



Solar Residential Poll of Industry Experts



1. Over the long term, how realistic do you think residential solar technologies such as photovoltaic panels for electricity, solar heating, etc., are as an energy option for U.S. households?

		Response Percent	Response Count
Very unrealistic		0.0%	0
Somewhat unrealistic		2.9%	1
Neutral		0.0%	0
Somewhat realistic		20.6%	7
Very realistic		76.5%	26
		answered question	34
		skipped question	1





2. In the next few years, do you think there is a "game changing" technology on the way that will be available "off the shelf" for households, and which will dramatically expand the use of residential solar technology?

		Response Percent	Response Count
No.		67.6%	23
Yes.		32.4%	11
		Optional comments:	18
		answered question	34
		skipped question	1



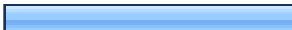


3. At some point in the future for U.S. household electricity consumption, do you think solar photovoltaic electricity will be delivered primarily by utilities ("in front of the meter"), or adopted primarily by households on-site ("behind the meter")? In other words, which side of the meter will "lead the way" if and when solar goes mainstream for U.S. households?

		Response Percent	Response Count
Delivered primarily by utilities.		41.2%	14
Adopted primarily by households on-site.		47.1%	16
Neither (please explain briefly below).		11.8%	4
	Optional comments:		16
	answered question		34
	skipped question		1



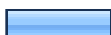

4. Considering technology diffusion and "tipping points," residential solar has recently experienced exponential growth, although estimates of overall U.S. market penetration are still 1% to 2% or less. When do you think overall U.S. household adoption will move from the "innovator" stage (less than 2.5% adoption) to the "early adopter" stage and achieve at least 10-15% household adoption?

		Response Percent	Response Count
Likely never.		0.0%	0
5 years or less.		20.6%	7
5-10 years.		50.0%	17
10-20 years.		20.6%	7
20+ years.		8.8%	3
		answered question	34
		skipped question	1

5. Overall, when do you think residential solar "grid parity" will be achieved in most U.S. states? (Please assume "business as usual" for all other factors and that grid parity means residential solar is cost-competitive at the retail electricity level to homeowners without federal or state subsidies, tax incentives, rebates, mandates, etc. Assume most is > 50%)

		Response Percent	Response Count
Less than 5 years.		25.0%	8
5-10 years.		43.8%	14
10-20 years.		25.0%	8
20+ years.		3.1%	1
Likely never.		3.1%	1
		answered question	32
		skipped question	3

6. Consider the last 25-50 years of technological developments in the U.S. and indicate whether you agree or disagree with the following statement. If domestic solar technologies had been given the same attention and R&D budgets by the federal government as were given to the space industry, or by the computing industry as were given to the software development business; then the majority of U.S. homes would currently be powered by solar technologies.

		Response Percent	Response Count
Firmly disagree		2.9%	1
Somewhat disagree		14.7%	5
Neutral		8.8%	3
Somewhat agree		55.9%	19
Firmly agree		17.6%	6
		answered question	34
		skipped question	1

7. Please rank these potential solar residential market DRIVERS when considering mainstream household adoption, by importance:

	Dropping PV cost &/or increasing PV efficiency	Financing options (lease/power purchase agreements/loans)	Net metering	Federal / state / local rebates & tax incentives	Household eco/green desire	Response Count
1 (most important / largest driver)	50.0% (17)	20.6% (7)	14.7% (5)	14.7% (5)	0.0% (0)	34
2	20.6% (7)	35.3% (12)	8.8% (3)	26.5% (9)	8.8% (3)	34
3	11.8% (4)	35.3% (12)	20.6% (7)	29.4% (10)	2.9% (1)	34
4	15.2% (5)	3.0% (1)	33.3% (11)	27.3% (9)	21.2% (7)	33
5 (smallest driver / least important)	2.9% (1)	5.9% (2)	20.6% (7)	2.9% (1)	67.6% (23)	34
Is there another important DRIVER, and if so where should it rank?						11
answered question						34
skipped question						1

8. Please rank these potential solar residential market BARRIERS when considering mainstream household adoption, by importance: (issues with or lack of . . .)

