SunShot
U.S. Department of Energy

Photovoltaic System Pricing Trends

Historical, Recent, and Near-Term Projections
2015 Edition

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Contents

Introduction

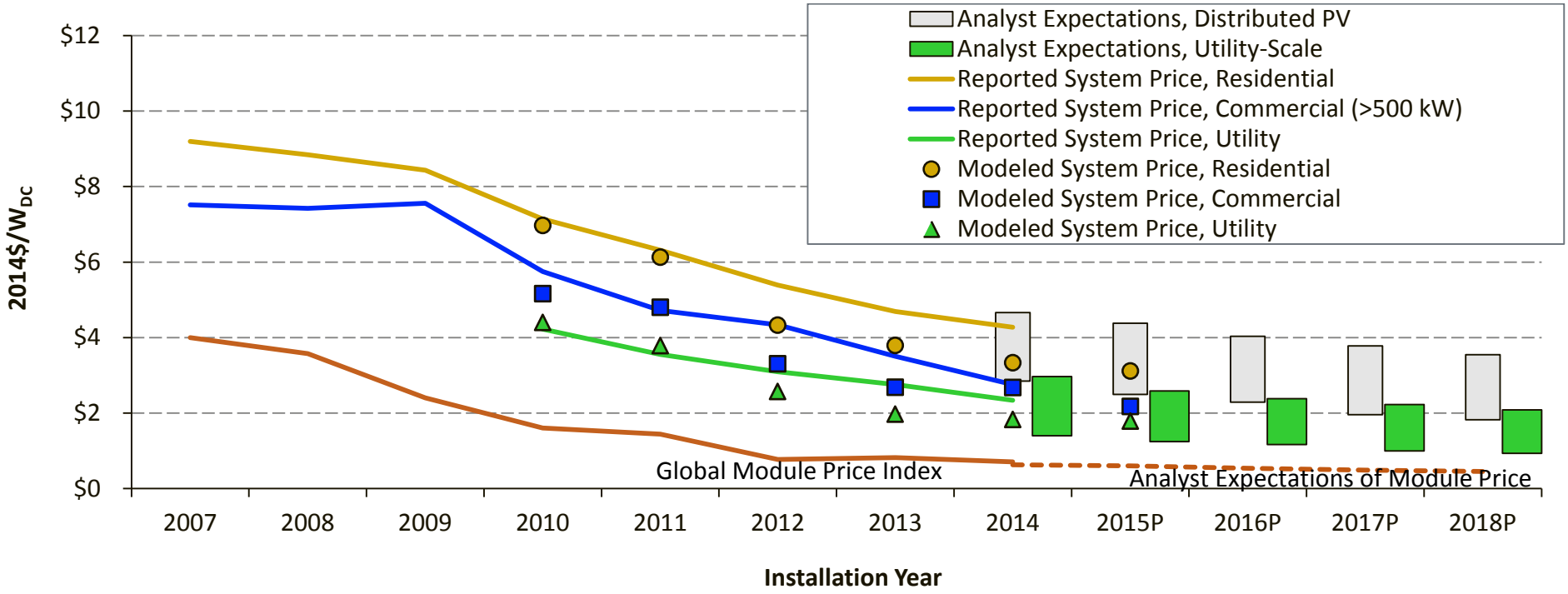
- **There is a need for reliable and comprehensive information on PV system pricing.**
  - Significant differences exist between various estimates of the cost and price of solar in the market; this briefing is designed to help clarify how to interpret these variances
  - Rapid market growth and rapid changes to PV system pricing in recent years has created a need to clearly distinguish between historical, current, and projected pricing
  - Policy support for PV deployment is premised on stimulating cost reductions through market scale and development
  - The DOE SunShot Initiative seeks to reduce PV system prices by 75% over the 2010-2020 period.
- **This briefing provides a high-level overview of historical, recent, and projected near-term PV system pricing trends in the United States, drawing on several ongoing research activities at LBNL and NREL:**
  - LBNL's annual *Tracking the Sun* and *Utility-Scale Solar* report series ("reported system prices")
  - NREL's bottom-up PV cost modeling ("modeled system prices")
  - NREL's synthesis of PV market data and projections.

Executive Summary

- Reported pricing for PV system installations *completed* in 2014 based in part on data reported to PV incentive programs:
  - Residential was **$4.27 /W** (median 6 kW)
  - Non-residential (>500 kW) was **$2.76/W** (median 1.1 MW); Non-residential (≤500 kW) was **$3.90/W** (median 30 kW)
  - Utility-scale (≥5 MW, ground-mounted) was **$2.08/W** (median (fixed-tilt) 14 MW).
- Modeled solar PV system prices, using industry validated tools, *quoted* in Q4 2013 (and expected to be installed in 2014):
  - Residential (5 kW) was $**3.33/W**
  - Commercial (223 kW) was **$2.68/W**
  - Utility-scale (185 MW) was **$1.83/W.**
- The delta between reported and modeled pricing is due to various factors pertaining to the inherent variability in the type of systems that are installed each year, their location, state and federal policies, and the ability of buyers and sellers to agree to a sales price (which may be effected by supply/demand market factors). Because the U.S. solar market is both heterogeneous and dynamic, these factors change location by location and year by year, which can influence the overall trends within the marketplace.
- Reported system prices of residential and commercial PV systems declined 6%–12% per year, on average, from 1998–2014, and by 9%–21% from 2013–2014, depending on system size.
- Market analysts expect system prices to continue to fall, but for module prices to stabilize in the near-term.
- Modeled system prices quoted in Q1 2015 (and expected to be installed in 2015):
  - Residential (5 kW) was $**3.12/W**, a reduction of 7% from Q4 2013
    - This is consistent with the large residential installers' pricing, such as SolarCity's ($2.95/W) and Vivint's ($3.21/W) reported Q1 2015 costs, plus a reasonable operating profit margin
  - Commercial (200 kW) was **$2.17/W**, a reduction of 19% from Q4 2013
  - Utility-scale (185 MW) was **$1.78/W**, a reduction of 2% from Q4 2013.

Note: All PV installed price data are reported in terms of real 2014 dollars per Watt-DC.

Reported, Bottom-up, and Analyst-Projected Average U.S. PV System Prices over Time



- All methodologies show a downward trend in PV system pricing
- Reported pricing and modeled benchmarks historically had similar results; however, they have recently diverged in estimated pricing.

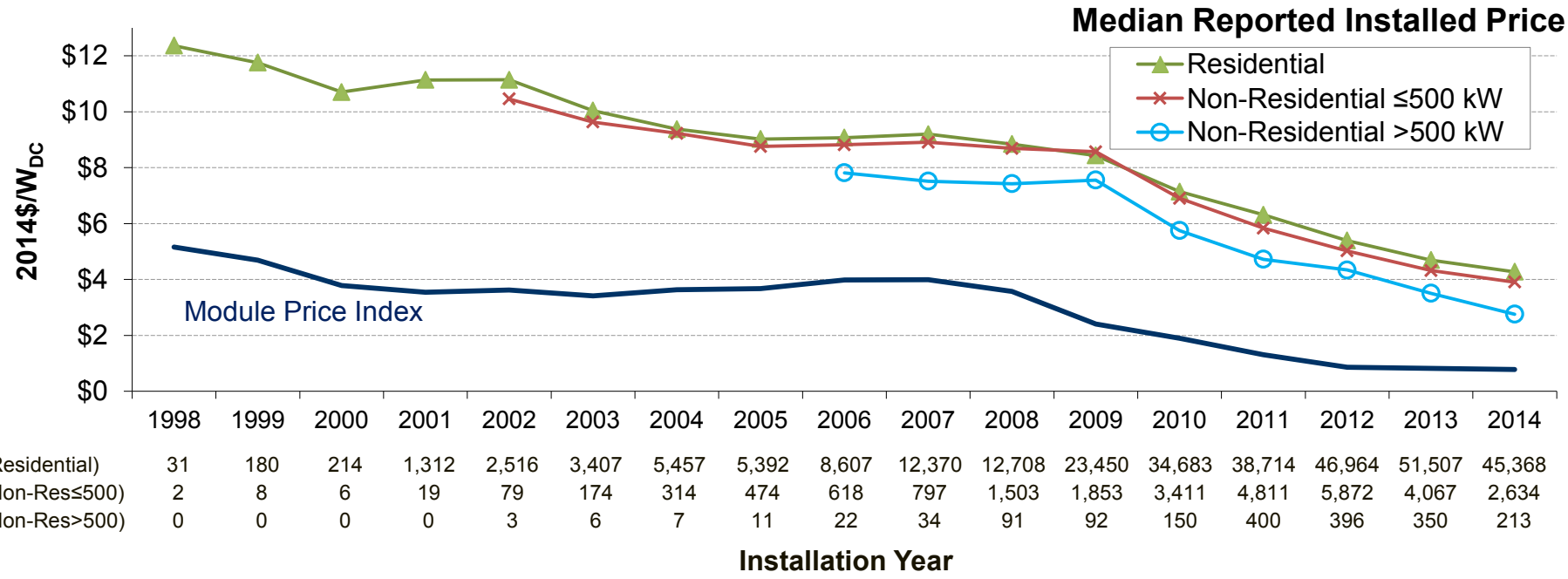
Note: The reported system price for the residential market is the median price of residential systems, with a median project size of 6.1 kW in 2014. The modeled residential system price represents a ~5 kW system. The reported system price for the commercial market is the median price reported for commercial systems greater than 500 kW, with a median project size of 1.1 MW in 2014. The modeled commercial system price represents a ~200 kW rooftop system. The reported system price for the utility-scale market is the median reported price for ground-mounted systems greater than or equal to 5 MW in size, with a median project size of 23 MW in 2014. The modeled system price of utility-scale systems represents a ~100 MW fixed-tilt ground-mounted system. Modeled system prices for all sectors are representative of bids issued in the fourth quarter of the previous year. Sources of analyst expectations located on slide 30. The Global Module Price Index is the average module selling price for the first buyer (P Mints SPV Market Research).

