

Study

# MARKET INFO USA/CALIFORNIA – PHOTOVOLTAICS

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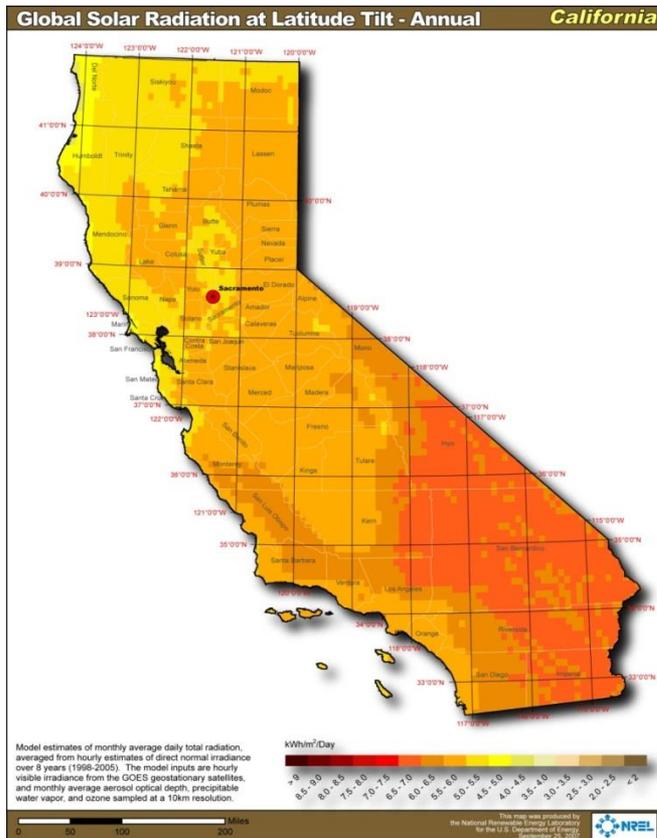


Federal Ministry  
for Economic Affairs  
and Energy

on the basis of a decision  
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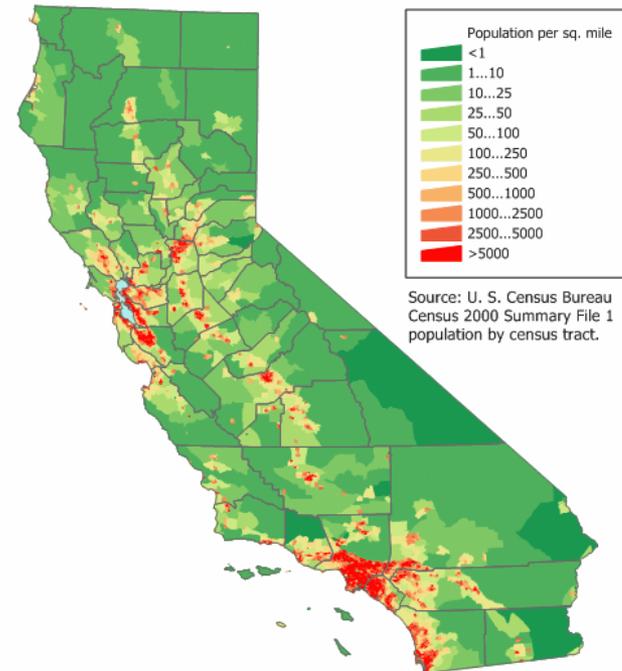
# SOLAR IRRADIATION & POPULATION DENSITY

## Annual global solar irradiation



Source: NREL (2012)

## Population density



Source: U. S. Census Bureau  
Census 2000 Summary File 1  
population by census tract.

