

2017 Public Power Forum

Kennewick, WA

26 October, 2017

Lawrence Makovich, Vice President and Chief Strategist, North American Power

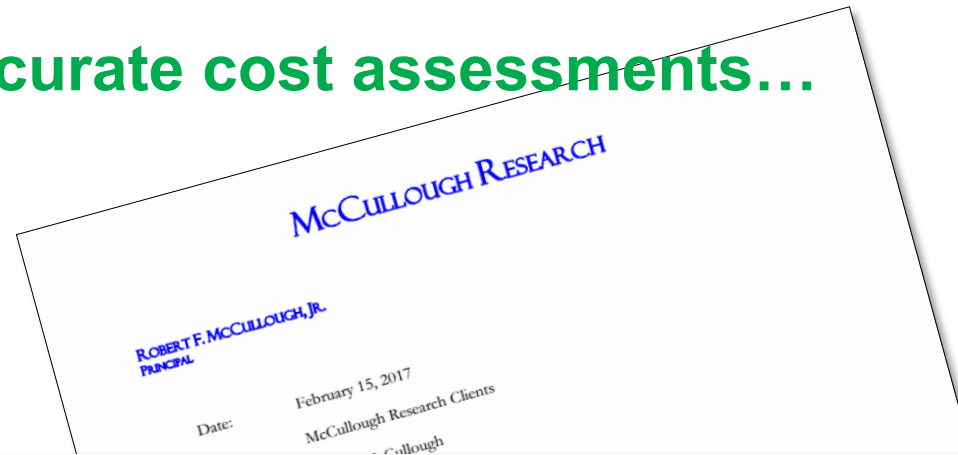
+1 617 866 5372, lawrence.makovich@ihsmarkit.com



Addressing the Discord between Public Policy and Market Operations

- An efficient electricity market outcome requires the harmonization of public policies and market operations. And here is the rub: an increasing lack of harmony is generating increasing wholesale electric market distortions.
- One of the primary drivers behind the formulation of public policies that are significantly at odds with market operations is the belief that mandates to increase intermittent renewable technology generation shares in a marketplace will reduce greenhouse gas emissions while also saving consumers money based on simple levelized cost of energy (LCOE) comparisons.
- Harmonizing public policies and market operations requires understanding the flaws of cost comparisons employing time ignorant, stand-alone and subsidized LCOE metrics.

Appealing but inaccurate cost assessments...



Report: Replacing the Columbia Generating Station with Renewable Energy

Appealing but inaccurate cost assessments

“Using renewable energy cost estimates from the financial advisory firm Lazard, and comparing them against Energy Northwest’s own projected cost of power, the net present value benefit of replacing CGS with a solar and wind portfolio is estimated to be \$261.2 million over the period March 2017 through June 2026”¹

- McCullough Research, February 15, 2017

trics' associated costs of electricity.

The announced closure of these two units will increase the cost of electricity from the Pacific Northwest, approximately 200 miles from Seattle. The Columbia Generating Station (CGS) nuclear plant provides the Bonneville Power Authority with the most expensive power in its generation portfolio. Since 2008, the plant has had the highest and incremental costs far above market alternatives.

In 2013, McCullough Research published a 216-page study recommending the replacement of the aging CGS with less expensive market supplies.¹ In turn, Energy Northwest, the operator of CGS, commissioned a study arguing that if natural gas prices rose to \$5.30/mmbtu, CGS

¹ McCullough, Robert, et al. "Economic Analysis of the Columbia Generating Station." McCullough Research. December 2013. <<http://www.mresearch.com/pdfs/541.pdf>>.

6023 REED COLLEGE PLACE • PORTLAND • OREGON • 97202 • 503-777-4616 • ROBERT@MRRESEARCH.COM

1. http://www.mresearch.com/pdfs/20170215_Replacing_CGS.pdf

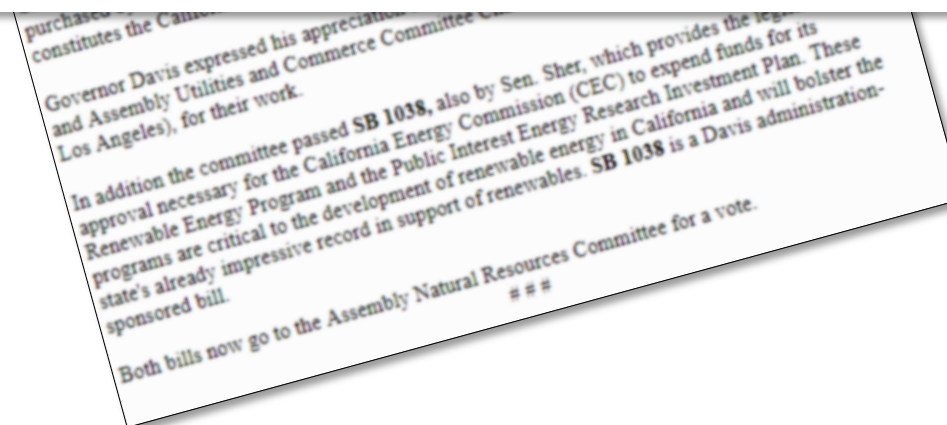
Appealing but inaccurate cost assessments...



Headline: Governor Davis Commends Legislators for Overcoming Impasse on Energy Legislation

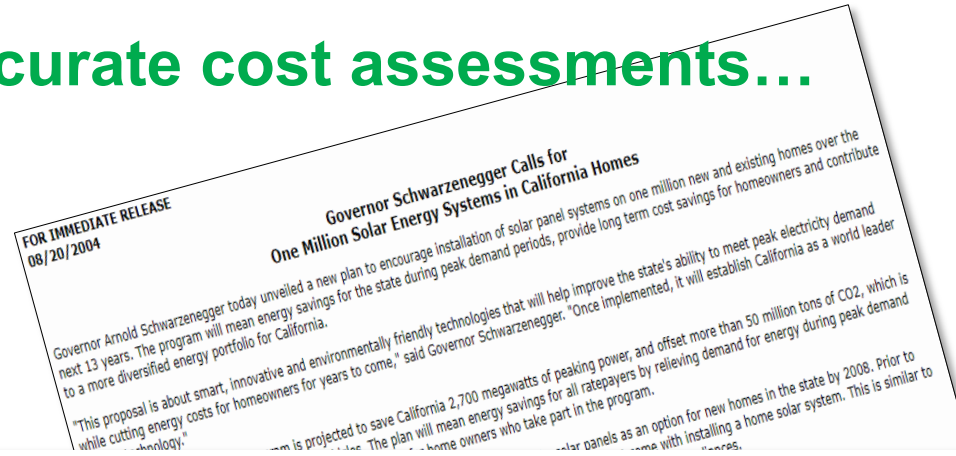
“The benefits of using renewable energy include the reduction of electricity market volatility by cutting California's reliance on natural gas; retiring old fossil-fuel fired plants that are particularly dirty and inefficient; reduced pollution and greenhouse gas emissions; and a net benefit to the state's economy worth billions of dollars” ¹