Contents

Data Sources and Methodology: Residential and Non-Residential PV

- Data and analysis excerpted from LBNL's *Tracking the Sun VIII* report
- Residential and non-residential PV defined to consist of projects <5 MW and/or roof-mounted, regardless of whether connected to customer-side of meter
- Median prices derived from project-level data reported for systems installed through year-end 2014 (and from a more limited set of states for H1 2015)
  - Data are self-reported by installers and likely subject to some inconsistency in reporting practices
- Project-level data obtained from ~50 program administrators, spanning 42 states, and including more than 400,000 systems
  - Preliminary sample represents 81% of all U.S. residential and commercial PV capacity installed through 2014 and 62% of capacity installed in 2014
- Projects for which reported prices represent appraised values, rather than prices paid to the installer/EPC, were removed from the final data sample
- Final Data Sample: Roughly 320,000 systems installed from 1998-2014, totaling 6,000 MW installed capacity.

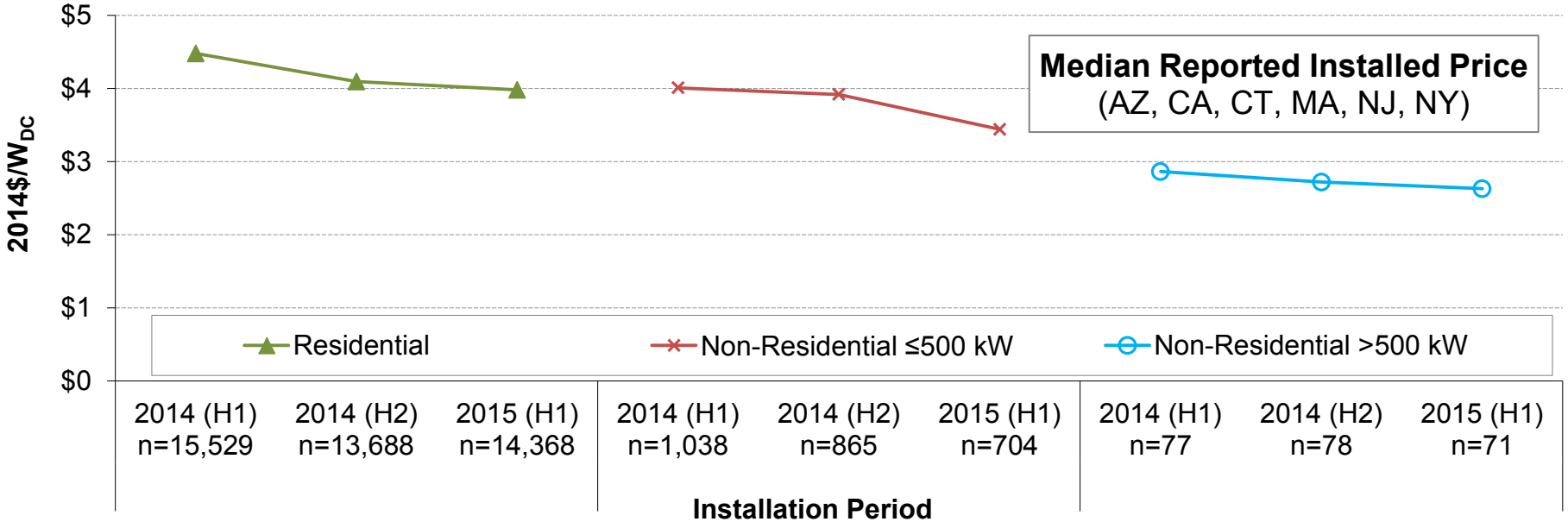
Median Reported Installed Prices of Residential and Non-Residential PV Systems over Time



Note: Median installed prices are shown only if 20 or more observations are available for the customer segment. The Module Price Index is the U.S. module price index published by SPV Market Research.

- Since 1998, reported PV system prices have fallen by roughly $0.50/W per year on average
- From 2013 to 2014, reported prices fell by $0.42/W (9%) for residential systems and by $0.75/W (21%) for large non-residential systems >500 kW
- By comparison, U.S. annual average module prices fell by $0.04/W from 2013-2014.

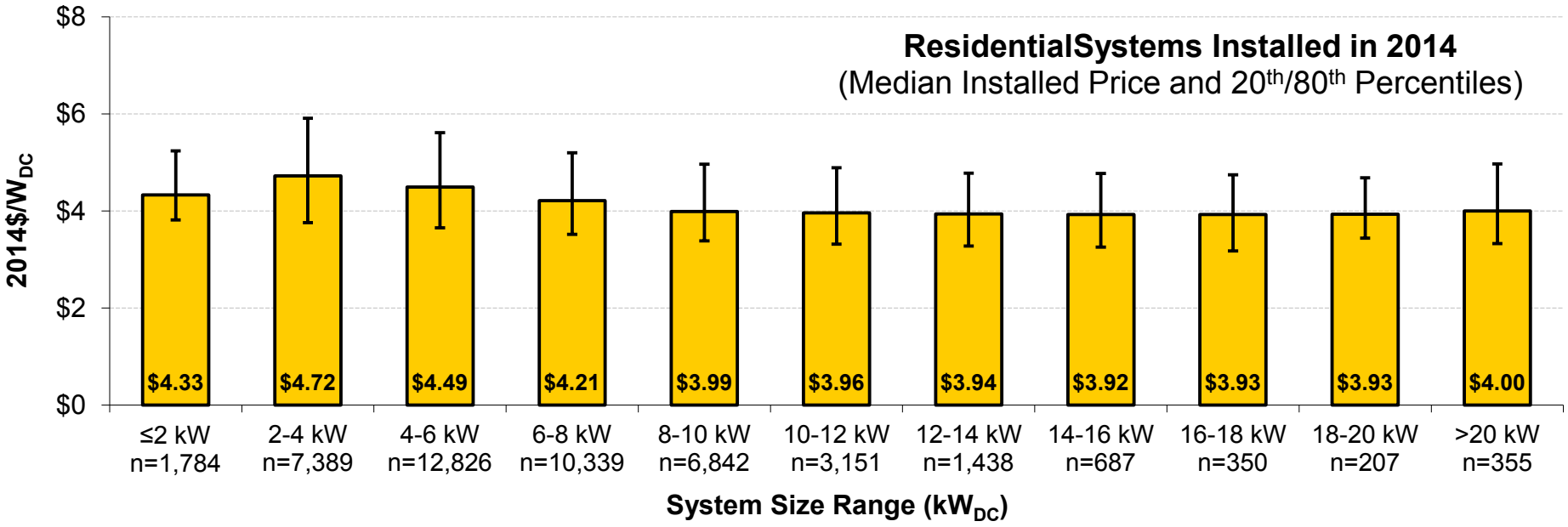
Preliminary Price Trends for Systems Installed in H1 2015 from a Subset of State Markets



Note: The 2014 and H1 2015 values in this figure are based on data from a smaller set of states than elsewhere in this section, and thus the 2015 values differ from the national median values cited previously.

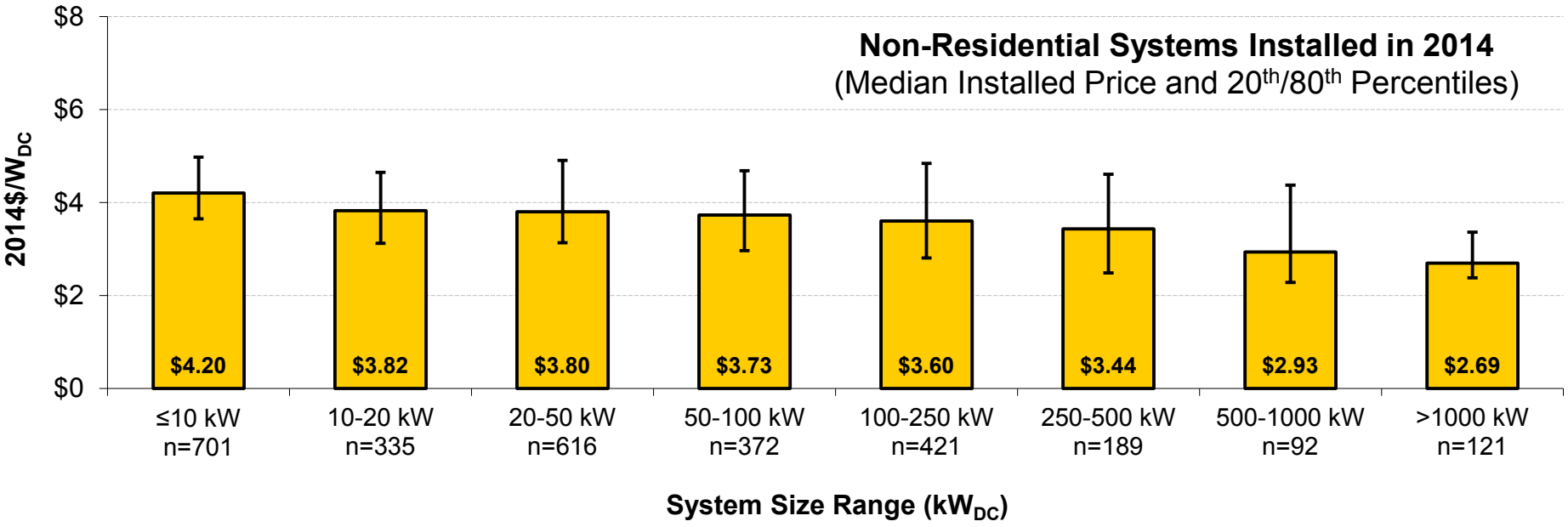
- Installations in a number of the larger PV incentive programs and state markets have shown continued price declines into H1 2015
- Median reported prices fell by roughly $0.18-0.33/W (6-13%) in H1 2015, relative to 2014, across the customer segments shown.