Source: thelargest.net (2012)

# BASIC DATA

General basic data (2012)			
Area	411,046 km <sup>2</sup>	GDP (est.)	2,050.7 bn US\$ (~1,602.1 bn €*)
Population (2013 est.)	38,041,430	GDP (per capita est.)	53,907 US\$ (~42,114.84 €*)
Language	English, Spanish	GDP Growth (est.)	2.7 %
Government type	Federal republic	Inflation	1.7 %
Administrative division	One state (of 50)	Unemployment rate	8.2 %
Basic energy market data (2011)			
Electricity consumption (total/per capita)	250.384 TWh/ 6,640kWh		
Total electricity import	84.539 TWh		
Average electricity price (industrial 04/2014)	10.72 ¢/ kWh (8.08 ¢ct/ kWh**)		
Average electricity price (commercial 04/2014)	13.11 ¢/ kWh (9.87 ¢ct/ kWh**)		
Average electricity price (residential 04/2014)	10.17 ¢/ kWh (7.66 ¢ct/ kWh**)		
Proportion of renewable energy (electricity consumption)	14.2 %		
Increase of electricity consumption (since 2000)	1.3 %		
Annual average global solar irradiation	1,900 kWh/ m <sup>2</sup> a		

\* Annual average exchange rate 2012 of the European Central Bank (ECB): 1 € = 1.28 US\$; \*\* Annual average exchange rate 2013 (ECB): 1Euro = 1.3281 US\$

# PHOTOVOLTAIC MARKET INDICATORS

Indicators						
Market size (annual installed capacity)	2010: 259 MW	2011: 537 MW	2012: 1,033 MW	2013: 2,746 MW	2014e: 3 GW	2015e: 4 GW
PV target	3,000 MW by 2016 for PV systems with a capacity < 1 MW (Go Solar California) 300 - 475 MW by 2014 for PV systems with a capacity from 3 ≤ 20 MW (Renewable Auction Mechanism -RAM)					
Main market drivers 2014	<ul style="list-style-type: none"> <li>California Renewable Portfolio Standard (RPS)</li> <li>California Solar Initiative (CSI): The program was closed to customers in the service territory of Pacific Gas and Electric (PG &amp; E) - applications will no longer be accepted here.</li> <li>California Net metering</li> <li>Federal Investment Tax Credit (ITC), Modified Accelerated Cost-Recovery System (MACRS)</li> </ul>					
Employees in PV industry	47,100 (2013)					
Changes in PV regulation	<ul style="list-style-type: none"> <li>April 2011: further development and extension of RPS (Senate Bill X1-2): 33 % share of renewable energy by 2020 in electricity sold in California (formerly: 20 % by 2010).</li> <li>November 2011: start of RAM-Program. RAM is a reverse auction mechanism with contracts between plant operators and utilities for 10-20 years.</li> <li>1<sup>st</sup> February 2013: extension of ITC from 01.02.2013 to 31.12.2016.</li> <li>May 2013: All support programs of the California Solar Initiative are available until the administrators /utilities of each program have spent the whole budget.</li> <li>July 2013: The Californian FIT program has been replaced by the Renewable Market Adjusting Tariff (Re-MAT) system in July 2013. Project proposals can be submitted since 1<sup>st</sup> October 2013 for a first period to adjust the tariff (see slide 11).</li> <li>October 2013: The California Net-Metering rules were amended by AB 327 (see slide 12).</li> <li>The California Public Utilities Commission adopted Resolution E-4655 on 15<sup>th</sup> May 2014 to modify the SCE's, PG&amp;E's, and SDG&amp;E's RAM solicitation protocols and pro forma PPAs before the fifth RAM auction.</li> </ul>					