- California Governor Gray Davis, Press Release, August 19, 2002



1. <http://www.gray-davis.com/ViewLibraryItem.aspx?ID=8272>

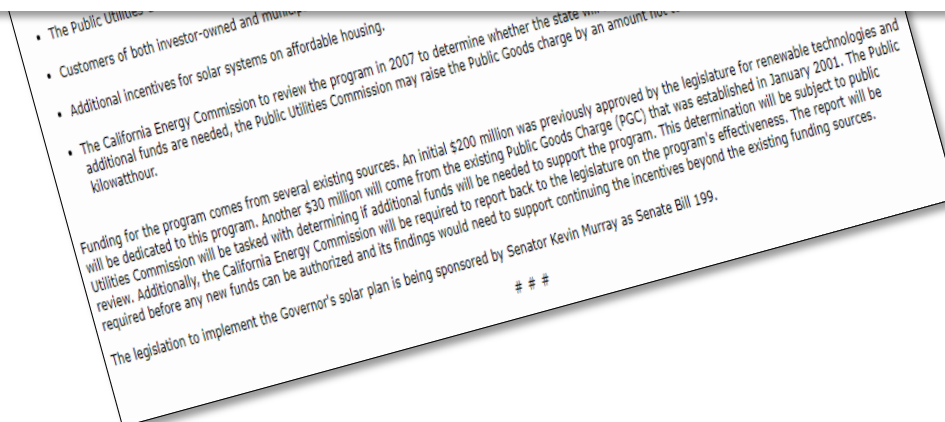
Appealing but inaccurate cost assessments...



Headline: One Million Solar Energy Systems in California Homes

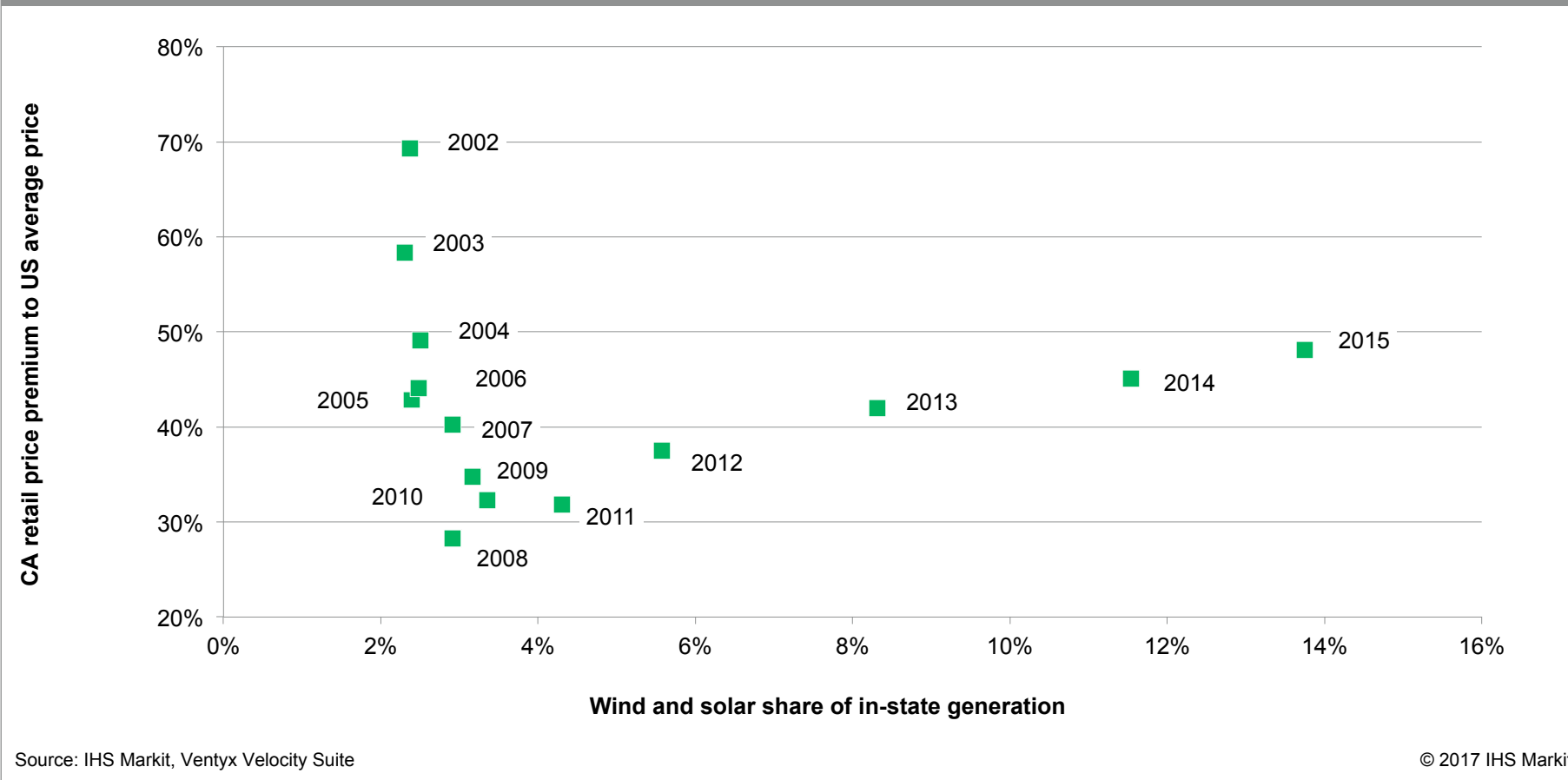
"This proposal is about smart, innovative and environmentally friendly technologies that will help improve the state's ability to meet peak electricity demand while cutting energy costs for homeowners for years to come"¹