Variation in Reported Price by System Size: Residential PV Systems in 2014



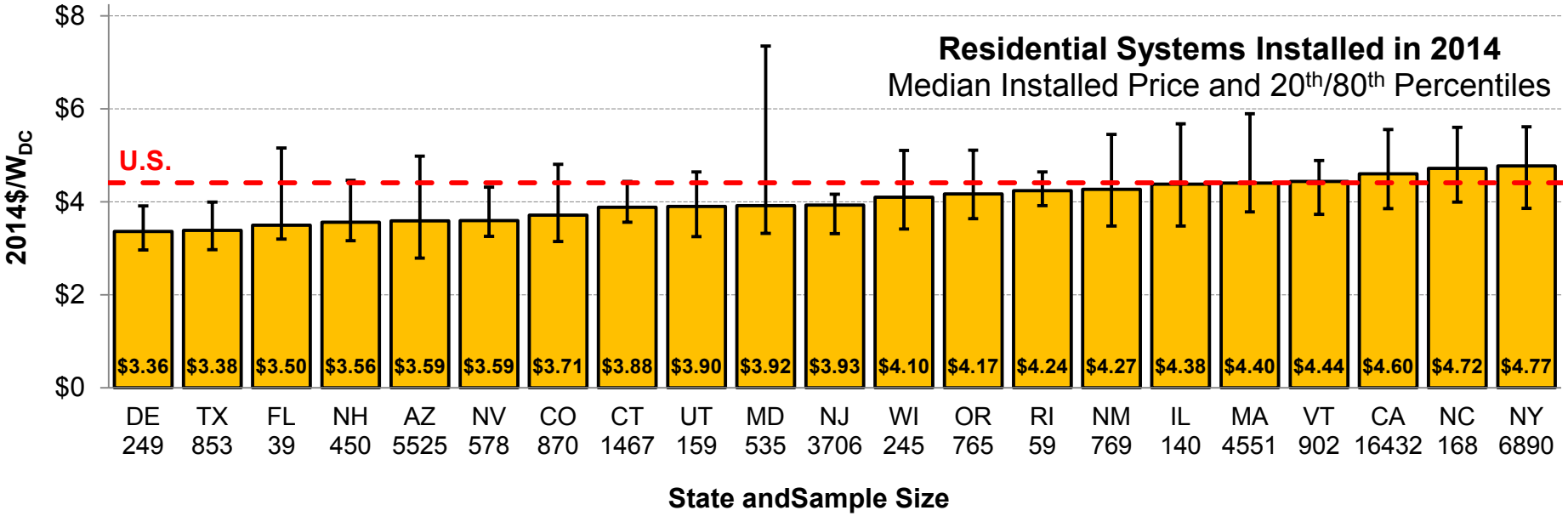
- Economies of scale for residential systems most apparent within the range of 2 to 10 kW, where the vast majority of residential systems reside, with reported installed prices 15% lower for systems 8-10 kW in size compared to 2-4 kW systems
- Low prices for systems ≤2 kW are associated with the high concentration of systems installed in new construction.

Variation in Reported Price by System Size: Non-Residential PV Systems in 2014



- Economies of scale for non-residential systems are gradual, but significant across the broad range of system sizes, with prices 36% lower for the largest class of non-residential systems >1,000 kW in size compared to the smallest non-residential systems ≤10 kW
- As with residential systems, substantial variability in reported prices exists within each system size range, reflecting different regional drivers of pricing, which may include market and policy dynamics, project/site-specifics, and installer specifics.

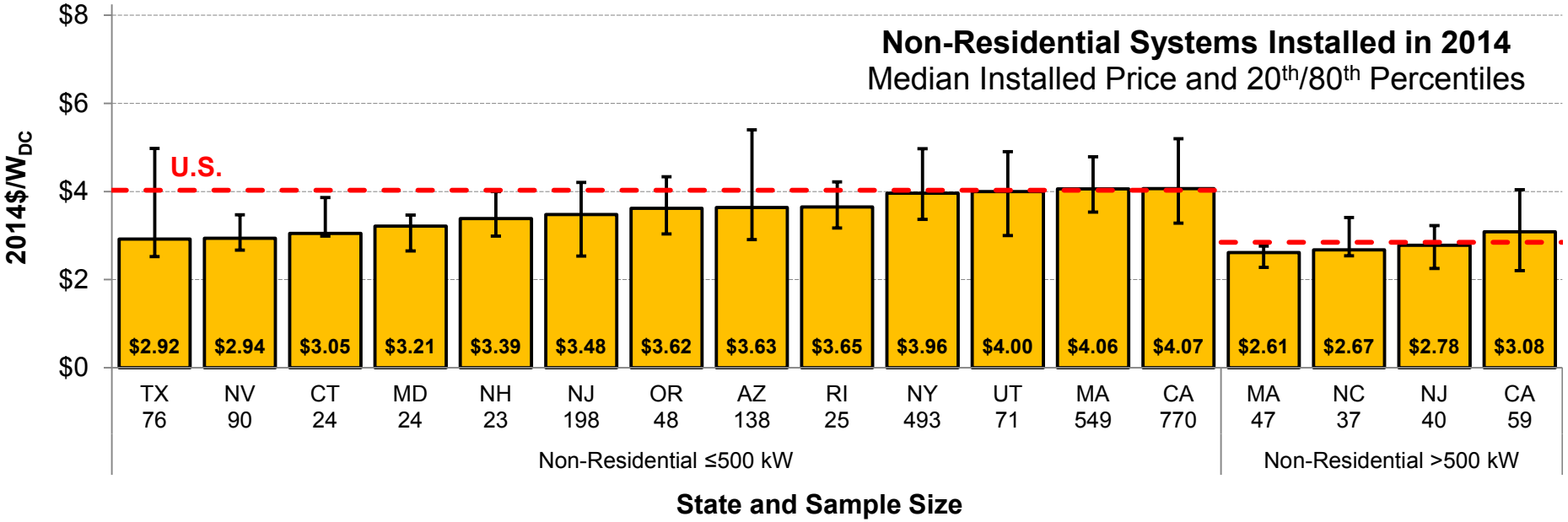
Variation in Reported Price by State:
Residential PV Systems in 2014



Note: Numbers below each state indicate the number of observations; installed price data are shown only if 20 or more observations are available for a given state.

- The median reported price differs by ~$1.40/W between the lowest- and highest-priced states, though similar variability also exists *within* most individual states
- Reported prices in several large state markets (CA, MA, NY) pull the U.S. median upwards
- Reported price differentials across states reflect a wide array of potential factors, including: market size and maturity, incentive levels, sales taxes, administrative costs, labor costs, and project characteristics.

Variation in Reported Price by State: Non-Residential PV Systems in 2014



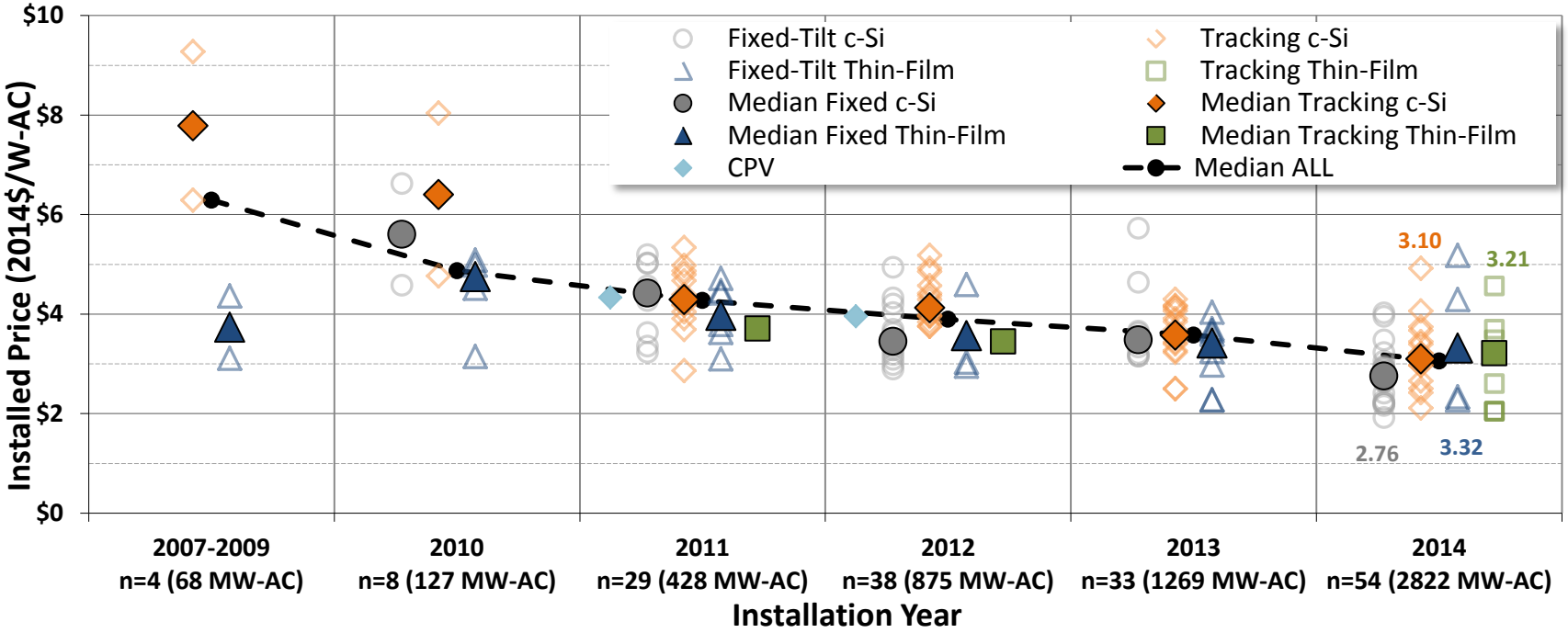
Note: Numbers below each state indicate the number of observations; installed price data are shown only if 20 or more observations are available for a given state.

