87	12.87	12.87	12.87	134.63	136.7	155.84	159.86	162.34	164.88
Citipower	15.20	15.20	15.20	15.20	15.20	104.79	108.4	93.38	95.26	97.17	99.13
Powercor	17.20	17.20	17.20	17.20	17.20	96.67	105.35	92.72	93.91	95.12	96.34

- UK study concluded that smart meter implementation would have £6.2 billion of net benefits, but critics saying that cost-benefit analyses of residential smart meters found that it would cost more than it would save
- Electric Power Research Institute, a utility industry think tank who conducted energy saving study from 8000 randomly smart meters found that there was “zero statistically different result compared to business as usual”.

FINDING: Metering-only solutions without displays / user-interaction capabilities, while popular with utilities because they fit existing business models and have cheap up-front capital costs, often result "backlash" from consumers, who foot the smart meter implementation bill.

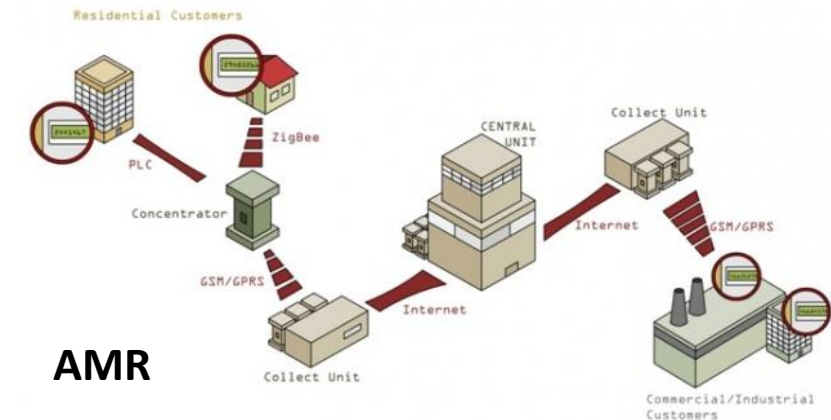
Security & Privacy Concerns for Smart Meters

- Very frequent reports would allow the utility company to infer behavioral patterns for the occupants of a house, such as when the members of the household are probably asleep or absent
- Research has demonstrated that smart meters sampling power levels at two-second intervals can reliably identify when different electrical devices are in use.
- UK Smart Meter critic Ross Anderson writes: "It is not necessary for my meter to tell the power company, let alone the government, how much I used in every half-hour period last month" and that "smart meters can provide targeting information for burglars"
- Concerns over hacking of smart meters, though, the European smart meter makes hacking unlikely, simply not worth the effort.
- Privacy and data safety concerns to be met



Smart Meter Infrastructure: AMR vs. AMI

- **Automatic Meter Reading (AMR)** only collects and reports the measured data, but does not allow for two-way communication.
- **Advanced Metering Infrastructure (AMI)** refers to systems that measure, collect, and analyze energy usage, and communicate with metering devices such as electricity meters, gas meters, heat meters, and water meters, either on request or on a schedule. These systems include hardware, software, communications, consumer energy displays and controllers, customer associated systems, meter data management software, and supplier business systems.
- Government agencies and utilities are turning toward advanced metering infrastructure (AMI) systems as part of larger “smart grid” initiatives. AMI extends automatic meter reading (AMR) technology by providing two way meter communications, allowing commands to be sent toward the home for multiple purposes, including time-based pricing information, demand-response actions, or remote service disconnects.