- California Governor Arnold Schwarzenegger, Press Release, August 20, 2004

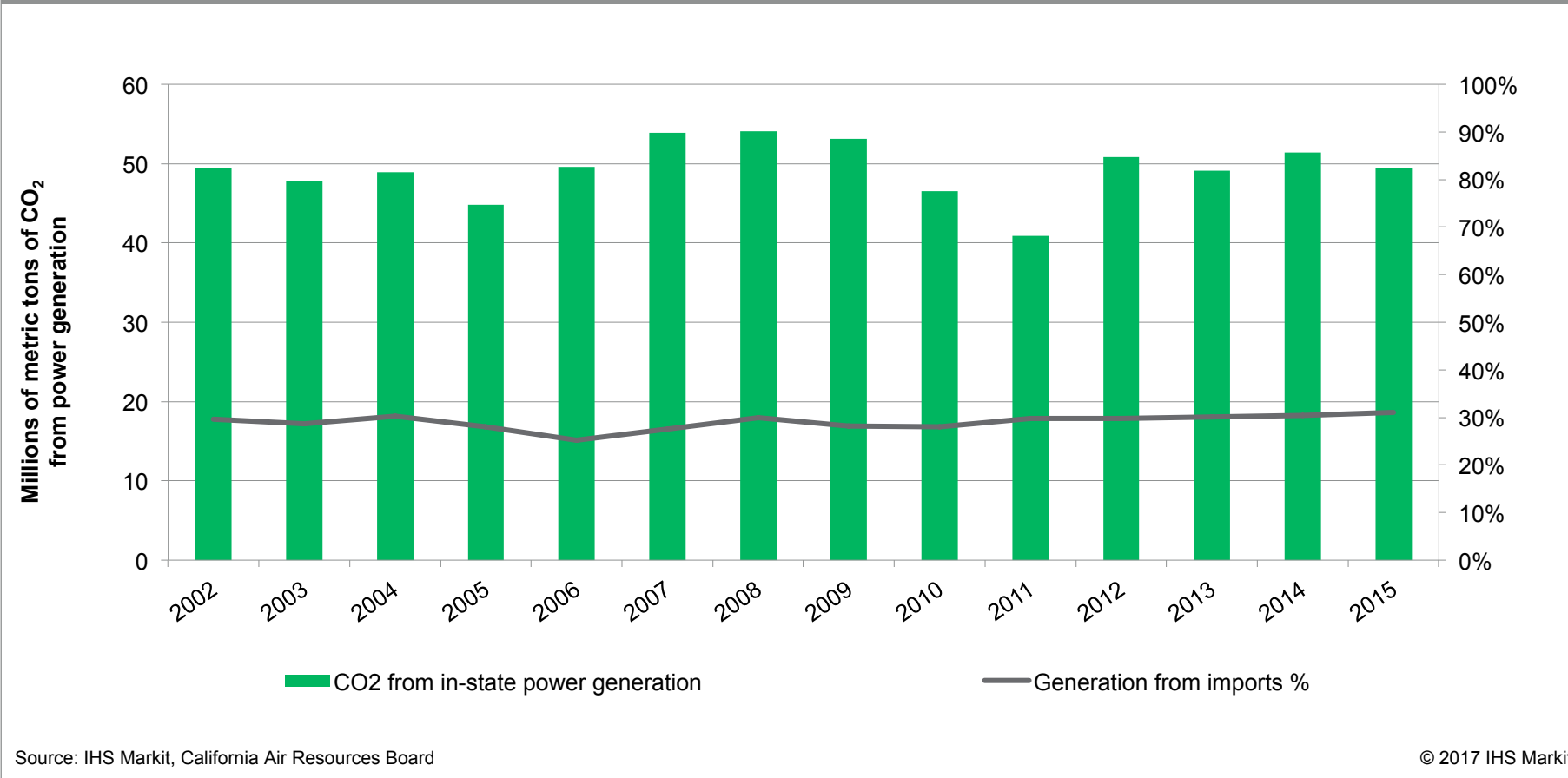


1. http://www.energy.ca.gov/releases/2004_releases/2004-08-20_governor_solar.html

California generation share of wind and solar and retail price premium to US average, 2002–2015



California in-state power generation CO₂ emissions and out-of-state electricity imports, 2002–2015



Appealing but inaccurate cost assessments...



Headline: SB 350: Golden State Standards

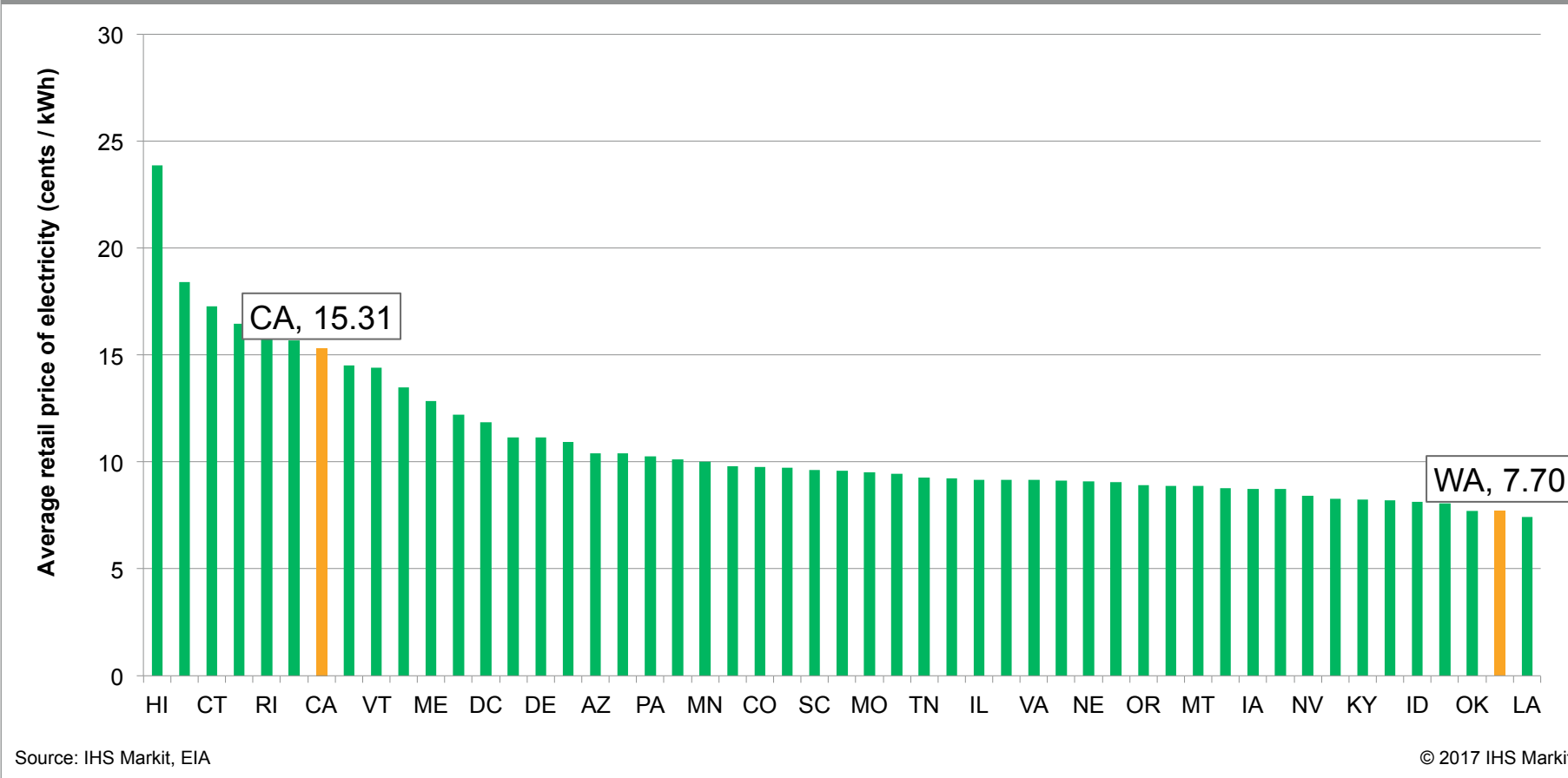
“Renewable energy is as cost-effective as fossil fuels and produces much less pollution. According to the International Renewable Energy Agency, renewable power generation costs in 2014 were either as cheap as or cheaper than coal, oil, and gas-fired power plants—even without financial support and despite drops in oil prices.”¹