- Median reported prices also vary widely across states for small non-residential systems (i.e., a difference of $1.15/W between the lowest- and highest-priced states)
- For large non-residential systems, few states have a sufficient number of systems to justify comparison, though even among this limited set installed prices can differ
- Cross-state variation for non-residential systems reflects the same kinds of factors cited on prior slide for residential (e.g., preponderance of large ground-mounted systems in NC, non-profit and public agency projects in CA, etc.).

Data Sources and Methodology: Utility-Scale Solar

- Data and analysis excerpted from LBNL's *Utility-Scale Solar 2014* report
- Utility-scale defined as ground-mounted systems ≥5 MW, regardless of whether electricity is delivered to utility or customer
  - Analysis considers only entire projects (not individual phases)
- Data sourced from FERC Form 1, Section 1603 Grant Program, SEC filings, company presentations, trade press, interviews with developers and owners
- Project sample consists of 170 fully operational projects installed through year-end 2014, totaling roughly 7,490 MW_{DC}, 5,874MW_{AC} (87% of total U.S. utility-scale)
- A few important caveats:
  - Significant and uncertain lags exist between when projects are contracted and installed (i.e., prices reported for projects installed in 2014 may reflect PPAs or EPC contracts signed in 2010-2013)
  - Data reliability is mixed, depending on data sources available for any individual project, with possible inconsistencies in the scope of cost components captured.

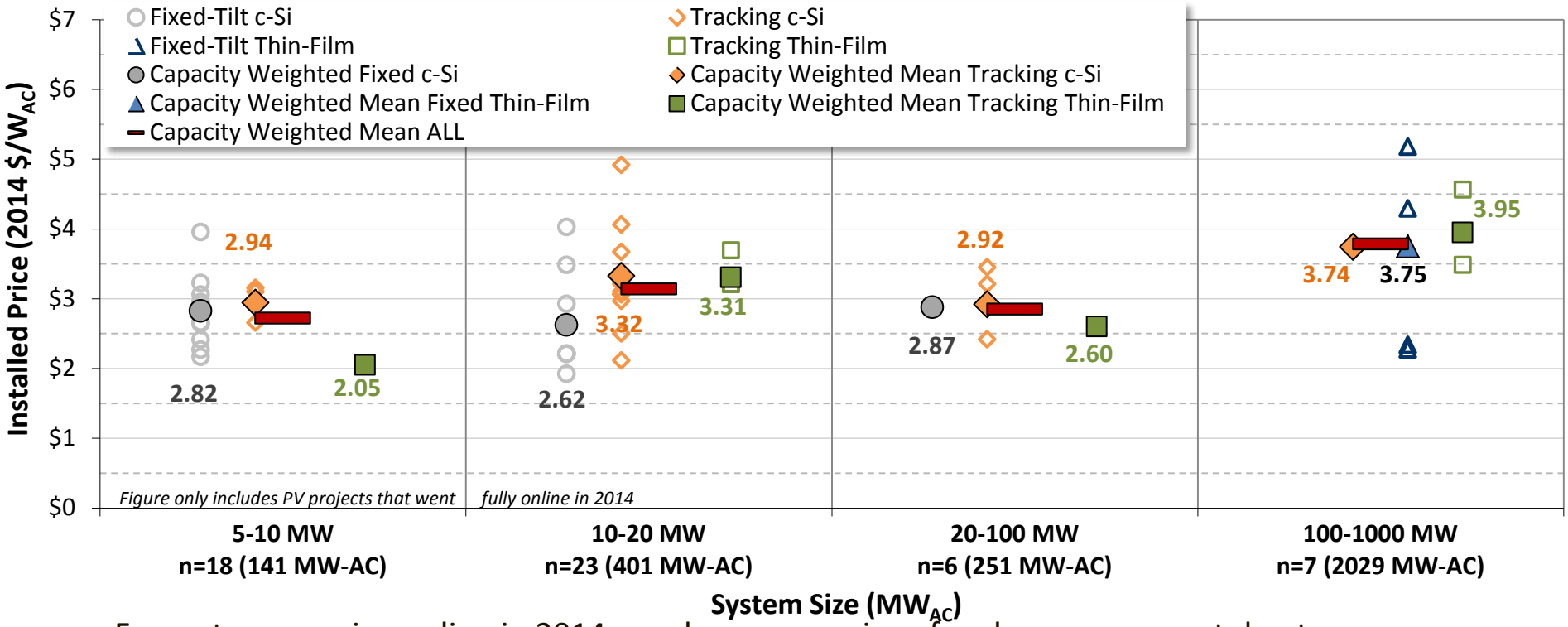
Reported Price of Utility-Scale PV Projects over Time



- Median prices have continuously declined, decreasing form \$3.51/W_{DC} in 2011 to \$2.34/W_{DC} in 2014. We see little movement in capacity-weighted average prices since 2012 as large projects pull up the mean
- Median prices were \$2.08/W_{DC} (\$2.76/W_{AC}) for crystalline, fixed-tilt; \$2.44/W_{DC} (\$3.10/W_{AC}) for crystalline with tracking; \$2.53/W_{DC} (\$3.32/W_{AC}) for thin-film, fixed-tilt; and \$2.34/W_{DC} (\$3.21/W_{AC}) for thin-film with tracking systems completed in 2014
- The majority of 2014 systems fall within a range of roughly \$1.78/W_{DC} (\$2.32/W_{AC})to \$2.83/W_{DC} (\$3.52/W_{AC}).

Note: ***Installed price in this graphic uses the unit \$/Watt$_{AC}$***, unlike the majority of this report which uses \$/Watt$_{DC}$. Utility-scale power plants are often referred to based on their AC ratings, particularly by utility companies.

Variation in Reported Price of 2014 Utility-Scale PV Projects by Size and Configuration



- For systems coming online in 2014, no clear economies of scales are apparent due to:
  - Technology and location-specific issues
  - Larger systems often have longer time lag between PPA execution and project completion and thus, may portray an earlier pricing environment (e.g., 2-4 years earlier for some of the largest utility-scale systems – for example the 348 MW_{AC} Agua Caliente Project).

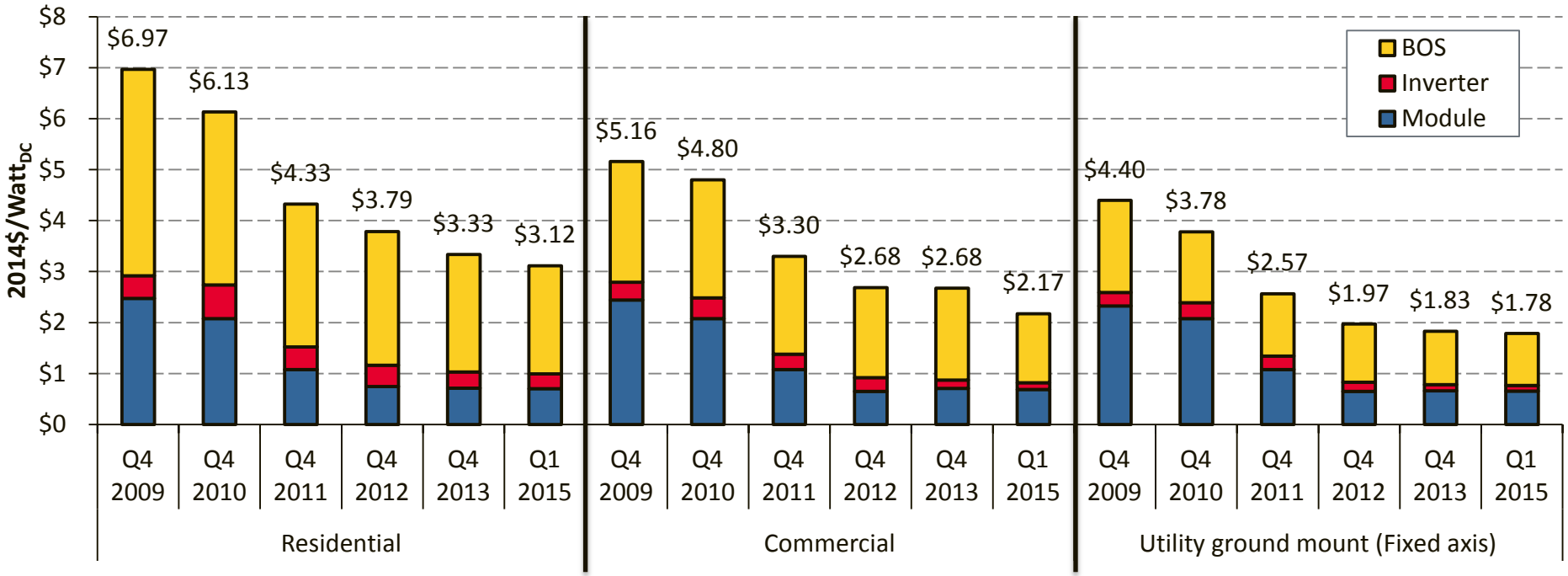
Note: ***Installed price in this graphic uses the unit $/Watt$_{AC}$***, unlike the majority of this report which uses $/Watt$_{DC}$. Utility-scale power plants are often referred to based on their AC ratings, particularly by utility companies.

Contents

Methodology for Bottom-up Modeling

- Detailed system pricing models for specific PV system designs were developed in collaboration with industry and account for all materials, labor, overhead and profit, land acquisition and preparation costs, and regulatory costs for a PV system up to the point of grid tie-in
  - Better able to determine individual components' contributions to total system price
- Input data for NREL models are compiled from numerous industry and primary sources, for each component of a system incurred by a manufacturer and/or installer, and validated with manufacturers and installers (more detail on this methodology can be found in Chung et al. 2015)
  - This approach allows for greater specificity and benefits from manufacturer and installer feedback on results
- Modeled prices represent installer bid or quoted prices for the time periods noted
- Modeled system sizes are specified for each market segment, and are described below the figures.

