Sharing the Sun:

Attitudes, Early Adopters and

Community Solar Projects

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I. Description of Survey and Method

To date, a limited amount of information is available regarding the preferences of potential subscribers to shared solar initiatives (Hoffman 2014). In order to address this issue, a survey of potential adopters was conducted in collaboration with Fresh Energy (FE) and the Community Energy Resource Teams (CERTs) of the University of Minnesota as well as Colorado State University Extension (CSUE). In each case, the survey was distributed electronically via SurveyMonkey to each organization's members and/or individuals on their mailing list (Table 1).[i]

The surveys addressed a number of issues critical to the future success of shared solar initiatives, including the decision to participate in a community solar project, preferences for specific attributes of a given project, and a potential participant's willing-to-pay a premium for these attributes.[ii] The survey also asked respondents about the two most commonly proposed methods of financing shared solar initiatives, namely, a *lump-sum* or *up-front payment* method and a *pay-as-you-go* subscription, or a monthly payment with no long-term obligation. Respondents were asked to consider what sort of payback period would be required to stimulate their interest and to assess the impact of some percent change in their monthly bill on their participation decision.

There were a number of differences between the Minnesota and Colorado surveys. First, the Colorado survey included questions drawn from an earlier survey of Minnesota residents. Second, the Minnesota version of the present survey included questions regarding projects both *inside* and *outside* of the respondent's community, a distinction not included in the Colorado survey. In a number of cases, therefore, the report provides information on the results of the earlier Minnesota survey (referred to as 'Round 1 survey') as well as present surveys in both Colorado and Minnesota (referred to as 'Round 2 survey').

II. Survey Participants

Respondents to the Round 1 survey included individuals affiliated with the following Minnesota-based environmental and energy advocacy organizations:

- **CERTs (Community Energy Resource Teams)** is a statewide partnership designed to connect individuals and their communities to the resources they need to identify and implement community-based clean energy projects.

- **Fresh Energy** is a policy-driven organization that focuses energy efficiency, clean energy, transportation and land use, and carbon reduction.

- **MN Community Solar** is a private, for profit organization whose primary aim is to identify optimal host sites and provide the financial, legal and design expertise required for the development of shared solar projects. Two MN Community Solar populations were surveyed, the first being individuals who had indicated a prior interest in community solar; the second consisted of individuals who had indicated a general interest in solar projects by signing a 'request for information' form used by the company at various venues.

- **MN Interfaith Power and Light (MN ILP)** Originally founded in 2004 as *Congregations Caring for Creation*, MN IPL seeks to mobilize religious support for landmark legislation to reduce greenhouse gas emissions in Minnesota, educate congregants, and work with every major religious denomination in the state. MN IPL respondents completed the survey during a meeting of congregant leaders in December 2013.

- The **Minnesota Renewable Energy Society (MRES)** is a membership-based, non-profit organization founded in 1978 to promote the use of and to engage in advocacy for renewable energies in Minnesota, with a particular emphasis on solar technologies.

- The **Izaak Walton League** is one of the nation's oldest and most respected conservation organizations, with more than 250 local chapters nationwide. Respondents to the survey included members of the St. Paul-based Midwest chapter only.

TABLE 1
Number of Respondents by Partner
Round 1 Survey

Partner	Total n of Responses	% of Total Responses
CERTs	148	31%
MN Community Solar 2	117	24%
Fresh Energy	67	14%
MN Community Solar 1	56	12%
IWL (MN Division)	51	10%
MRES	26	5%
MN IPL	19	4%
Total	**484**	

The Minnesota portion of the Round 2 survey was limited to CERTs and Fresh Energy. Colorado participants were drawn from individuals affiliated with the CSUE. One-hundred and twenty-seven individuals responded to the survey (Table 2).