- California Senators Kevin de León and Mark Leno, 2015

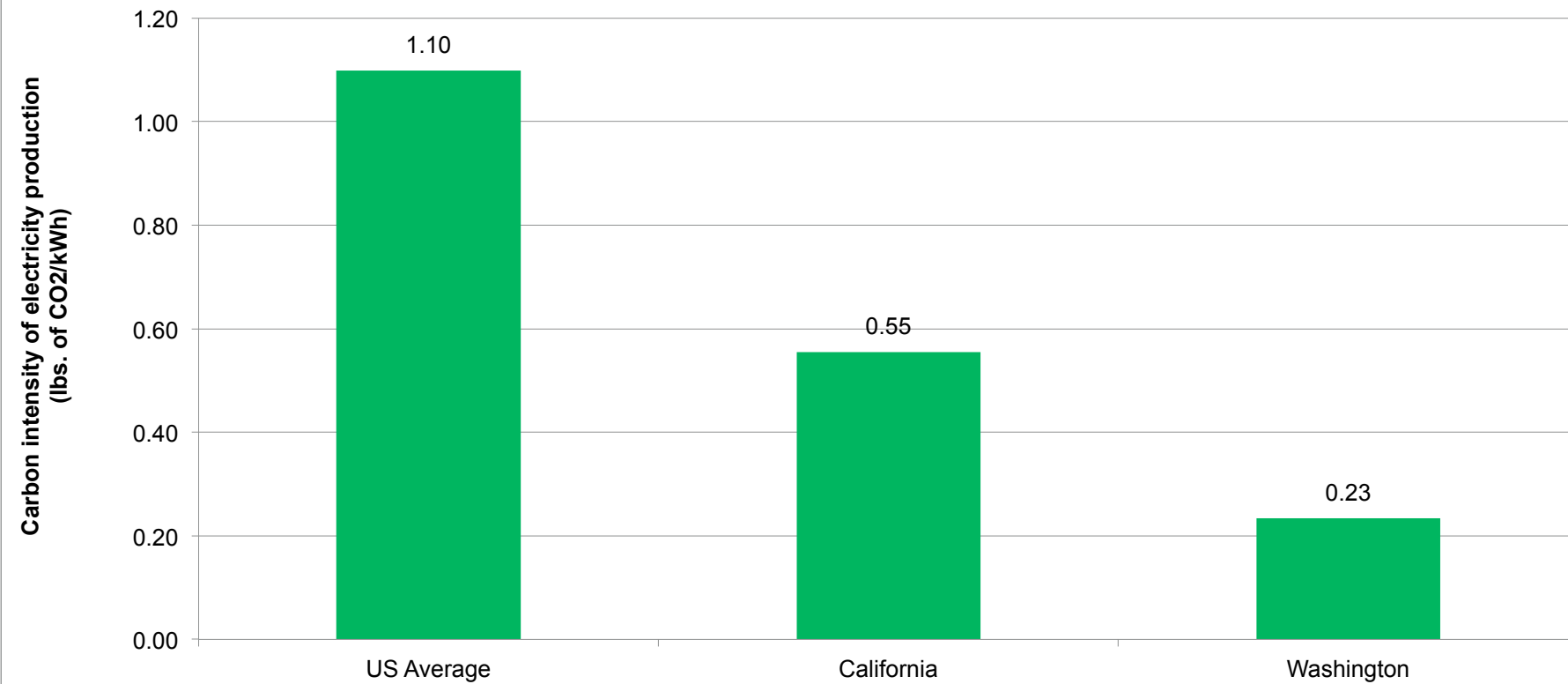
prices. Solar-p...
expensive than it was in...
Fifteen years ago, California enacted the mandate...
power from renewable sources. Prior to this mandate, ...
overall electrical mix in the state. Within 5 years of implementation...
or had purchased under contract, enough power to meet or exceed 20% RPS...
In 2011, Governor Brown signed legislation to increase RPS to 33% by the year 2020 [SB 2-1A...
Statutes of 2011]. Currently, most energy utilities have bought or have built enough energy resources to meet...
the 33% RPS before the target year. Also, according to numerous studies, California's RPS standard has...
created hundreds of thousands of new jobs, millions of new investment and tax dollars, and significant clean
air and climate benefits.
This legislation increases the RPS to 50% by the year 2030.
For a description of one pathway to achieve the 50% RPS please see the following fact sheet issued by the
California Energy Commission.