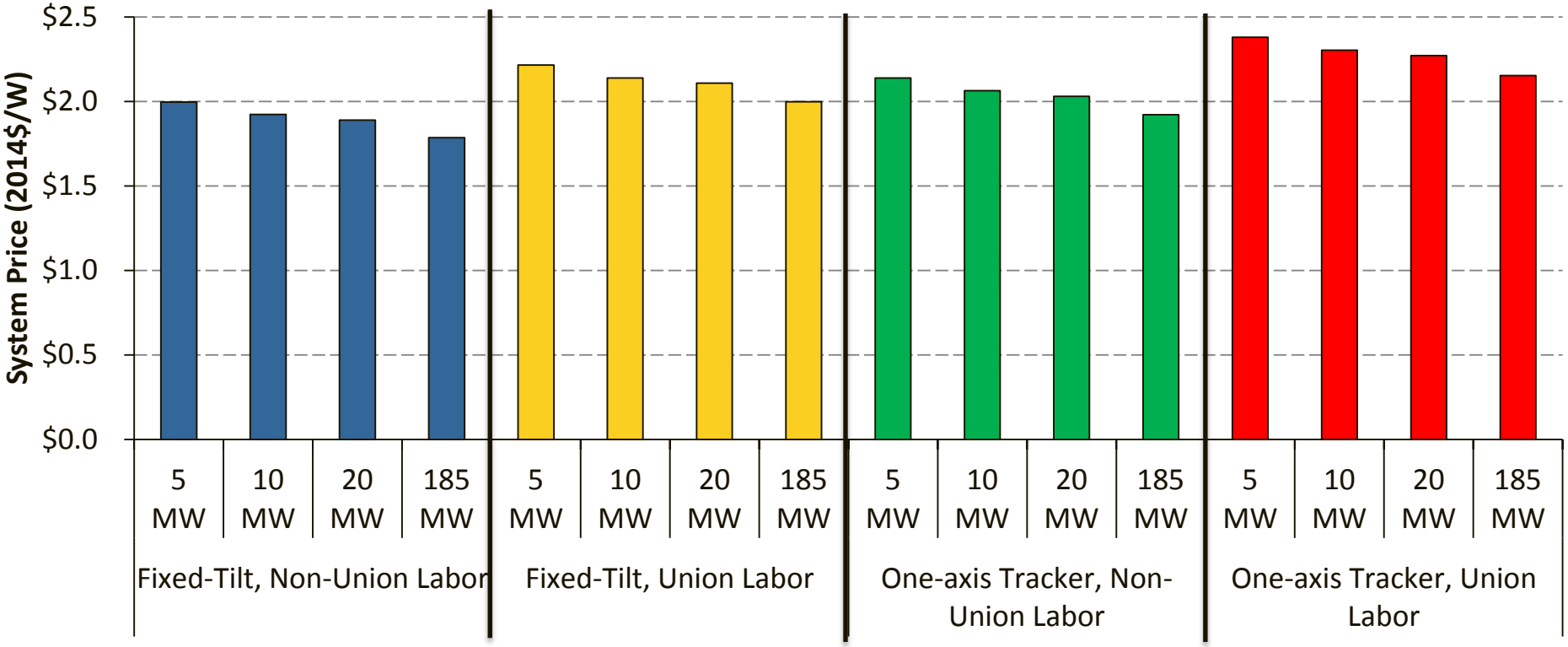
Bottom-up Modeled System Price of PV Systems by Sector, Q4 '09 – Q1 '15



- Since Q4 2009, modeled system prices fell between 15% – 17% per year
  - 45% - 65% of reduction attributed to module price reductions
- From Q4 '13 to Q1 '15, modeled system prices fell between $0.05/W - $0.42/W, or 3-16%
- Q1 2015 bottom-up modeled residential system price of $3.10/W is consistent with leading residential installers' pricing, such as SolarCity's ($2.95/W) and Vivint's ($3.21/W) reported Q1 2015 costs, plus a reasonable operating profit margin.

Note: Standard crystalline silicon modules (13.5% efficiency in Q4 2009 to 16.0% in Q1 2015). System sizes: residential: 5 kW in Q4 2009 through Q4 2013; commercial: 202 kW in Q4 2009 to 223 kW in Q4 2012 (200 kW in Q1 2015); utility-scale: 100 MW in Q1 2015 to 185 MW to Q4 2013). Modeled system sizes in the residential and commercial rooftop sectors were chosen based on typical system sizes, then adjusted for optimal inverter configuration. System sizing for utility-scale benchmarks were chosen for comparison purposes against pricing reported from DOE's Energy Information Administration (2010).
Sources of installer's costs: 1) SolarCity. (2015). "Cost Calculation Methodology." Accessed June 25, 2015: http://investors.solarcity.com/events.cfm. 2) Vivint. (2015). "Estimated Cost per Watt Methodology." May 12, 2015.

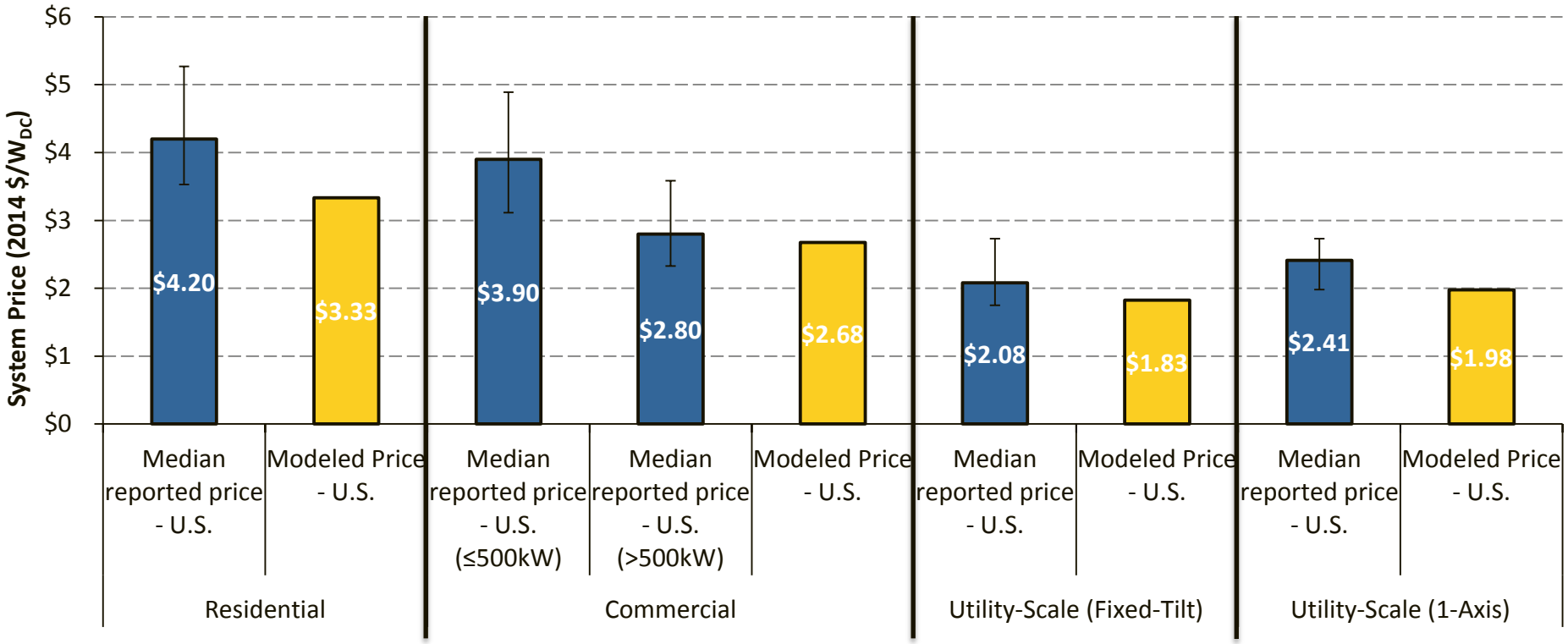
Bottom-up Modeled Overnight Capital Cost of Utility-Scale PV Systems by Size



- Economies of scale for utility-scale projects are illustrated in modeled system prices
- Prices decline by 10-11% from 5 MW to 185 MW
- About ½ of the price reduction accompanies increasing size from 5 MW to 20 MW, with diminishing returns to scale beyond 20 MW.