TABLE 2
Participants
Round 2

Partner	N of Responses	% of Respondents
CERTs	43	34%
FE	37	29
CSUE	47	37
Total	127	

Sixty-three percent of the Round 2 respondents reside in Minnesota with the remainder living in Colorado (Table 2). An overwhelming ninety-two percent of the respondents reported living in single-family housing units and unlike most 'average' Americans, some eleven percent claimed to own an electric vehicle (EV), though a smaller six percent report such ownerhip in Colorado. Overall, sixty-nine percent of the respondents received their electricity from an investor owned utility, while twenty-two and nine percent were serviced by co-operative utilities or municipal utilities, respectively. In the case of Colorado, a greater percentage of residents were serviced by local public providers compared to investor owned utilities. Particularly in the case of Minnesota, respondents were also economically advantaged, with almost one-third (31 percent) reporting household incomes of more than $100,000 annually (Table 3).

TABLE 3
Respondent Characteristics
Round 2 Survey
shading indicates a 10% or greater difference

		Aggregate	CSUE
Housing:	Single Family unit	92%	91%
	Multi-family unit	8	9
Electric Vehicle owner:	Yes	11	6
	No	89	94
Electric Utility provider:	IOU	69	53
	Co-op	22	32
	Muni	9	13
Household Income:	< $ 40,000	12	7
	$41 – 60,000	12	20
	$61 – 80,000	24	24
	$81 – 100,000	21	24
	> $100,000	31%	24%

III. Participation in an Individual Solar Project

The first question in the survey assessed the relative importance of various obstacles inhibiting the installation of an individual solar energy project, such as a residential rooftop PV system. A variety of what might be termed 'hassle factors' were specified, including a perceived lack of knowledge about how a solar energy system works, the inability to maintain a system, and an unwillingness to enter into a complex contract with the relevant utility or third party. Also included was the suitability of the property for solar panels, that is, excessive shading, size, and orientation.

Among all respondents, suitability of property ranks highest amongst this set of concerns.[iii] Aggregate responses also indicate the importance of the complexity of the contract and the difficulty of maintaining a system, with CSUE respondents being somewhat more concerned about these issues than the survey population as a whole. On the other hand, other competency issues such as the dealing with installers and lack of knowledge about the workings of the system are less worrisome to both CSUE and the aggregate set of survey respondents (Table 4).

TABLE 4

Importance of 'Hassle Factors'
CSUE (Round 1 aggregate %)
shading indicates a 10% or greater difference

	Very Important			**Not at all Important**
Suitability of property	**45%** (42%)	**30%** (16%)	**11%** (13%)	**15%** (13%)
Difficulty of maintaining system	**36** (24)	**32** (25)	**19** (25)	**13** (19)
Complexity of contract	**35** (27)	**35** (29)	**22** (23)	**9** (13)
Lack of knowledge about how system works	**11** (15)	**26** (21)	**20** (27)	**43** (32)
Dealing with installers	**13** (8)	**28** (22)	**32** (30)	**28** (40)

Respondents were also asked to assess a number of uncertainties confronting the adoption decision for an individual solar project.[iv] In all cases, respondents expressed an extremely high degree of confidence regarding the environmental benefits that are perceived to be associated with the adoption of solar energy. Uncertainty about the need to change their home's existing infrastructure was evenly distributed across all possible response as was the anticipated payback period of an individual system, except in Colorado, where respondents expressed much higher uncertainty in regards to this issue (Table 5).

TABLE 5
Uncertainty of:
CSUE % (Round 1 aggregate %)
shading indicates a 10% or greater difference

	Very Important			**Not at all Important**
Payback period	**41%** (24%)	**24%** (32%)	**20%** (23%)	**15%** (15%)
Changing existing infrastructure	**21** (28)	**26** (28)	**28** (26)	**26** (19)
Environmental benefit	**17** (8)	**9** (16)	**33** (26)	**41** (44)

IV. Participation in a Community Solar Project

The decision to participate in a community solar project is potentially influenced by a number of factors. Three categories of motivating factors were specified, the first being three personal factors, namely, the ability to use 'cutting edge' technology, the opportunity to achieve energy independence, and personal economic benefit. A second set of what might be referred to as 'community', though socially distant, benefits included generalized environmental benefits of shared solar, perceived local energy use, and whether or not Minnesota companies would build and/or maintain the system. Finally, two factors relevant to the community-building benefits of such systems were included, these being the opportunity to partner with either neighbors or members of a particular affinity group such as a faith community or business association.