	Homeowner awareness &/or education	PV cost &/or efficiency	Financing options	State/federal/local rebates & tax incentives	Net metering standards	Neighborhood / ordinance PV restrictions	Response Count
1 (most important / biggest barrier)	23.5% (8)	35.3% (12)	26.5% (9)	5.9% (2)	5.9% (2)	2.9% (1)	34
2	17.6% (6)	20.6% (7)	32.4% (11)	20.6% (7)	5.9% (2)	2.9% (1)	34
3	18.2% (6)	24.2% (8)	15.2% (5)	18.2% (6)	21.2% (7)	3.0% (1)	33
4	6.1% (2)	6.1% (2)	18.2% (6)	30.3% (10)	27.3% (9)	12.1% (4)	33
5	24.2% (8)	6.1% (2)	3.0% (1)	18.2% (6)	30.3% (10)	18.2% (6)	33
6 (smallest barrier / least important)	9.1% (3)	9.1% (3)	3.0% (1)	6.1% (2)	12.1% (4)	60.6% (20)	33
Is there another important BARRIER, and if so where should it rank?							8
answered question							34
skipped question							1

9. How critical to mainstream solar residential adoption are U.S. FEDERAL and STATE renewable portfolio standards which specifically address residential solar options for households (beyond utilities)?

	STATE	FEDERAL	Response Count
Not critical	33.3% (1)	66.7% (2)	3
Somewhat non-critical	20.0% (1)	80.0% (4)	5
Neutral	50.0% (5)	50.0% (5)	10
Somewhat critical	44.4% (8)	55.6% (10)	18
Very critical	60.0% (12)	40.0% (8)	20
		Optional comment	12
		answered question	34
		skipped question	1

10. Considering the top 5 solar residential states below by installed capacity, where do you think each lies on the road to mainstreaming residential solar at the state level (in terms of grid parity and/or achieving a 10% household adoption threshold)? (note you may skip this question if not familiar with solar trends in states below)

	At grid parity	Will achieve grid parity and/or 10% household adoption in 5 years	Will achieve grid parity and/or 10% household adoption in 10 years	Will not achieve grid parity nor 10% adoption in 10 years or less	Response Count
California	20.0% (4)	60.0% (12)	20.0% (4)	0.0% (0)	20
New Jersey	5.3% (1)	47.4% (9)	31.6% (6)	15.8% (3)	19
Pennsylvania	0.0% (0)	10.5% (2)	52.6% (10)	36.8% (7)	19
Arizona	0.0% (0)	26.3% (5)	57.9% (11)	15.8% (3)	19
Colorado	0.0% (0)	27.8% (5)	50.0% (9)	22.2% (4)	18
				Optional comment	6
				answered question	20
				skipped question	15

11. Is there a question you would like to ask other solar or energy industry experts? If so please note it here!

	Response Count
	13
answered question	13
skipped question	22

Page 2, Q2. In the next few years, do you think there is a "game changing" technology on the way that will be available "off the shelf" for households, and which will dramatically expand the use of residential solar technology?

1	There needs to be additional game changing policies enabled, such as widespread third party sales, that would dramatically expand the use of res solar tech.	Feb 19, 2012 12:37 PM
2	Real time pricing technology will open up this market	Feb 17, 2012 8:12 AM
3	I don't think that there is a game changing technology. The game changers are going to be both the continued cost reduction/incremental efficiency gains/higher traditional generation power pricing which deliver a lower relative \$/kWh AND new, innovative financing products.	Jan 30, 2012 6:52 AM
4	The growth of solar technologies will follow the increasing costs of power with highest priced areas leading the growth. Incentives will increase rate of adoption in many areas regardless of cost of power.	Jan 21, 2012 11:38 AM
5	it will not be a new hardware--the technology will be streamlined simplified application system	Jan 19, 2012 4:33 PM
6	Energy storage options could be game changing.	Jan 19, 2012 4:31 PM
7	Technological improvements can and will take place, but both the pace of improvements and adoption is incremental in nature rather than explosive in the broad energy context. Moreover, solar economics are heavily influenced somewhat localized factors (e.g., state policy, utility rates) so adoption is likely to continue to be somewhat lumpy and focused. As far as solar "off the shelf" is concerned, there are legitimate concerns about safety and quality that must be considered and I would expect that institutional inertia will have a slowing effect, which I think is actually a good thing (the industry does not need any more black-eyes). Innovations in financing that deliver a more "off the shelf" financial arrangement to homeowners are I think more likely to spur quicker adoption than technological advancements. This is already taking place in locations where the underlying policies and economics support it.	Jan 19, 2012 2:52 PM
8	I think the time horizon for "game changing" shifts in the industry, at least on the distributed scale, are about a decade or two out still. At the utility scale however, I think that horizon is much nearer. We will see enormous solar plants going into operation in the next few years.	Jan 18, 2012 8:21 AM
9	This technology already exists.	Jan 17, 2012 2:42 PM
10	not in the next few years, but most likely in the next 15 years	Jan 14, 2012 8:21 PM
11	There will continue to be incremental improvements in PV technology and there may be continuing cost reductions, both	Jan 13, 2012 9:55 AM

Page 2, Q2. In the next few years, do you think there is a "game changing" technology on the way that will be available "off the shelf" for households, and which will dramatically expand the use of residential solar technology?

of which can spur market penetration.