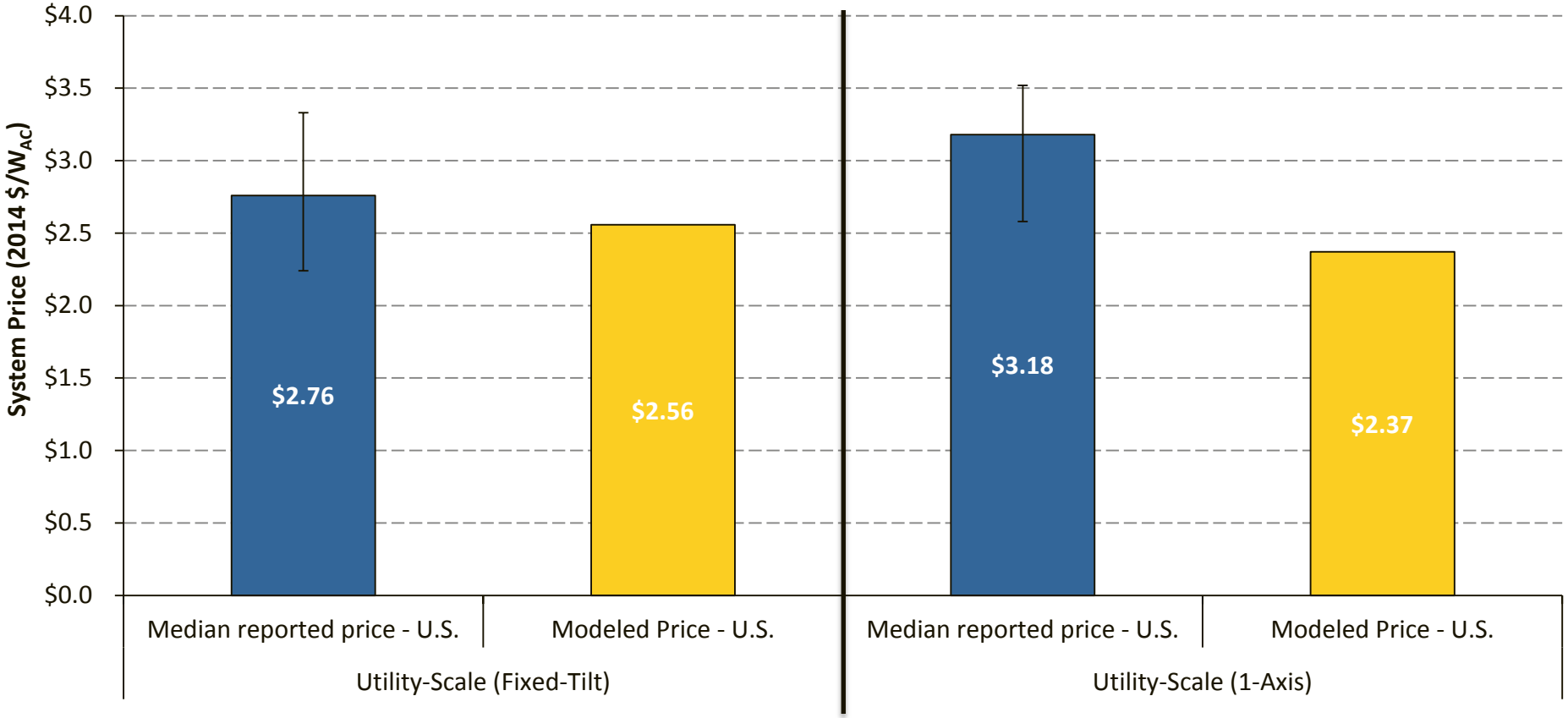
Contents

2014 Reported Median Prices vs. Q4 2013 Bottom-up Benchmark (Quoted) Modeled Prices



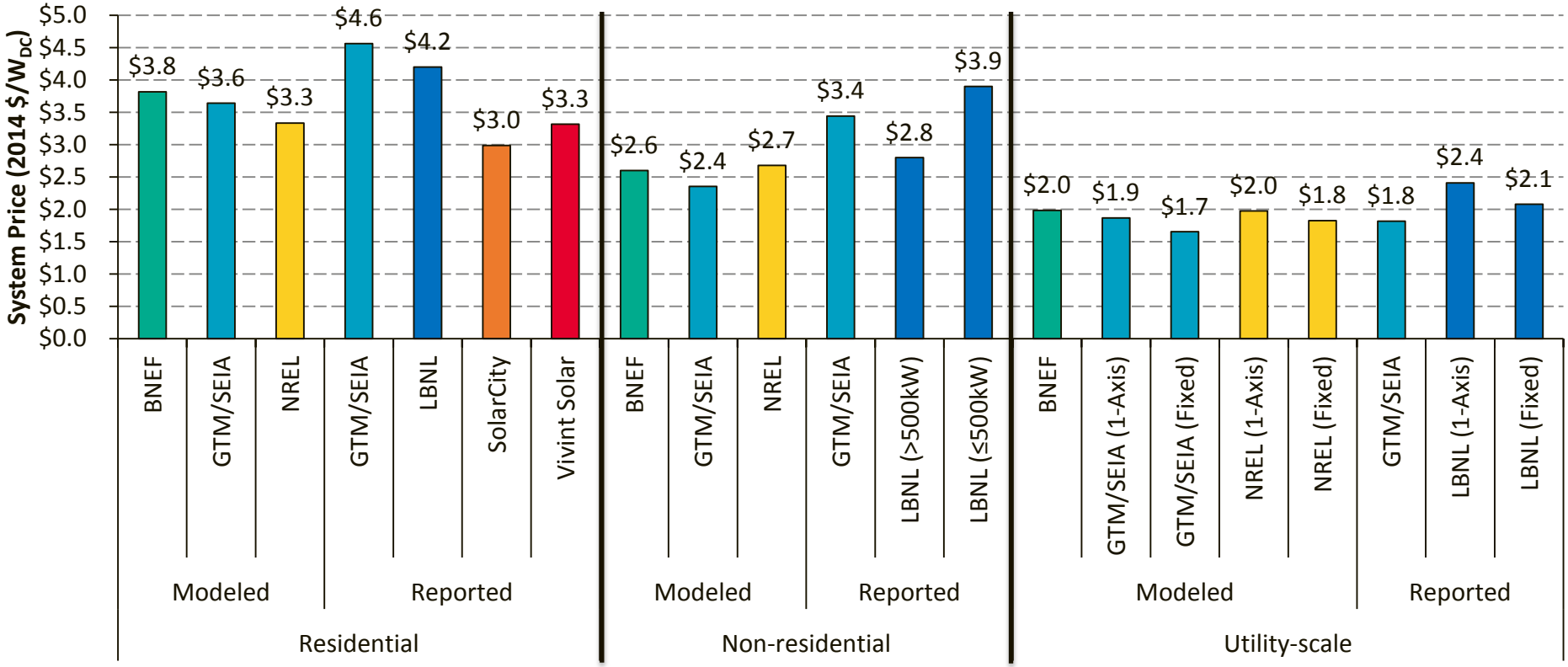
Note: Many factors contribute to the reported price and overnight capital cost differing values including the additional costs above and beyond the overnight capital cost of a project, such as third-party financing; different system sizing; installation time lag; and various methods for calculating system sales price. Error bars for reported price data represent 20/80 percentile of data sets. The costs included in the bottom-up benchmarks represent national averages; there is significant cost variation for each component, depending on the installer, market, or time frame. The above data are representative of the following system sizing: median residential reported size= 6.1 kW; residential bottom-up benchmark overnight capital cost = 5 kW; median commercial reported size (> 500 kW) = 1.1 MW; median commercial reported size (≤ 500 kW) = 29.2 kW; commercial bottom-up benchmark overnight capital cost = 200 kW; median fixed-tilt ground-mounted system (≥5 MW) reported size= 14 MW; median 1-Axis ground-mounted system (≥5 MW) reported size= 26 MW; utility-scale bottom-up benchmark overnight cap. cost = 185 MW.

2014 Utility-Scale Reported Median Prices vs. Q4 2013 Bottom-up Benchmark (Quoted) Modeled Prices ($/$W_{AC}$)



Note: ***Installed price in this graphic uses the unit $/Watt$_{AC}$***, unlike the majority of this report which uses $/Watt$_{DC}$. Utility-scale power plants are often referred to based on their AC ratings, particularly by utility companies. Many factors contribute to the reported price and overnight capital cost differing values including the additional costs above and beyond the overnight capital cost of a project, such as third-party financing; different system sizing; installation time lag; and various methods for calculating system sales price. Error bars for reported price data represent 20/80 percentile of data sets. The costs included in the bottom-up benchmarks represent national averages; there is significant cost variation for each component, depending on the installer, market, or time frame. The above data are representative of the following system sizing ; median fixed-tilt ground-mounted system (≥5 MW) reported size= 11 MW_{AC}; median 1-Axis ground-mounted system (≥5 MW) reported size= 20 MW_{AC}; utility-scale bottom-up benchmark overnight cap. cost = 185 MW.

2014 Modeled and Reported System Price From Various Sources



- NREL and LBNL PV system pricing figures are consistent with other sources
- Across various sources, reported system pricing is generally higher than modeled system pricing
  - Reported values by SolarCity and Vivint Solar are lower, but they report *cost—not price.*

Sources: 1. GTM/SEIA. (2015). "U.S. Solar Market Insight: 2014 Year-in-Review." 2. SolarCity. "Cost Calculation Methodology." Accessed June 25, 2015: http://investors.solarcity.com/events.cfm. 3. Vivint Solar. (2015). "Estimated Cost per Watt Methodology." 4. Bloomberg New Energy Finance. (2015). "H1 2015 North American PV Outlook."