# OVERVIEW OF PV SUPPORT SCHEMES

PV support	
Rebate programs / soft loans	<p>Support programs of the California Solar Initiative (CSI)</p> <ul style="list-style-type: none"> <li>Investment subsidies for PV systems on existing and new buildings</li> </ul> <p>Local support programs of municipal utilities (MUNIs)</p> <ul style="list-style-type: none"> <li>Utility rebate programs (rebate depends on investment)</li> <li>Utility loan programs (soft loans to finance investment)</li> </ul> <p>Local support of counties and cities</p> <ul style="list-style-type: none"> <li>Local rebate (Grant) programs</li> <li>Local green building incentive programs (exemption of fees/or a simplified approval process for PV systems in connection with construction or retrofit projects of buildings)</li> </ul>
Tax incentives	<ul style="list-style-type: none"> <li>The Californian Law is offering the exemption of property taxes for operators of qualifying solar systems. (California Revenue and Taxation Code, § 73).</li> <li>The installation of a roof-top system will not lead to an increased property tax, as the value of the system is not added to the property value.</li> <li>Investment Tax Credit (ITC)</li> </ul>
Other	<ul style="list-style-type: none"> <li>RPS, California Net Energy Metering, pace-financing, Re-MAT, California FIT, Renewable Auction Mechanism</li> <li>The whole US PV market is expected to benefit from recent action of the Federal Energy Regulatory Commission (FERC): With the beginning of February 2014 the "Order No. 792 Small Generator Interconnection Agreements and Procedures (Final Rule)" came into force and as a result it is easier for small power generation projects to get a network connection. Among other things, the upper limit for participation in the simplified connection process was increased up to 5 MW for inverter-based grid connected systems.</li> <li>Details on the Order No. 792 Small Generator Interconnection Agreements and Procedures (Final Rule): <a href="http://www.ferc.gov/whats-new/comm-meet/2013/112113/E-1.pdf">www.ferc.gov/whats-new/comm-meet/2013/112113/E-1.pdf</a></li> </ul>

# CALIFORNIA RENEWABLE PORTFOLIO STANDARD (RPS)

Category	Details
Description	By 2020, Californian utilities are obliged to have a 30 % share of renewable energy in the electricity sold (possible with power purchase or self generated amounts of electricity). This applies to all electricity retailers in the state including publicly owned utilities (POUs), investor-owned utilities (IOUs), electricity service providers, and community choice aggregators.
Enacted / development	Established in 2002 under the Senate Bill 1078, California's Renewables Portfolio Standard was accelerated in 2006 under Senate Bill 107 by requiring that 20 % of electricity retail sales be served by renewable energy resources by 2010. This new RPS pre-empts the California Air Resources Boards' 33 % Renewable Electricity Standard and applies to all electricity retailers in California including publicly owned utilities (POUs), investor-owned utilities (IOUs), electricity service providers, and community choice aggregators. All entities must adopt the RPS goals of 20 % of retail sales from renewables by the end of 2013, 25 % by the end of 2016, and the 33 % requirement being met by the end of 2020.
Changes	Since 18 <sup>th</sup> August 2011: The Renewable Auction Mechanism (RAM) requires from three investor-owned utilities in California (PG&E, SCE, SDG&E) the auction of new renewable generation capacity of 1,000 MW ( ~ 300 to 475 MW of solar capacity). Total capacity was expanded to 1,299 MW by <a href="#">D.12-02-035</a> and <a href="#">D.12-02-002</a> through RAM by holding four auctions over two years. RAM, is a simplified market-based procurement mechanism for renewable distributed generation (DG) projects greater than 3 MW and up to 20 MW. The fourth RAM auction closed on 28 <sup>th</sup> June 2013. The California Public Utilities Commission adopted <a href="#">Resolution E-4655</a> on 15 <sup>th</sup> May 2014 to modify the SCE's, PG&E's, and SDG&E's RAM solicitation protocols and pro forma PPAs before the fifth RAM auction.
Weblinks	<a href="http://www.energy.ca.gov/portfolio/index.html">www.energy.ca.gov/portfolio/index.html</a> <a href="http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm">www.cpuc.ca.gov/PUC/energy/Renewables/index.htm</a> <a href="http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/Renewable+Auction+Mechanism.htm">www.cpuc.ca.gov/PUC/energy/Renewables/hot/Renewable+Auction+Mechanism.htm</a>