AMR

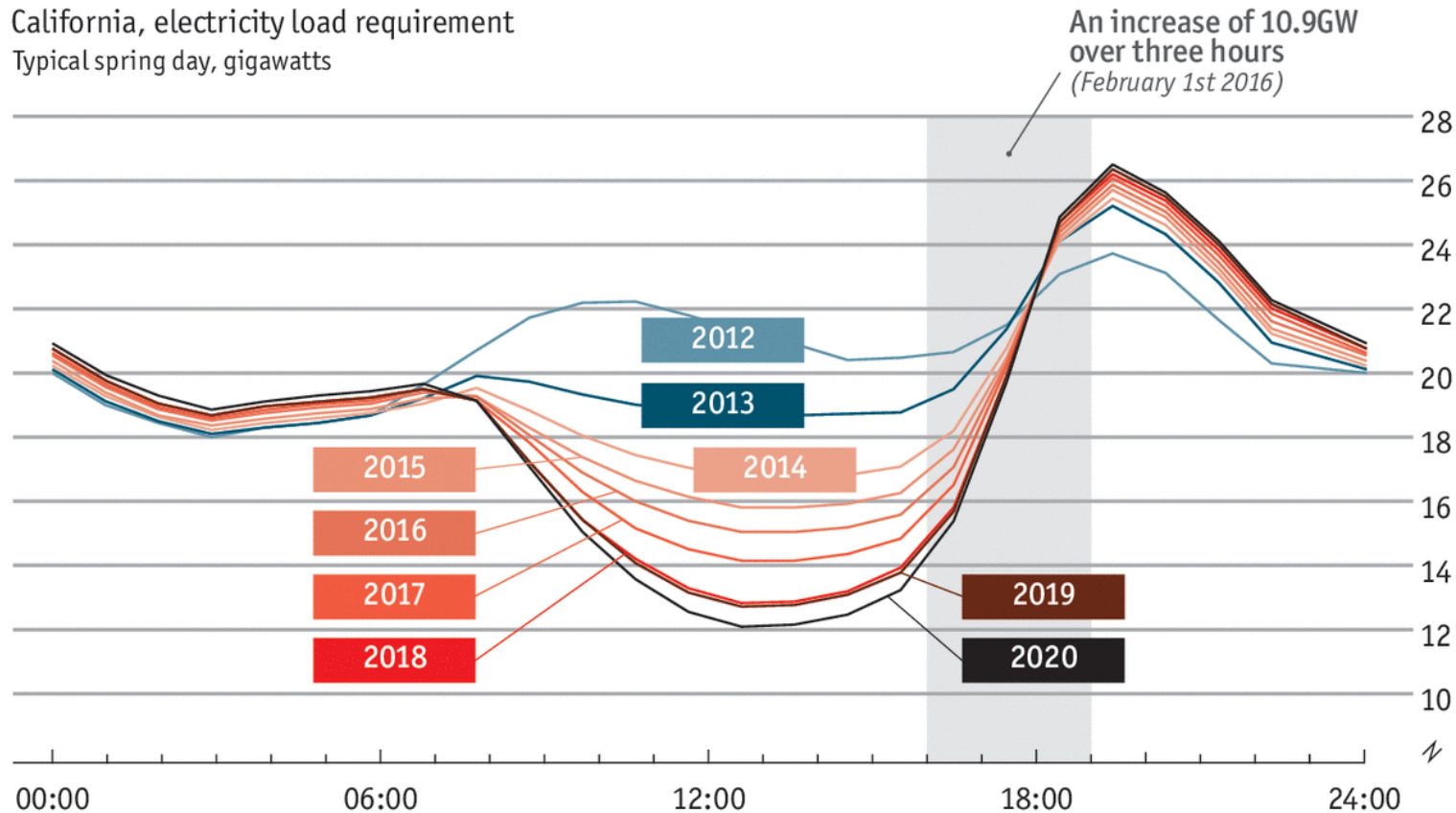


AMI

Increased future demand for Smart Meters: More variable energy supply from solar, i.e. the “Duck Curve”

Who gets the bill?

California, electricity load requirement
Typical spring day, gigawatts



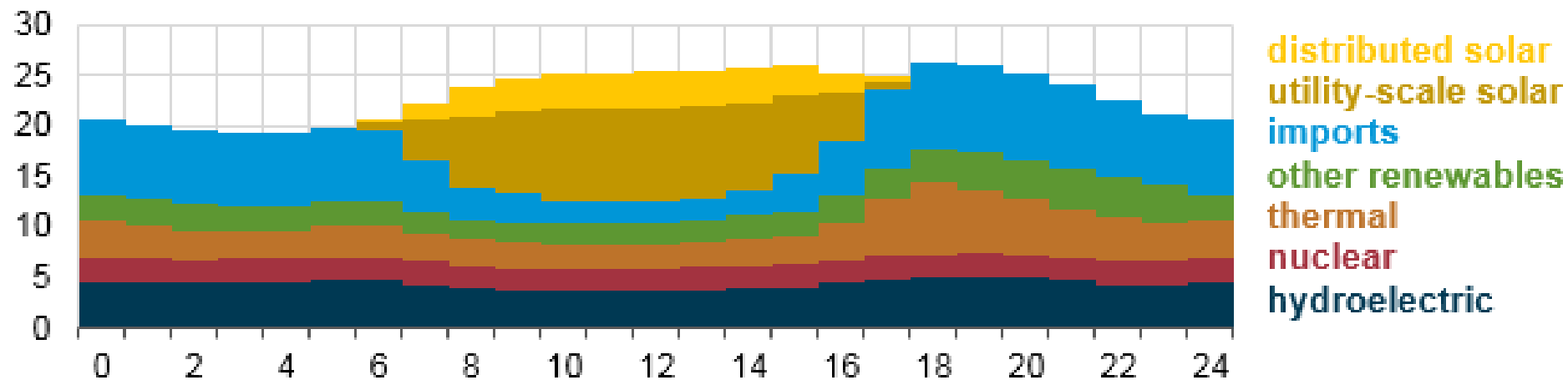
Source: California ISO

Increased future demand for Smart Meters: More variable energy supply and variable electricity rates

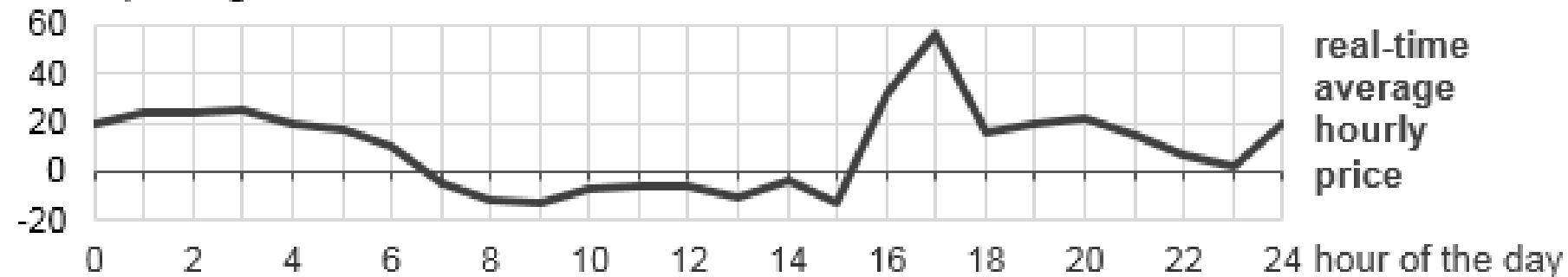
California Independent System Operator net generation, March 11, 2017



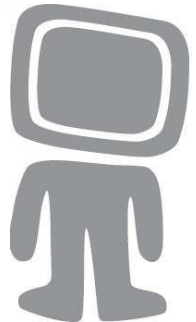
gigawatthours



dollars per megawatthour



Thank you



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My smart commute in
Kuala Lumpur
(video [link](#))