Reasons for Deviations Between Reported and Modeled Installed Prices

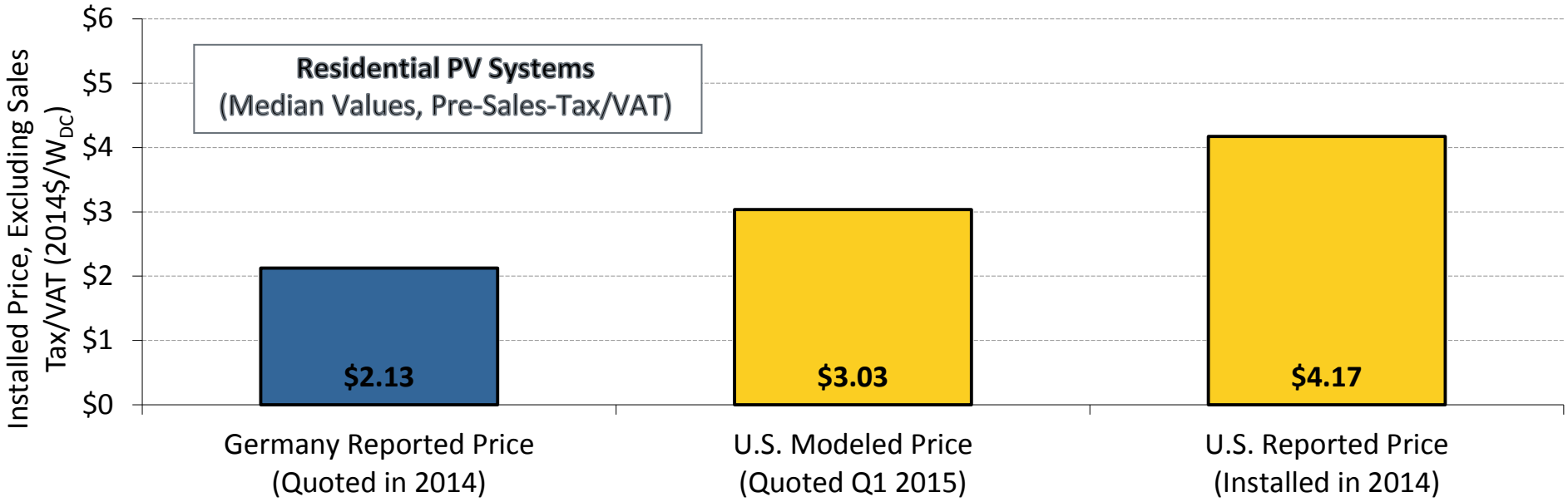
- Price and cost represent different things
  - Reported pricing reflects what customers[+] did pay for systems (i.e., what the market will bear). A customer's purchase price may be significantly higher than it would be elsewhere, regardless of the underlying cost to the installer, due to:
    - Higher electricity rates (e.g., CA)
    - Higher incentive levels (which may lower a customer's upfront cash outlay, though not the price paid to the installer)
    - Lower levels of competition, consumer awareness, etc.
  - The bottom-up benchmarks reflect consistent, transparent cost assumptions and representative margins of each subcomponent to an installer, regardless of market conditions or incentives
- Utility-scale projects' duration between signature of electricity sales agreement and placed-in-service date can be significant
  - Reported pricing generally reflects module and other component pricing at the time that electricity sales agreements (PPAs) were signed
  - Time lags of up to 4 years exist between date of PPA signature and commercial operation for utility-scale projects installed in 2014
  - Bottom-up overnight capital costs represent pricing at the time of benchmark.

[+] Note: a "customer" may be the end-user of energy or a financial entity which owns a system.

Reasons for Deviations Between Reported and Modeled Installed Prices (cont.)

- Large variety in projects currently built in the United States
  - Lack of standards and transparency in incentive program reporting
  - Large differences across system configurations for geographic, market, and LCOE purposes
  - Bottom-up, modeled system prices represents a specific prototypical project
  - The median system size of utility-scale systems which reported prices in 2014 was 14 MW; the bottom-up utility-scale system models a 185 MW system which has achieved full economies of scale
- Reported system pricing may include embedded cost components not included in bottom-up, modeled system prices
  - Examples of additional items include: re-roofing costs, loan origination fees, union labor, and additional interconnection costs
- Large variety in how United States PV installation and development companies operate and report data
  - Reported system pricing reflects the characteristics and reporting conventions of a diverse set of installers and developers in the sample, many of which are relatively small or regional
  - Bottom-up, modeled system prices represent a set of specific models and practices.

Installed Prices for Residential PV: United States vs. Germany

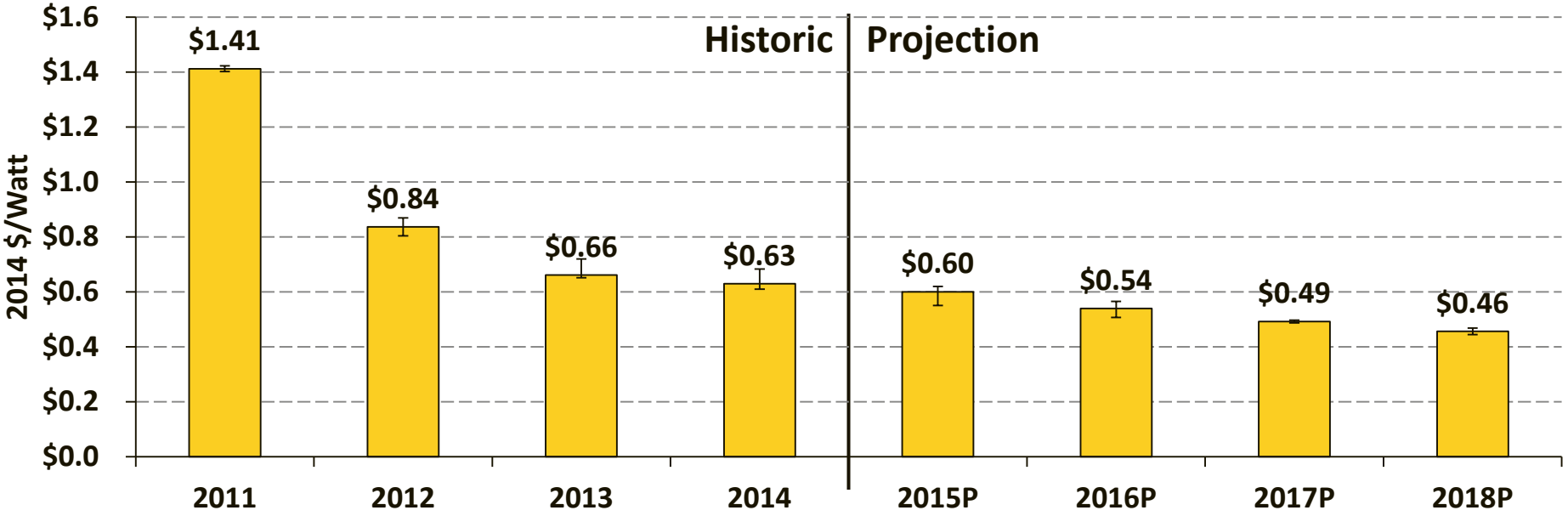


Note: The German data are based on price as reported in the International Energy Agency's "National Survey Report of PV Applications in Germany: 2014."

- Installed prices in the United States are high compared to many other major international PV markets; the disparity is particularly stark in comparison to Germany (regardless of the price metric used)
- Hardware costs are fairly similar across countries; thus, the gap in total installed prices must reflect differences in soft costs (including installer margins)
- Suggestive of a potential for near-term installed price reductions in the United States
  - However, because Germany operates under a different institutional and regulatory environment, the United States may not be able to achieve price reductions in the same manner.

Contents

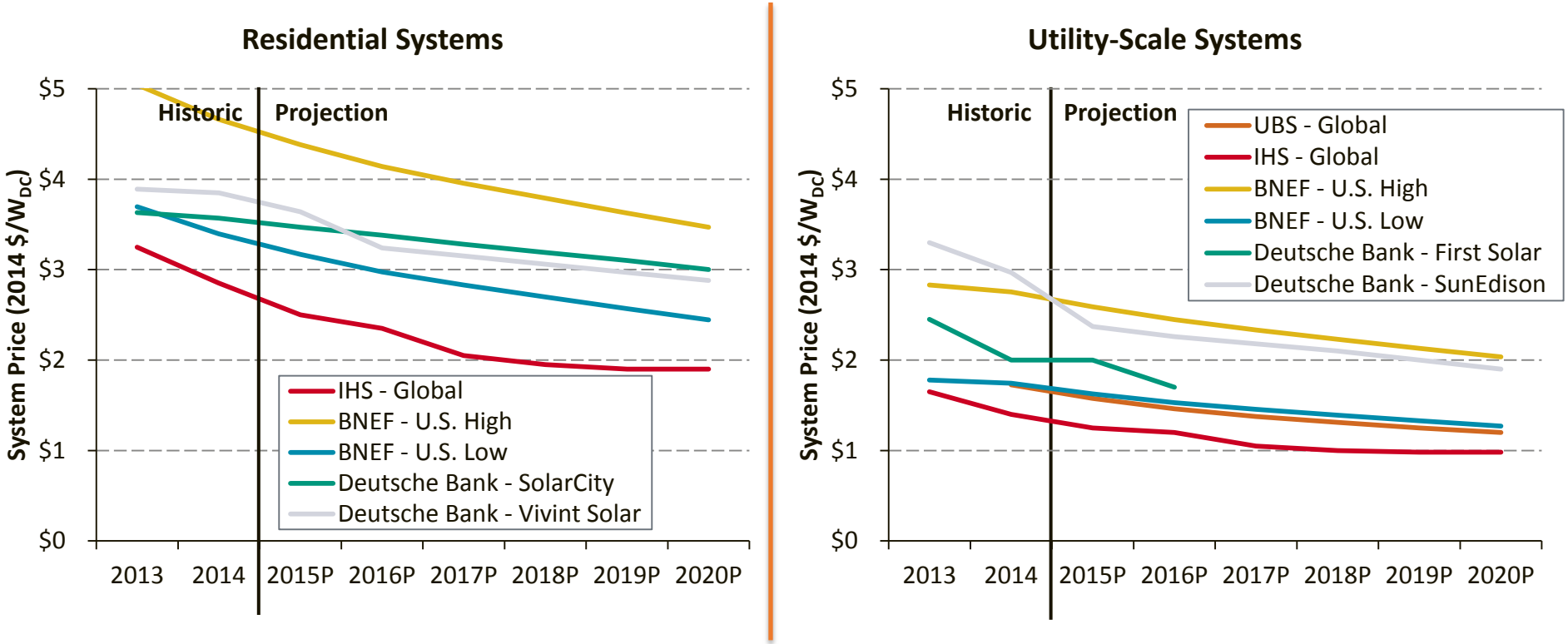
Median and Range of Analyst Expectations of Global Module Average Selling Price



- Global module prices in 2014 remain at historically low levels
- Continued module price reductions expected in near future, getting below $0.5/W by 2017
- Major system price reductions must come from other categories to hit SunShot targets
- Due to current and pending U.S. tariffs on Chinese and Taiwanese solar products, ASP in the United States may be considerably higher than global average.