1. <http://focus.senate.ca.gov/sites/focus.senate.ca.gov/files/climate/505050.html>

US average retail price of electricity by state, 2016



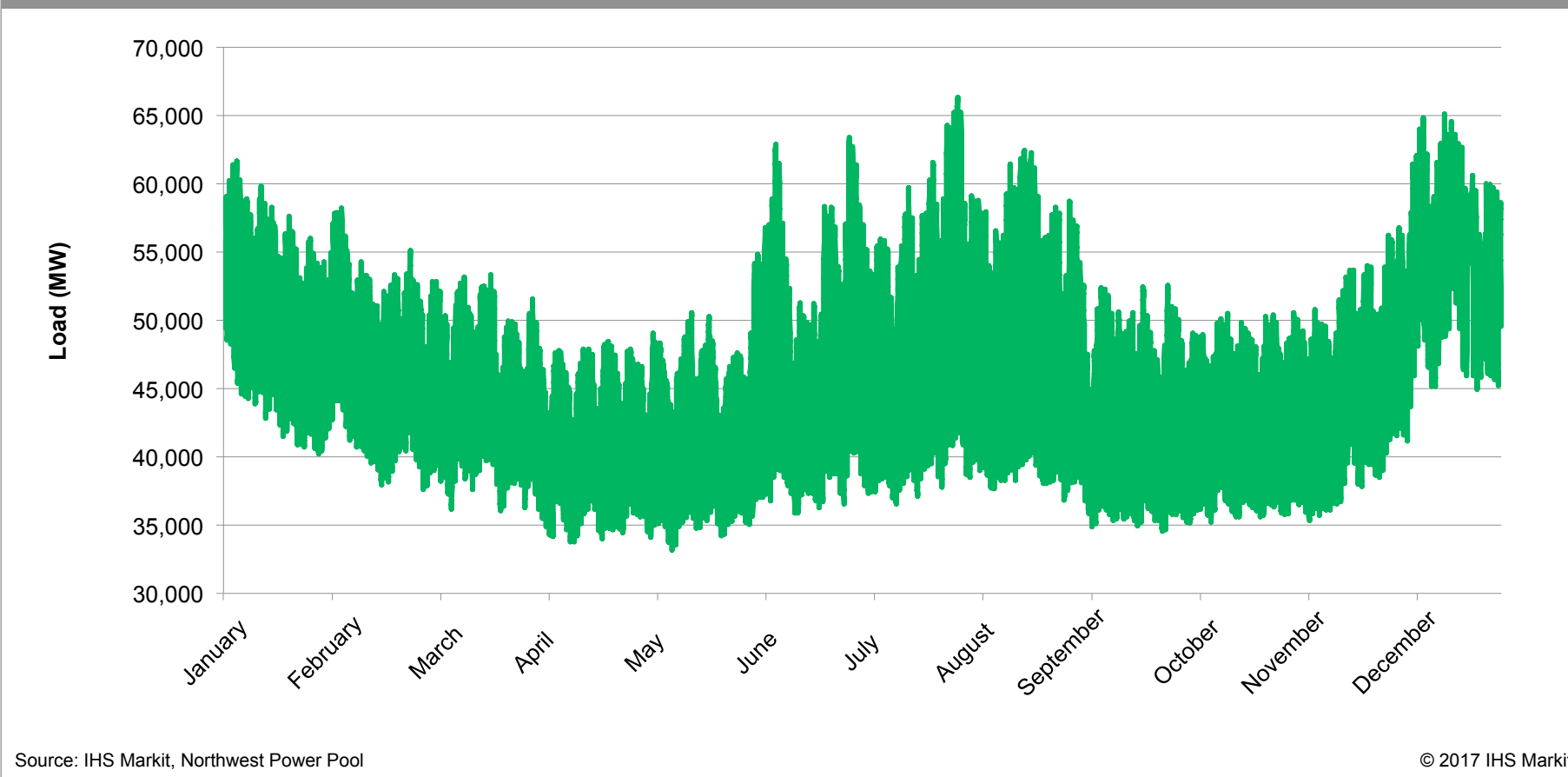
Carbon intensity of electricity production, 2015