12	Technology is moving slowly and steadily and already relevant and practical	Jan 11, 2012 10:24 AM
13	I think it already exists, but needs to be brought to the market.	Jan 10, 2012 6:37 PM
14	I think the disruptive technology was invented more than 30 years ago: PV crystalline modules. The "game changer" is PV's mass production and widespread deployment using innovative financing mechanisms.	Jan 10, 2012 5:41 PM
15	But, the SunShot initiative at DOE has an RFI out now seeking to create a "Plug n Play" PV experience for the residential customer. https://eere-exchange.energy.gov/Default.aspx?Search=plug&SearchType=	Jan 10, 2012 9:02 AM
16	It is a construction project but it will become easier and streamlined just not DIY.	Jan 9, 2012 10:02 PM
17	Why not?	Jan 9, 2012 9:29 PM
18	To the extent "off the shelf" has a do it yourself component, I have answered "No." While technology will certainly improve, the requirement that an installed system be compatible with the grid and safely installed will probably limit "off the shelf" penetration in the market. I also am assuming the question to refer to photovoltaic. I do believe that "off the shelf" technology for solar hot water is quite possible in the near future.	Jan 9, 2012 5:36 PM

Page 2, Q3. At some point in the future for U.S. household electricity consumption, do you think solar photovoltaic electricity will be delivered primarily by utilities ("in front of the meter"), or adopted primarily by households on-site ("behind the meter")?

In other words, which si...

1	Third party providers.	Feb 19, 2012 12:37 PM
2	Not that there won't be a lot of residential solar net metered, but the scale of utility delivered solar will be much more.	Jan 30, 2012 6:52 AM
3	This comment applies to Southeastern electric markets. Outcome may be different in other states with more progressive and forward thinking utilities.	Jan 19, 2012 4:38 PM
4	From a scale perspective, I think utilities will lead the way in the nearerterm. However, if creative financing structures continue to advance for residential buyers, adoption could accelerate quickly.	Jan 19, 2012 4:31 PM
5	In gross energy production terms, I would expect wholesale solar energy to exceed behind-the-meter systems in the near future. However, the place of behind the meter generation will not disappear I think because it delivers benefits that wholesale systems cannot and these benefits are generally recognized by policy makers.	Jan 19, 2012 2:52 PM
6	I think PV technology will be much more widely applied to the individual home or business. However, I think concentrating thermal applications will be more common at the utility-scale, and much of that will end up being consumed by homes and businesses too.	Jan 18, 2012 8:21 AM
7	I believe that the majority of households will be served by utilities, but I would be thrilled if behind the meter technologies approached a 20% penetration rate by 2020 (or so).	Jan 17, 2012 11:27 AM
8	Distributed generation facilities will make the most sense in the future. Housing starts will be built with solar packages included.	Jan 17, 2012 10:26 AM
9	I believe that both approaches will proceed about equally. In fact, utilities may begin playing an active role in "owning" systems on customers' roofs. In other words, utility companies may play a role on both sides of the meter.	Jan 13, 2012 9:55 AM
10	It will be a combination of both.	Jan 10, 2012 6:37 PM
11	If solar electricity is delivered primarily by utilities, society has missed a historic opportunity to capitalize on the true value proposition presented by distributed generation - allowing customers to take control of their own power generation rather than remaining beholden to monopolies.	Jan 10, 2012 5:41 PM
12	It is in a utilities "DNA" to own the production facilities in one way or another. While there will be many "hot spots" of rooftop DG, the majority of PV generation will eventually be owned (through leasing) by the utilities and their subsidiaries.	Jan 10, 2012 9:02 AM

Page 2, Q3. At some point in the future for U.S. household electricity consumption, do you think solar photovoltaic electricity will be delivered primarily by utilities ("in front of the meter"), or adopted primarily by households on-site ("behind the meter")?

In other words, which si...