As seen in Table 6, the personal or individual benefits associated with a shared solar project are clearly significant in the adoption decision. Thus, an overwhelming majority of respondents understood energy independence and the ability to use leading-edge technology as critical determinants of their decision. Also, all respondents agreed on the importance of personal economic benefit with CSUE respondents being particularly emphatic about the need for a shared solar project to deliver to a participant some degree of individualized economic benefit.

TABLE 6

Individual Benefits of Shared Solar
CSUE % (Round 1 aggregate %)
shading indicates a 10% or greater difference

	Very Important			**Not at all Important**
Ability to achieve energy independence	**60%** (58%)	**27%** (24%)	**8%** (10%)	**4%** (4%)
Personal economic benefit	**58** (41)	**27** (32)	**10** (21)	**4** (4)
Desire to use leading-edge technology	**36** (25)	**23** (34)	**19** (24)	**21** (12)

While the personal benefits associated with a shared solar project are significant, respondents are equally also motivated by what at least some of might be termed "community benefits", most notably the perceived environmental benefits associated with a project. Respondents are also highly motivated by the perception that locally *generated* energy is being *used* locally[v] and that a community solar project will be brought to them by Colorado or Minnesota-based companies and, presumably, through the labors of state-based workers (Table 7).

TABLE 7

'Local-ness' Benefits
CSUE % (Round 1 aggregate %)
shading indicates a 10% or greater difference

	Very Important			**Not at all Important**
Environmental benefits	**67%** (71%)	**21%** (19%)	**8%** (4%)	**4%** (3%)
Energy to be used locally	**43** (46)	**36** (31)	**6** (15)	**15** (5)
CO/MN companies will build and maintain system	**35** (41)	**46** (35)	**15** (17)	**4** (3)

The final set of motivating factors concerns the socializing opportunities embedded in shared solar initiatives. Taken together with the above-noted results, Table 8 indicates that the appeal of *local and/or community* benefits is bound up with an abstract sense of these things, one rooted in a comfortable distance from *specific* individuals or communities. Thus, while there are a sizable number of respondents that do seem eager to work with their neighbors or members of an affinity group, the number of respondents seeing community-building opportunities as 'very important' is much less than those that place an emphasis on personal economic benefits. Indeed, the two lowest ranked motivating factors are the opportunity to partners with either one's neighbors or members of an affinity group. Civic engagement and public partnering do not seem to be on the mind of even these potential early adopters.

TABLE 8

Community-Building Benefits
CSUE % (Round 1 aggregate %)

	Very Important			**Not at all Important**
Opportunity to partner with neighbors	**23%** (25%)	**38%** (35%)	**23%** (26%)	**15%** (9%)
Opportunity to partner with members of affinity groups	**15** (17)	**23** (28)	**32** (30)	**30** (21)

V. Location, Location, Location

Location is a critical feature of any community solar project, beginning with the question of whether or not to locate a project within a subscriber's community versus locating a project outside what is perceived to be the geographic borders of that community. In the former, the physical nexus between the location of the project and the location of the subscribers may create a greater sense of 'ownership' at both the individual and community level. This, in turn, may encourage participation by providing a sense of shared community benefit that can be extended to one's neighbors with minimal effort while avoiding the sort of partnering activities discussed above. Proximity may also allow existing social assets such as neighborhood schools, churches and other places of worship, etc. as well as informal community-based organizations such as book clubs, garden clubs, and so on, to be used a potentially valuable 'recruitment centers' (Hoffman and High-Pippert 2010).