# INVESTMENT TAX CREDIT (ITC)

Category	Details
Description	Corporate Tax Credit: The credit is equal to 30% of expenditures, with no maximum credit. Eligible solar energy property includes equipment that uses solar energy to generate electricity.
Supported PV market segment	Commercial, industrial, agricultural customers and utilities
Enacted	01/01/2006
Changes in 2013/2014	<p>In February 2013, the ITC was extended for PV installations in operation until 31<sup>st</sup> December 2016. A number of changes to this credit are scheduled to take effect for systems taken into service after 31<sup>st</sup> December 2016. The credit for equipment that uses solar energy to generate electricity will decrease from 30 % to 10 %.</p> <p>June 2014: The future of the ITC after 2016 is still uncertain. In U.S. politics, various efforts have been made to unify the broad promotion of renewable energies. For example, President Obama attempted to let the Investment Tax Credit for solar energy phase out completely in 2016 as stated in his budget plan that was proposed in March 2014 for the upcoming fiscal year ("Budget of the United States Government, Fiscal Year 2015"). Instead, PV plant operators would be able to make use of the "Production Tax Credit" (PTC). As a result, the promotion would be a production-dependent tax credit over a period of ten years, which would then also be designed to be recoverable in the future. The Solar Association SEIA rejected this proposal. The industry association tries to achieve an extension of the ITC after 2016.</p>

# GO SOLAR CALIFORNIA (CSI AND NSHP)

Category	Details
Description	<p>California Solar Initiative (CSI) Program: (Incentives for rooftop PV systems on existing buildings)</p> <ul style="list-style-type: none"> <li>▪ PV systems <math>\leq</math> 50 kW: Expected Performance Buydown (EPBB): Incentive (per installed capacity) depending on expected performance.</li> <li>▪ PV systems <math>\geq</math> 50 kW: Performance Based Incentive (PBI): Incentive (per generated kWh) for a duration of five years</li> <li>▪ New Solar Home Partnership (NSHP) Program: Incentives for rooftop PV systems in newly constructed buildings</li> </ul>
PV market segment	Residential and commercial market
Enacted	01/07/2009
Incentives	See following slides
Weblinks	<p><a href="http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA134F&amp;re=1&amp;ee=1">http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA134F&amp;re=1&amp;ee=1</a></p> <p><a href="http://www.gosolarcalifornia.ca.gov/">http://www.gosolarcalifornia.ca.gov/</a></p> <p>Current status: <a href="http://www.csi-trigger.com">http://www.csi-trigger.com</a></p>

# CSI-INCENTIVES FOR ROOFTOP SYSTEMS (CERB)

Expected Performance Buydown (EPBB) Incentive (per installed Watt) (PV system capacity ≤ 50 kWp)					Performance Based Incentive (PBI) (Incentive per generated kWh within five years ) (PV system capacity ≥ 50 kWp)		
Step	supported PV capacity (in MWp) in step	Residential market (in \$/Watt)	Non-residential market		Residential market (in \$/kWh)	Non-residential market	
			Commercial (in \$/Watt)	Government/ non-profit (in \$/Watt)		Commercial (in \$/kWh)	Government/ non-profit (in \$/kWh)
1	50	n/a	n/a	n/a	n/a	n/a	n/a
2	70	2.50	2.50	3.25	0.39	0.39	0.50
3	100	2.20	2.20	2.95	0.34	0.34	0.46
4	130	1.90	1.90	2.65	0.26	0.26	0.37
5	160	1.55	1.55	2.30	0.22	0.22	0.32
6	190	1.10	1.10	1.85	0.15	0.15	0.26
7	215	0.65	0.65	1.40	0.09	0.09	0.19
8	250	0.35	0.35	1.10	0.044*	0.044*	0.139*
9	285	0.25	0.25	0.90	0.032*	0.032*	0.114*
10	350	0.20	0.20	0.70	0.025	0.025	0.088

\*tariffs were revised and are in force since February 12, 2011. For current status and step see <http://www.csi-trigger.com> .