13	Both will occur but in the day and age of Facebook, where User Created Content has displaced mainstream media, user created power will be the dominant form for residential electricity. The whole grid will be bidirectional and we'll all be producer consumers - especially in the residential space.	Jan 9, 2012 10:02 PM
14	with much 'behind the meter' too.	Jan 9, 2012 9:33 PM
15	We got solar. Now the utilities want to charge us for distribution. They still are going to be in "control".	Jan 9, 2012 9:29 PM
16	To say that solar is not "mainstream" for U.S. households when there are tens of thousands of household solar installations operational seems inaccurate. Question 4, for example, ignores the fact that installations at this time are concentrated in jurisdictions that have moved to publicly support solar, such as California and New Jersey. The market penetration in such jurisdictions will be higher than in those without incentives. I would have preferred to answer "Both" because I believe that utilities are going to get into delivering on-site household photovoltaics, either through on bill financing or leasing. Household level feed-in-tariffs will produce a joint delivery by the household and the utility.	Jan 9, 2012 5:36 PM

Page 3, Q7. Please rank these potential solar residential market DRIVERS when considering mainstream household adoption, by importance:

1	removal of 15% barrier for solar penetration in systems (rank1); amending PURPA to require retail payments for produced electricity	Feb 26, 2012 9:04 AM
2	These drivers all interact with each other to provide customers with attractive financial choices. I think individually they are meaningless.	Jan 21, 2012 11:44 AM
3	Feeder tariffs second	Jan 19, 2012 7:44 PM
4	Upfront cost is wrapped up in PV cost, fed & state incentives and financing options so ideally I would rank all of them the same,	Jan 19, 2012 7:33 AM
5	Rising cost of conventional power; rank 3rd.	Jan 17, 2012 10:34 AM
6	Building codes or insurance incentives for "resilient homes"	Jan 13, 2012 10:07 AM
7	Make solar the low hanging fruit. Affordable, accessible, easy to implement.	Jan 10, 2012 6:40 PM
8	Ease of access to the service of solar electricity; peer support to go solar.	Jan 9, 2012 10:05 PM
9	resale value	Jan 9, 2012 9:32 PM
10	Outreach and education #4	Jan 9, 2012 5:36 PM
11	desire for energy independence - ranks last	Jan 6, 2012 1:57 PM

Page 3, Q8. Please rank these potential solar residential market BARRIERS when considering mainstream household adoption, by importance:

(issues with or lack of . . .)

1	Utility regulatory structure/fees and adoption of smart grid tech to enable real-time pricing #1-	Feb 17, 2012 8:17 AM
2	barrier is complexity (caused by energy regulation and subsidization of all energy)	Jan 30, 2012 6:56 AM
3	Again individually I believe these are mostly meaningless. The ROI of the customer rules decision making.	Jan 21, 2012 11:44 AM
4	Feeder tariffs. Second	Jan 19, 2012 7:44 PM
5	Same comment as above.	Jan 19, 2012 7:33 AM
6	complexity of installing on one's home.	Jan 17, 2012 10:34 AM
7	Upcoming barriers/challenge will include awareness of equipment recalls and warranty issues.	Jan 10, 2012 9:11 AM
8	Trust (close to awareness but not the same). Ease (make it simple!).	Jan 9, 2012 10:05 PM

Page 3, Q9. How critical to mainstream solar residential adoption are U.S. FEDERAL and STATE renewable portfolio standards which specifically address residential solar options for households (beyond utilities)?

1	This question does not make sense.	Feb 19, 2012 12:41 PM
2	Only in the sense that they drive volume that reduces price and sorts out other market barriers (interconnection rules, etc)	Feb 17, 2012 8:17 AM
3	SREC markets are just a transitional subsidy or mandate. It is effective in that in the long run, as PV pricing declines, the SREC pricing declines are well. We should do this with all energy subsidies.	Jan 30, 2012 6:56 AM
4	Same comment as # 8 above.	Jan 21, 2012 11:44 AM
5	In the short term these factors are critical. Over the long term, solar needs to be competitive without any incentives if it is to achieve "mainstream" status and penetrate 10%+ of US households.	Jan 19, 2012 4:42 PM
6	State RPS policies with solar/DG provisions are currently very critical to solar development within those states. A federal standard would create greater access in the laggards, but I am doubtful that any near term policy would have any teeth and our current system of electricity regulation puts states in control of retail transactions (i.e., behind the meter installations). Consequently I would not expect a federal standard to offer much to homeowners.	Jan 19, 2012 3:11 PM
7	I wanted to check somewhat critical for both but it would not let me. To the degree that RPS drive incentive programs they are critical, but if the incentives exist independently then they are not. In most cases the incentives follow the RPS though...	Jan 19, 2012 7:33 AM
8	Local (statewide) programs such as rebates are equally as important as an RPS set-aside	Jan 17, 2012 11:31 AM
9	Portfolio are far more important for utility-scale adoption of solar	Jan 13, 2012 10:07 AM
10	Are you refering to a solar carve-out? It could be very interesting for residential deployment if a state like California had a solar or DG carve out as part of its RPS.	Jan 10, 2012 5:54 PM
11	States requiring utilities to green their electricity generation is critical.	Jan 10, 2012 9:11 AM
12	The more mandates the better.	Jan 9, 2012 10:05 PM

Page 3, Q10. Considering the top 5 solar residential states below by installed capacity, where do you think each lies on the road to mainstreaming residential solar at the state level (in terms of grid parity and/or achieving a 10% household adoption threshold)?