Source: IHS Markit, EIA, CARB

© 2017 IHS Markit

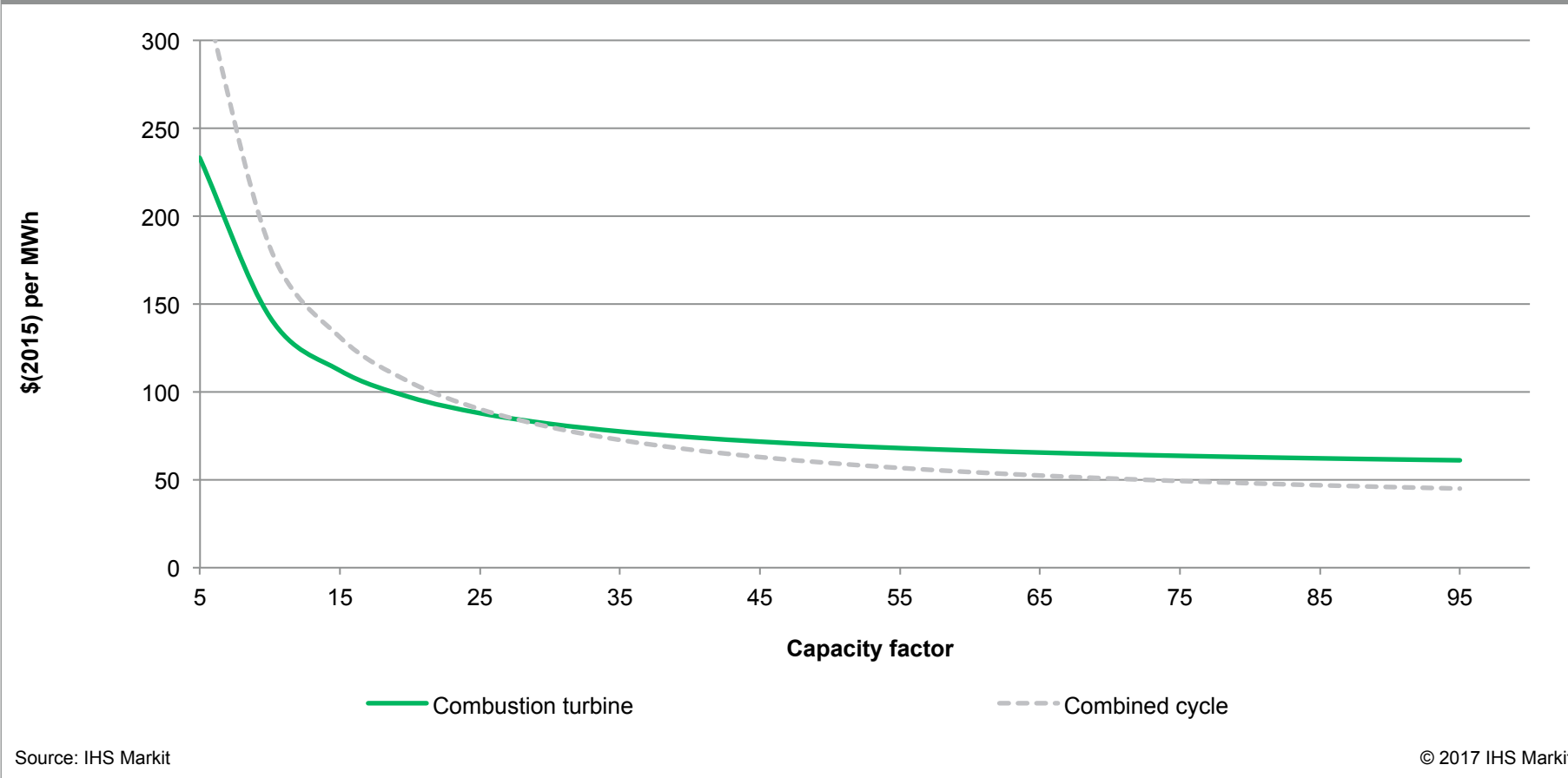
Northwest Power Pool hourly load, 2016



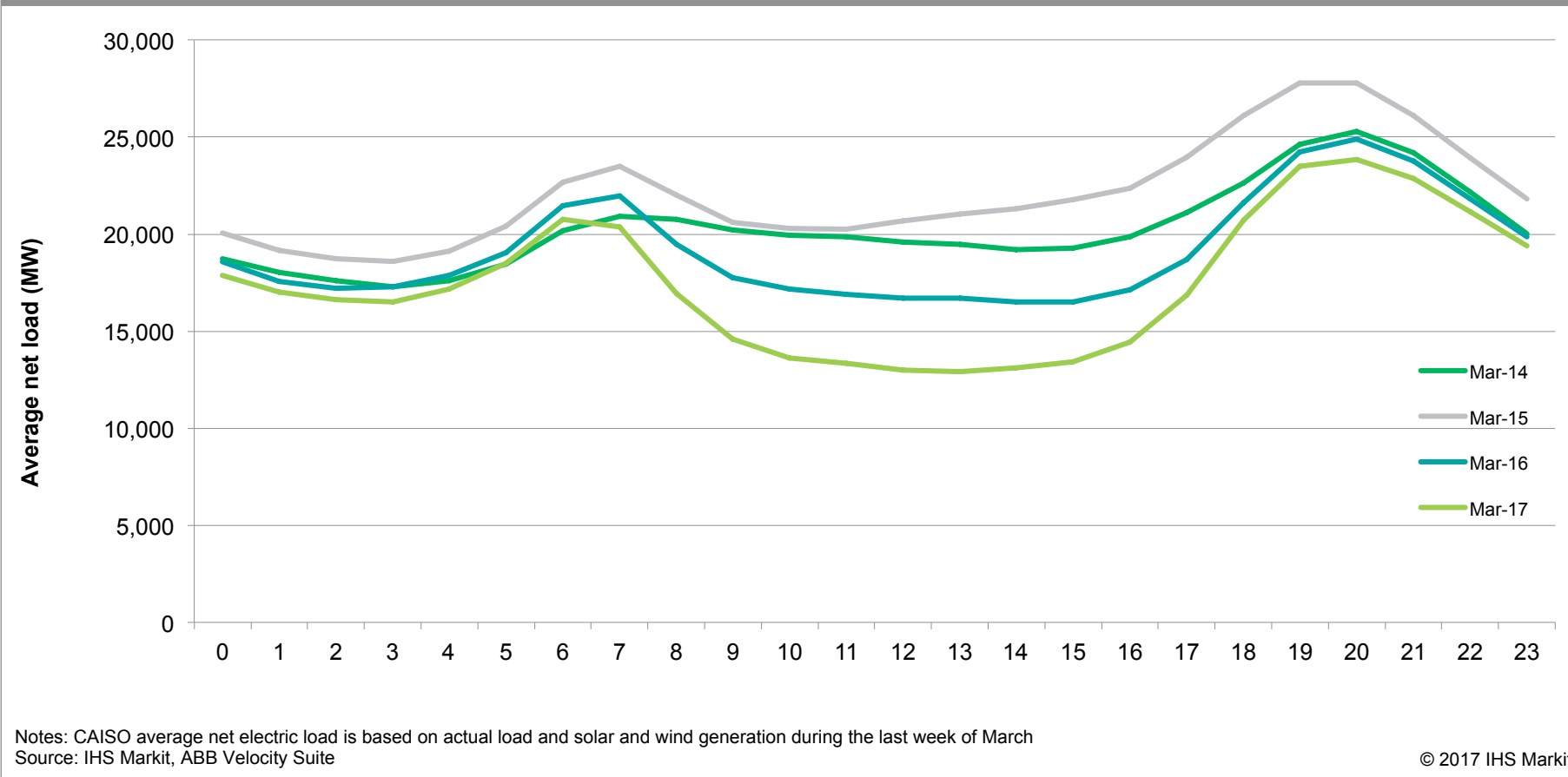
Source: IHS Markit, Northwest Power Pool