# RENEWABLE MARKET ADJUSTING TARIFF

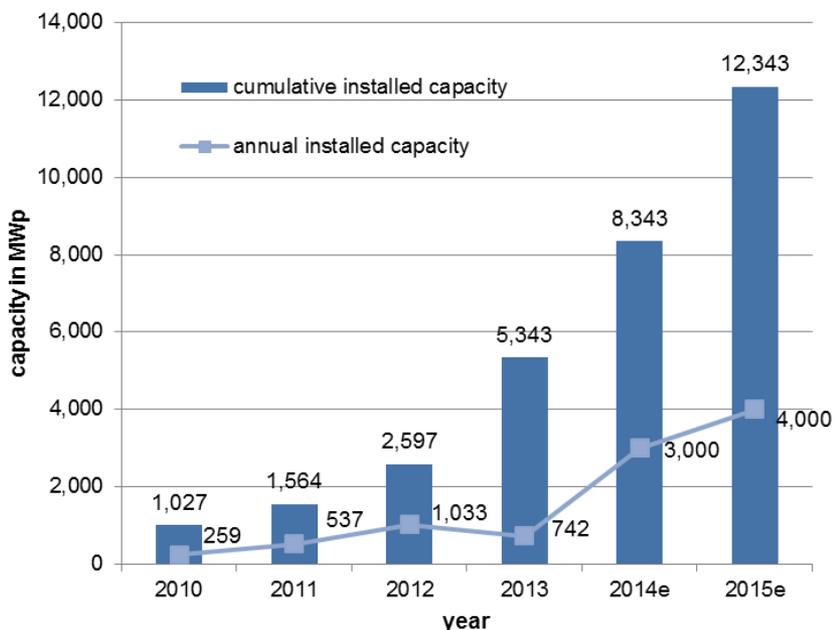
Category	Details
Renewable Market Adjusting Tariff (Re-MAT) For Small-Scale Renewable Generation	<ul style="list-style-type: none"> <li>Project proposals are being received by the three IOUs San Diego &amp; Electric, Pacific Gas and Electric, and Southern California Edison within the framework of the Renewable Market Adjusting Tariff (Re-MAT) program since 1<sup>st</sup> October 2013.</li> </ul>
	<p><b>Application</b></p> <ul style="list-style-type: none"> <li>Within the Re-MAT program electricity providers are offering contracts for off-taking electricity generated by PV projects with a capacity up to 3 MWp.</li> <li>The PV projects have to be within the service area of one of the three electricity providers and be using their transmission grids.</li> </ul>
	<p><b>Status/ timeframes</b></p> <ul style="list-style-type: none"> <li>An application fee of 2 US Dollar/kW (~ 1.50 €/kW) is charged for every project.</li> <li>The client can chose between a contract duration of 10, 15, or 20 years.</li> <li>Re-MAT is divided into two-month-periods.</li> <li>First period started 1<sup>st</sup> of November 2013.</li> <li>Seventh period started on 1<sup>st</sup> November 2014.</li> </ul>
	<p><b>Tariff</b></p> <ul style="list-style-type: none"> <li>The FIT has been determined at an introduction rate of 89.23 US Dollar/MWh (~ 66.86 €) and will be adjusted every two months according to demand.</li> <li>The introduction rate also applied in the sixth period (in September/October 2014).</li> </ul>
	<p><b>Adjustment</b></p> <ul style="list-style-type: none"> <li>In case that in a two-month-period less than 20 % of the available capacity will be used, the tariff will be increased for the next period.</li> <li>When in one period 100 % of the available capacity is used, then the tariff will decrease for the next period.</li> </ul>

# CALIFORNIA NET ENERGY METERING (NEM)

Category	Details
Description	PV system operators ( $\leq 1$ MWp) as customers of Californian utilities have the right to apply for California net metering (without customers of LADWP). Commercial or residential PV system operators receive an electricity bill with figures about own use and excess generated PV electricity, which is fed into the distribution grid in the service area of their relevant utility.
PV support	Utilities (IOUs and MUNIs) are obliged to connect PV systems to the grid and to accept excessive generated PV electricity as well. Net metering for PV system operators proceeds with the principle of avoided electricity costs. A meter will monitor excessive PV electricity. Excessive electricity will be accounted for in the electricity bill of the PV system operator.
Market segment	Commercial and residential PV market
Support since 1996	California Public Utilities Code § 2827 (01/1996) ; CA Public Utilities Code § 2830 (09/2008) ; AB 327 (10/2013)
Market cap until first of July 2017	The AB 327 of November 2013 stipulates that utilities with more than 100,000 domestic service connections must offer net metering until the relevant market cap or the 1 <sup>st</sup> July 2017 is reached, whichever occurs first. For additional clarity the legislation offers a specific market cap for each of the three major utilities in California (see below). Starting with 1 <sup>st</sup> July 2017 or when the cap has been reached, the utilities must offer standard contracts or tariffs for new producers of electricity from the respective customer base. Capacity limits for net metering of the three major utilities in California: San Diego Gas and Electric: 607 MW Southern California Edison: 2,240 MW Pacific Gas and Electric: 2,409 MW
Weblink	<a href="http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA02R">http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA02R</a>