(note you may skip this question if not fami...

1	In California, solar has reached retail grid parity under certain rate structures. However, retail grid parity is a somewhat contrived phenomenon because the rate structures under which it currently occurs do not necessarily bear a relation to actual electricity costs. As such, grid-parity could be lost (or gained) overnight with a tariff revision. True wholesale grid parity is a better metric but it plays a different role in household adoption than retail grid parity.	Jan 19, 2012 3:11 PM
2	not familiar with these trends	Jan 14, 2012 8:24 PM
3	Difficult to comment. I am concerned California has lost some momentum in residential deployment with CSI drawing to a close and RPS favoring utility scale deployment.	Jan 10, 2012 5:54 PM
4	States with major coal and natural gas resources will have a hard time achieving 10% solar penetration.	Jan 10, 2012 9:11 AM
5	It is happening in the next 5 years across most of the country with cost curves going down and grid prices going up.	Jan 9, 2012 10:05 PM
6	Dont know enough about these other markets to say.	Jan 6, 2012 1:57 PM

Page 4, Q11. Is there a question you would like to ask other solar or energy industry experts? If so please note it here!

1	Note that in previous question you asked when solar grid parity will happen with unsubsidized solar. This is a loaded question as all energy is subsidized. If you are taking the subsidy out of solar, you need to compare LCOE of unsubsidized energy for all energy options.	Jan 30, 2012 6:58 AM
2	The big shift in the last 12 months is the now forecasted decline in electricity prices because of falling natural gas prices. This is the real hinge on our medium term goals in my mind. Does fracking really provide us cheap gas for 100 years? Will we put a price on the potential environmental costs? Will our leadership look past this windfall at our really longer term challenges? Will a shift to EV bump electricity prices in 10 years? Hard decisions and complex questions for sure. Renewables are still in a spot where the next 10 years view of growth is not solid, but on a 50 year cycle they are clear leaders. The prices of solar will continue to fall and performance will continue to improve. No question about this really Talking about levelized cost of energy(LCOE) is the smart metric in my mind. Thanks for the opportunity to participate.	Jan 21, 2012 11:51 AM
3	What is the environmental footprint of the various types of panels?	Jan 19, 2012 7:45 PM
4	Many states have enacted solar set-asides in the portfolio standards. As costs drop, these set-asides may not be needed. Therefore, how do you anticipate solar competing against other renewable energy technologies?	Jan 19, 2012 4:44 PM
5	What is the appropriate IRR for using as a benchmark for residential solar? Are customers demanding a higher return than is warranted by the level of risk in making a solar investment?	Jan 19, 2012 3:14 PM
6	When talking about the future, I think a pertinent question is the availability and ease of interconnection from the local IOUs. The closer we get to parity on the cost front, I believe the utilities will start imposing additional fees or roadblocks on connecting to their system.	Jan 17, 2012 11:33 AM
7	What is the importance of a trained and certified workforce in developing a sustainable PV industry?	Jan 11, 2012 10:28 AM
8	What about the sterling engine?	Jan 10, 2012 6:41 PM
9	How will the forecasted price of natural gas influence the uptake of solar PV in the next 10 years? Great questions, Erik. Good luck with your research. I would be interested in receiving a copy of your paper.	Jan 10, 2012 5:57 PM
10	Do you think it likely that the fossil fuel industry will own and operate most PV manufacturing and project development by 2015? And if so, will it be because they are transitioning to a clean fuel model or because they want to cap/retard the competition coming from clean fuels?	Jan 10, 2012 9:20 AM
11	How long can coal last?	Jan 9, 2012 10:06 PM
12	Do you think that the rapid development of shale gas resulting in significant long term suppliers and low prices will	Jan 9, 2012 5:38 PM

Page 4, Q11. Is there a question you would like to ask other solar or energy industry experts? If so please note it here!

dampen the implementation of solar?

13 What is the biggest policy threat to the solar industry in the next 3-5 years. What is the biggest threat to the solar industry in the next 3-5 years. Jan 6, 2012 1:57 PM