Sources: Lines represent the median, max., and min. of ASP for First Solar, Trina Solar, Yingli, and global-weighted average from the following analysts: Bloomberg New Energy Finance, "PV Market Outlook Q2 2015" (05/26/15); Cowen (05/21/15); Deutsche Bank (02/25/15, 03/25/15, 05/21/15); Goldman Sachs (04/13/15); GTM Research, "GTM Research Global PV Price Outlook 2015" (March 2015). Note: historic pricing in this slide uses a different data set than what is used in other sections of this report.

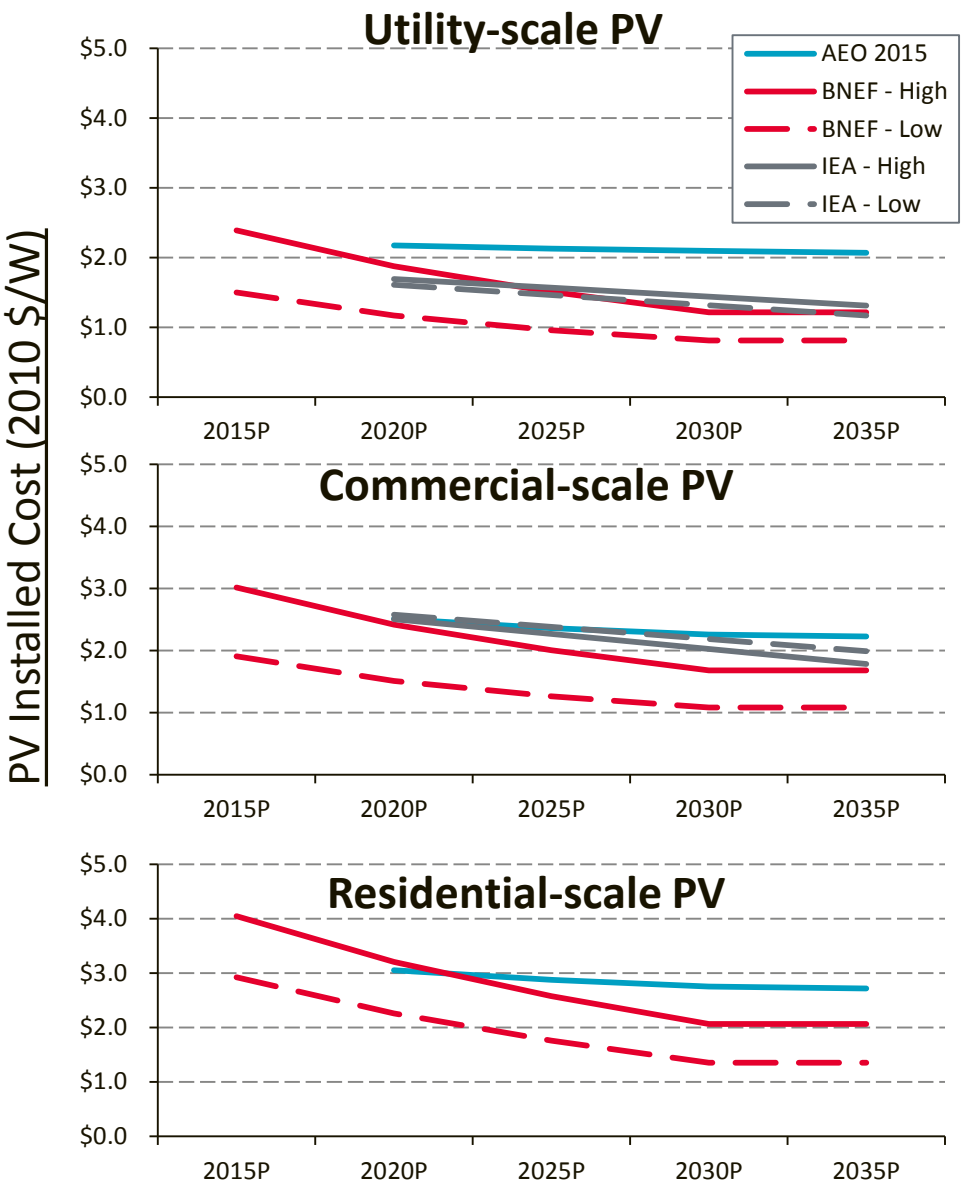
Analyst Estimates (2013-14) and Projections (2015–2020) of Average System Price



- Analysts expect the system prices of both utility-scale and distributed systems to continue to fall in the near future
  - Residential systems are expected to reach $1.5/W - $3.0/W and utility-scale systems are expected to reach $1.00/W - $1.75/W by 2020
  - Analysts project that from 2014-2020, system prices will fall 16%-33% for residential systems and 26%-36% for utility-scale systems, or between 3%-12% per year.

Note: P = projection. Data represent the max. and min. figures from: Bloomberg New Energy Finance, "H1 2015 North American PV Outlook" (01/16/15); Deutsche Bank (02/19/15, 02/25/15, 05/04/15, 05/13/15); IHS, "Solar Market Intelligence," (07/07/15); Navigant Consulting, "Distributed Solar PV Market Drivers and Barriers, Technology Trends, Competitive Landscape, and Global Market Forecasts," (Q3 2015); UBS (06/03/15). Inflation adjusted using: EIA, AEO, Table 20, Gross Domestic Product.

Range of Analyst Expectations of Long-term U.S. System Price



- BNEF and IEA expect pricing in all PV markets to continue to decrease and to get very close to the SunShot targets between 2020-2030
- AEO has a much more conservative outlook with respect to PV system pricing, with system pricing projected to remain relatively flat through 2035
- Analyst expectations of future pricing are currently far lower than projections made even just a few years ago, reflecting very rapid change in the U.S. market.

Sources: International Energy Agency, "World Energy Outlook 2014," November 2014 (New Policy & 450 Scenarios for utility-scale & commercial-scale); Bloomberg New Energy Finance, "H1 2015 North American PV Outlook" (01/16/15); U.S. Energy Information Administration, Annual Energy Outlook 2015 (June 2015). In years where projection was not made, most recent projection used.

Contents

Conclusion

- Continued system price reductions in 2014; more expected in the near-term, despite U.S. tariffs on foreign PV modules
  - Reported distributed system pricing fell 9-21% from 2013-2014
  - Modeled system prices fell 2-19% from Q4 2013 to Q1 2015
- Despite downward trend, large variation in reported pricing within market segment in 2014
  - A difference of roughly $1.40/W in median reported price between the lowest- and highest-priced states for residential, and similar variability also exists *within* individual states
  - The reported price of utility-scale projects generally ranged (20-80%) from $2.32/$W_{AC}$ ($1.78/$W_{DC}$) to $3.52/$W_{AC}$ ($2.83/$W_{DC}$), though some of those systems may have been contracted in 2010-2012 (or earlier)
- Difference between reported and modeled system prices for similarly segmented systems in 2014
  - Residential ($4.20/W reported price, $3.33/W modeled price); commercial ($2.80/W reported price (> 500kW), $2.68/W modeled price); utility-scale ($2.08/W reported price (fixed-tilt), $1.83/W modeled price (fixed-tilt))
  - Delta between reported and modeled pricing is due to various factors, such as market fundamentals (e.g., large variety in different business models and reporting methods for installers and developers in U.S. PV industry), inefficient pricing (i.e., value-based pricing), project characteristics(e.g., high-efficiency panels with single-axis tracking), and long temporal lags between contract signing and installation for large utility-scale projects.

For Further Reading, Please see the Following Reports:

- Barbose, G.; Darghouth, N. (2015). *Tracking the Sun VIII: An Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2014*. Berkeley, CA: LBNL.
- Bolinger, M.; Seel, J. (2015). *Utility-Scale Solar 2014: An Empirical Analysis of Project Cost, Performance, and Pricing Trends in the United States*. Berkeley, CA: Lawrence Berkeley National Laboratory.
- Chung, D.; Davidson, C.; Fu, R.; Ardani, K. Margolis, R. (2015). *U.S. Photovoltaic (PV) Prices and Cost Breakdowns: Q1 2015 Benchmarks for Residential, Commercial, and Utility-Scale Systems*. NREL/TP-6A2064746. Golden, CO: NREL.
- Feldman D.; Barbose, G.; Margolis, R.; Darghouth, N.; James, T.; Weaver, S.; Darghouth, N; Fu, R.; Davidson, C.; Booth, S.; Wiser. R. (2014). *Photovoltaic System Pricing Trends: Historical, Recent, and Near-Term Projections. 2014 Edition*. NREL/PR-6A20-62558. Golden, CO: NREL.
- Feldman, D.; Barbose, G.; Margolis, R.; Wiser. R.; Darghouth, N.; Goodrich, A. (2012). *Photovoltaic System Pricing Trends: Historical, Recent, and Near-Term Projections*. Golden, CO: NREL.
- Fu, R.; James, T.; Chung, C.; Gagne, D.; Lopez, A.; Dobos, A. *Economic Competitiveness of U.S. Utility-Scale Photovoltaics Systems in 2015: Regional Cost Modeling of Installed Cost ($/W) and LCOE ($/kWh)*. Forthcoming paper. Accepted by IEEE PVSC, 2015.
- Goodrich, A.; James, T.; Woodhouse, M. (2012). *Residential, Commercial, and Utility-Scale Photovoltaic (PV) System Prices in the United States: Current Drivers and Cost-Reduction Opportunities*. NREL/TP-6A20-53347. Golden, CO: NREL. Accessed July 2014: http://www.nrel.gov/docs/fy12osti/53347.pdf.
- U.S. Department of Energy (DOE). (2012). *SunShot Vision Study*. DOE/GO-102012-3037. Washington, D.C.: DOE. Accessed 2013: http://www1.eere.energy.gov/solar/pdfs/47927.pdf.

Thank You

To download this briefing, please go to the following link:

http://www.nrel.gov/docs/fy15osti/64898.pdf

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