# MARKET DEVELOPMENT AND BARRIERS

## Development of installed PV capacity



Sources: NPD SolarBuzz (2013), SEIA (2013), SEIA (2014)

projection 2015: dena



## The main barriers in the Californian PV market

### Site permit:

- Approval process of renewable energy projects can be complex, long and uncertain based on a site permit, which is mandatory.
- Type of approval process depends on: Technology, capacity and site.

### Approval process:

- Fees for approval processes vary enormously in California.

### Several support schemes:

- Eligible PV system operator cannot apply for ReMAT and CSI-programmes. PV support exist in parallel and are excluding each other. Net metering is exempt from this rule and can be combined with other support schemes.

## MARKET NEWS (1/4)

Date	Topic	Source
07/10/2014	<p><a href="#">Panasonic, Coronal complete nine solar projects for Southern California Edison</a> Coronal's total joint project development with Panasonic is now more than 100 MW. The nine installations mark the first commercial projects to be finished under Panasonic and Coronal's exclusive partnership.</p>	PV-Magazine
26/09/2014	<p><a href="#">Sunrun announces expansion plans</a> The leading US residential solar company will open or expand 10 new offices across four states before the end of the year. The company, which currently has offices in California, Colorado, Nevada, New York, New Jersey, Hawaii and Arizona, will increase its presence in Arizona, California, Nevada and Hawaii to meet rising demand for its services.</p>	PV-Magazine
22/09/2014	<p><a href="#">Vivint Solar targets IPO of \$371 million</a> The financing target sees the residential solar installer step up its efforts to gain a greater share of the US leasing market.</p>	PV-Magazine
18/09/2014	<p><a href="#">U.S. installed solar PV costs continue to fall</a> The latest report by Berkeley Lab shows that installed PV costs in the United States fell 12-15% during 2013, despite a stabilization in PV module costs. However, America still has the highest installed costs among major markets for systems under 100 kW.</p>	PV-Magazine

## MARKET NEWS (2/4)

Date	Topic	Source
10/09/2014	<p><a href="#">Solar, wind gaining as drought continues to hamper California's hydroelectric power</a></p> <p>Ongoing drought conditions in California have caused its hydroelectric power production to plummet to 10 % of the state's total generation, according to data released by the U.S. Energy Information Administration. The shortage of hydropower has caused California to rely more heavily on natural gas-fired capacity, with natural gas production 16 % higher from January to June this year compared to the average from the past decade. Other renewables are also filling the gap left by hydro, with wind and solar generation growing.</p>	HydroWorld
21/08/2014	<p><a href="#">Bill to streamline solar permitting passes the California legislature</a></p> <p>Legislation to standardize and improve the “byzantine” permitting and inspection procedures in various cities and counties in California has passed both houses of the state's legislature. CALSEIA says that this will both reduce installation time and help bring down the cost of solar.</p>	PV-Magazine
20/08/2014	<p><a href="#">US lowers anti-dumping tariffs on Taiwanese solar cells, modules</a></p> <p>The U.S. Department of Commerce has issued a “correction” to preliminary anti-dumping tariff levels on PV cells and modules produced in Taiwan by Motech Industries, citing an error in its calculations.</p>	PV-Magazine
07/08/2014	<p><a href="#">PACE returns: 17 counties launch clean energy funding programs in California</a></p> <p>Enabled by legislation at the state level, counties across California have launched property assessed clean energy (PACE) programs. This represents a revival for PACE, a promising mechanism for property owners to finance solar systems and energy efficiency improvements, and the program administrator expects CaliforniaFirst to support US\$250 million in solar PV systems in 2015.</p>	PV-Magazine