© 2017 IHS Markit

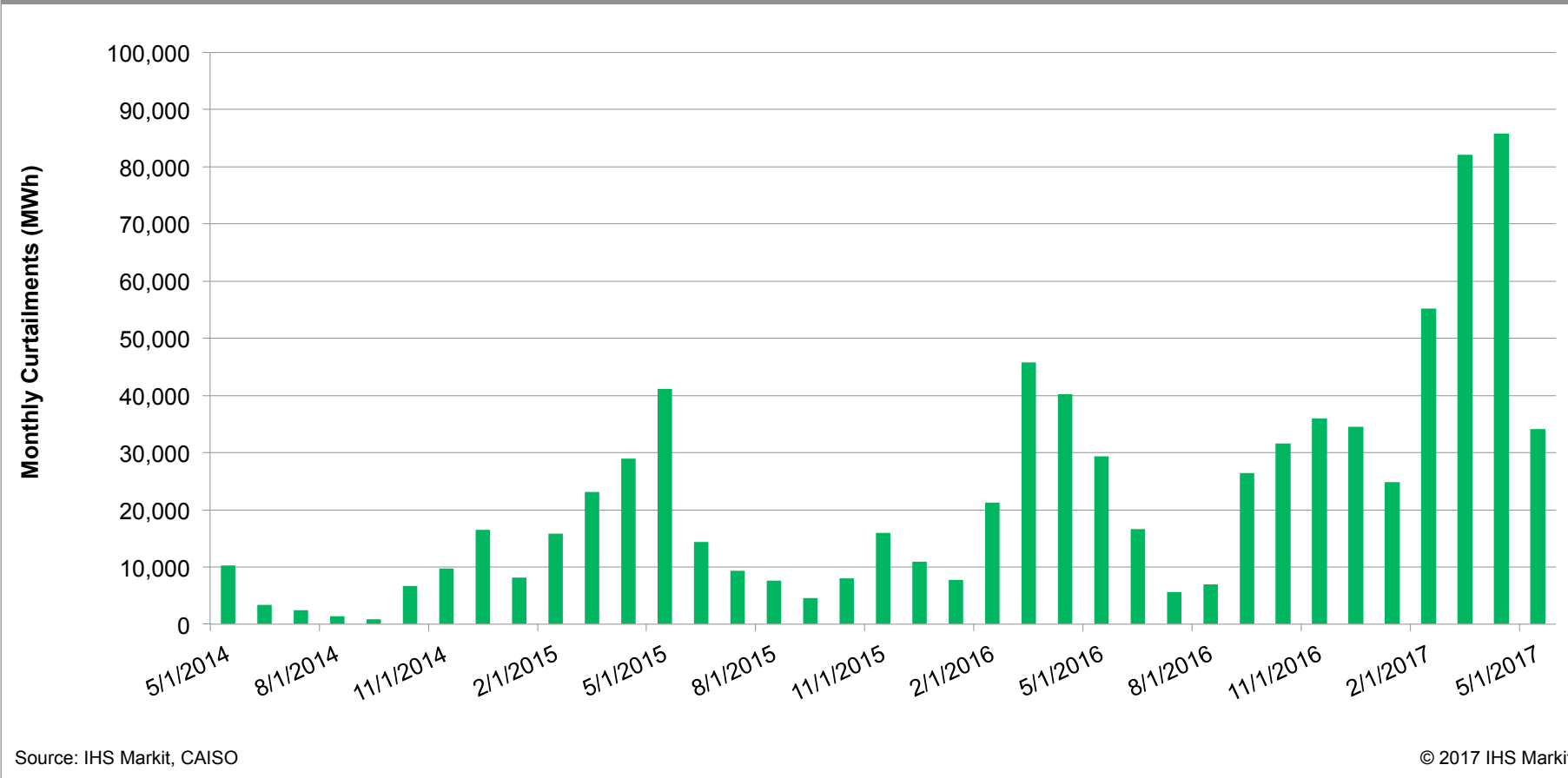
Annual levelized cost of energy versus capacity factor



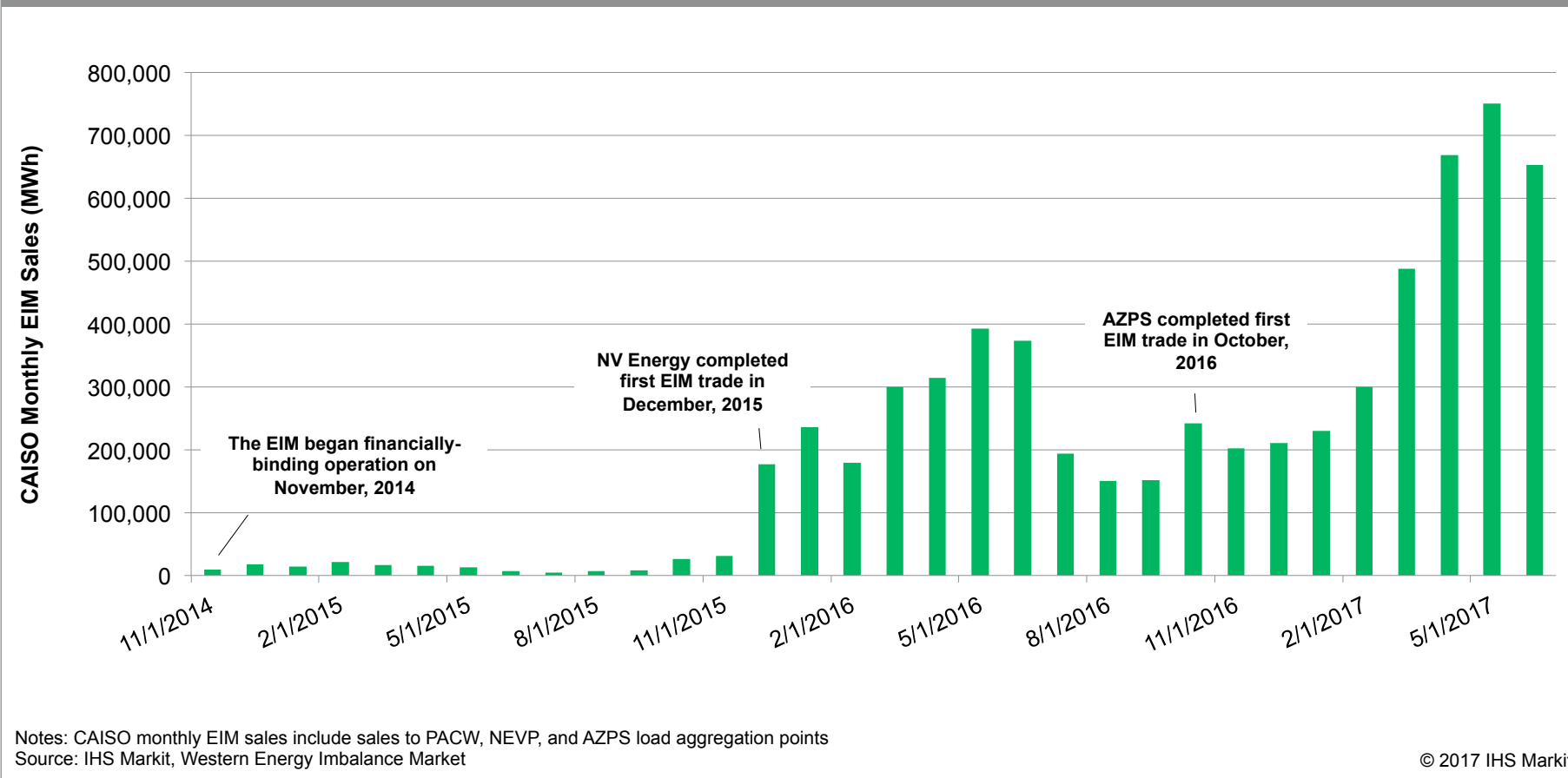
CAISO average net electric load / "Duck Curve", March 2014 - 2017