## MARKET NEWS (3/4)

Date	Topic	Source
04/08/2014	<p><a href="#">US anti-dumping case threatens future of 3 GW of solar projects</a>            As much as 3 GW of solar PV projects in the U.S. could be under threat following the confirmation last month that fresh anti-dumping tariffs will be levied on solar modules from China and Taiwan. A new report from solar analysts NPD Solarbuzz suggests that many project pipelines may be forced to find alternative suppliers or potentially pay higher prices for the Chinese modules they had originally lined up, with approximately 3 GW of capacity at risk from the new ruling.</p>	PV-Magazine
24/06/2014	<p><a href="#">California moves to fast-track rooftop solar applications</a>            Law makers in California have moved to expedite and standardize the state's solar permitting process in an effort to make it even easier for homeowners to install rooftop PV arrays. If passed, the legislation could simplify the permitting process for solar installations on homes – a process that, currently, can take months.</p>	PV-Magazine
24/03/2014	<p><a href="#">First Solar acquires 250 MW PV Project in Nevada from K Road Power</a>            First Solar, Inc. (Tempe, Arizona, USA) on September 26<sup>th</sup>, 2013 announced that it has acquired the 250 megawatt (MW) AC solar photovoltaic (PV) project Moapa from K Road Power Holdings LLC (San Diego, California, USA). The PV project is located in the Moapa River Indian Reservation in Clark County, Nevada. The project will be designed and built by First Solar using its Cadmium-Telluride (CdTe) thin film solar modules, and has in place a 25-year Power Purchase Agreement (PPA) with Los Angeles Department of Water and Power (LADWP).</p>	SolarServer

## MARKET NEWS (4/4)

Date	Topic	Source
16/01/2014	<p><a href="#">California greenlights 485 MW PV project</a>            While considerably smaller than originally planned, the \$1.13 billion project will spur California's transition to renewable energy and help advance its climate change goals, say regulators. The California Energy Commission on Wednesday approved NextEra Energy's plan to use photovoltaic technology rather than the previously approved solar parabolic trough system for its planned 484 MW Blythe Solar Power Project.</p>	PV-Magazine
31/10/2013	<p><a href="#">USA: storage expansion goal favourable for grid integration of renewables (in German)</a>            The California Public Utilities Commission (CPUC) has set a goal for a power storage capacity of 1.325 GW for the three biggest private power suppliers until 2020.</p>	Exportinitiative
21/10/2013	<p><a href="#">Vivint secures US\$540 m for residential solar</a>            August Vivint has secured 200 m US Dollars for installations in the residential market. It is planned to install rooftop systems on private homes. The electricity can then be bought by the home owners at a cheaper rate than from the electricity supplier.</p>	PV-Tech
16/10/2013	<p><a href="#">First Solar to build California solar plant for NextEra</a>            First Solar, the biggest US producer of PV systems, is constructing a PV plant with a capacity of 250 MW in California for NextEra. The construction will start by the end of 2014 and be completed by the end of 2016. The generated electricity will be sold to the power company Southern California Edison.</p>	Bloomberg

## CONTACT INFORMATION

Category	Name	Website
Renewable Energy Database of the North Carolina Solar Center	Database of State Incentives for Renewables & Efficiency	<a href="http://www.dsireusa.org">www.dsireusa.org</a>
Federal US Energy Market Regulator	Federal Energy Regulatory Commission (FERC)	<a href="http://www.ferc.gov">www.ferc.gov</a>
State Energy Policy and Planning Agency	California Energy Commission (CEC)	<a href="http://www.energy.ca.gov">www.energy.ca.gov</a>
Renewable Energy Association	Center for Sustainable Energy California (CCSE)	<a href="http://www.energycenter.org">www.energycenter.org</a>
Solar Energy Association	California Solar Energy Industries Association (CALSEIA)	<a href="http://www.calseia.org">www.calseia.org</a>
Authority for Consumer Protection	California Public Utilities Commission (CPUC / PUC)	<a href="http://www.cpuc.ca.gov">www.cpuc.ca.gov</a>
Transmission Grid Operator	California Independent System Operator (CA ISO)	<a href="http://www.caiso.com">www.caiso.com</a>
Certification Body	Underwriter Laboratories (UL)	<a href="http://www.ul.com">www.ul.com</a>

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