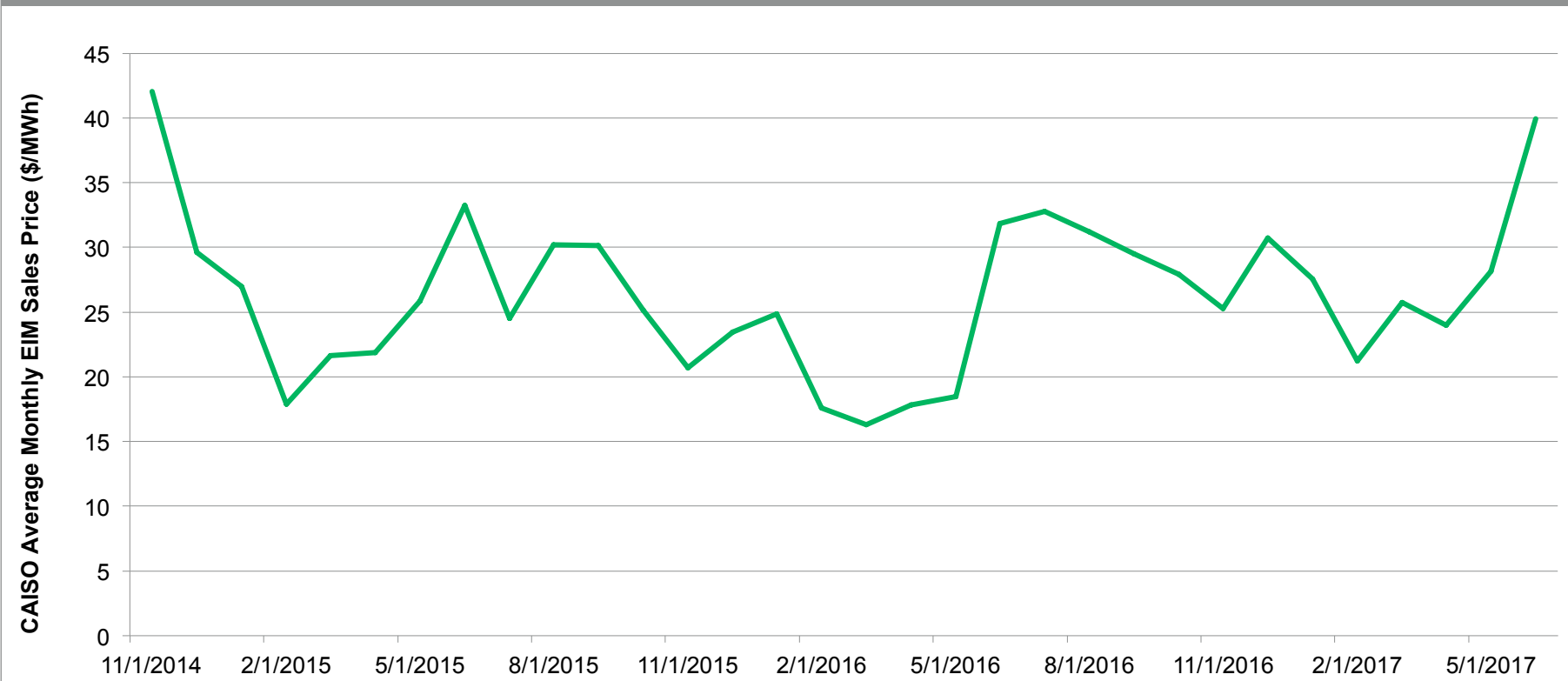
CAISO monthly solar and wind curtailments, May 2014 - May 2017



CAISO monthly EIM sales, November 2014 - June 2017



CAISO average monthly EIM sales price, November 2014 - June 2017



Source: IHS Markit, Western Energy Imbalance Market

© 2017 IHS Markit

IHS Markit Customer Care

CustomerCare@ihsmarkit.com

Americas: +1 800 IHS CARE (+1 800 447 2273)

Europe, Middle East, and Africa: +44 (0) 1344 328 300

Asia and the Pacific Rim: +604 291 3600

Disclaimer

The information contained in this presentation is confidential. Any unauthorized use, disclosure, reproduction, or dissemination, in full or in part, in any media or by any means, without the prior written permission of IHS Markit Ltd. or any of its affiliates ("IHS Markit") is strictly prohibited. IHS Markit owns all IHS Markit logos and trade names contained in this presentation that are subject to license. Opinions, statements, estimates, and projections in this presentation (including other media) are solely those of the individual author(s) at the time of writing and do not necessarily reflect the opinions of IHS Markit. Neither IHS Markit nor the author(s) has any obligation to update this presentation in the event that any content, opinion, statement, estimate, or projection (collectively, "information") changes or subsequently becomes inaccurate. IHS Markit makes no warranty, expressed or implied, as to the accuracy, completeness, or timeliness of any information in this presentation, and shall not in any way be liable to any recipient for any inaccuracies or omissions. Without limiting the foregoing, IHS Markit shall have no liability whatsoever to any recipient, whether in contract, in tort (including negligence), under warranty, under statute or otherwise, in respect of any loss or damage suffered by any recipient as a result of or in connection with any information provided, or any course of action determined, by it or any third party, whether or not based on any information provided. The inclusion of a link to an external website by IHS Markit should not be understood to be an endorsement of that website or the site's owners (or their products/services). IHS Markit is not responsible for either the content or output of external websites. Copyright © 2017, IHS Markit™. All rights reserved and all intellectual property rights are retained by IHS Markit.