Alternatively, subscribers may be located some distance from the site upon which the panels are located. While such distance may not be a barrier to the use of social assets as recruitment centers, it may significantly weaken the social appeal of a solar garden. Yet such an arrangement would a subscriber to act upon highly individualistic motives, including environmental or economic agendas, while avoiding unwanted or minimally attractive requirements for social engagement. Developers may also find distance between subscribers and projects beneficial in that it expands the scope of potential sites beyond those proximate to specific communities or neighborhoods.

In order to understand the significance of place in the participation decision, Minnesota respondents were asked to consider projects located both inside and outside of their community and/or neighborhood; while CSUE respondents were not asked to distinguish amongst such projects their locational preferences are reported as well. As can be seen in Table 9, there was little importance attached to whether or not a project would be located inside or outside of one's community or neighborhood. Other factors that might create awareness of a project, and therefore a sense that it is an important part of one's neighborhood or community, were also considered unimportant. Thus, the size of the project,[vi] the distance between one's place of

residence and the project site, and the visibility from the street were all seen as relatively unimportant in affecting the participation decision.

TABLE 9

Factors Influencing Decision Whether to Participate in a Community Solar Project

	Very Important			**Not at all Important**
Project Site[vii]				
Inside	17%	27%	23%	32%
Outside	17	16	20	47
CSUE	13	22	38	27
Owned/Operated by your group				
Inside	9	26	33	33
Outside	9	16	26	49
CSUE	17	27	34	21
Size of Project				
Inside	10	32	23	35
Outside	11	26	19	44
CSUE	NA			
Distance to your residence				
Inside	7	19	30	44
Outside	5	19	20	56
CSUE	13	24	30	33
Visibility from street				
Inside	9	14	38	40
Outside	10	10	23	57
CSUE	2	28	21	49
Whether located in your community				
Inside	9	23	27	41
Outside	5	21	21	45
CSUE	17	22	24	37

Potential economic benefit to you				
Inside	40	33	22	5
Outside	35	28	26	11
CSUE	58	27	10	4

Table 10 further refines the locational question by considering a variety of potential host sites. Again, Minnesota respondents were asked to consider projects located both inside and outside of their community and/or neighborhood while CSUE respondents were not asked to distinguish amongst projects on this basis. Unlike the more generic locational issues discussed in Table 9, respondents have strong preferences for specific locations in considering whether or not to participate in a project. Respondents are, for instance, eager to see brownfield sites turned into something productive; they also express a strong preference for projects located on school roofs, a sentiment that speaks to the potential for using important neighborhood or public assets as a means of securing acceptance of and/or participation in a project.

TABLE 10

Preferred Location for a Community Solar Project Inside/Outside of Community

	Strongly Prefer			**Makes No Difference**
Small commercial roof				
Inside	17	26	21	36
Outside	14	18	19	49
CSUE	15	30	13	41
Church roof				
Inside	29	22	17	32
Outside	16	21	19	43
CSUE	16	20	11	53

School roof				
Inside	48	20	8	23
Outside	36	23	10	30
CSUE	26	33	7	35
Large Commercial roof				
Inside	29	21	21	25
Outside	23	15	20	41
CSUE	18	27	14	41
Empty city lot				
Inside	21	14	32	33
Outside	11	21	21	46
CSUE	25	23	20	32
Farm field				
Inside	7	22	26	38
Outside	4	18	19	56
CSUE	19	7	28	47
Brownfield site				
Inside	40	26	9	23
Outside	29	25	14	31
CSUE	49	22	7	22

A preference for something does not, of course, necessarily translate into a willingness-to-pay for these preferences, a fact clearly demonstrated in Table 11.[viii] Thus, even though a strong preferences were expressed for projects located on a brownfield site or on a school roof, an overwhelming percentage of respondents indicated that they would be unwilling to pay any greater amount for a project no matter the nature of the site.

TABLE 11

Willingness-to-pay for a Project Inside/Outside of Community

	Would Pay a Great Deal More		Would Not Pay Any More	
Low Income Access				
Inside	12	34	24	29
Outside	12	28	25	35
CSUE	4	21	42	33
Church roof				
Inside	4	17	22	56
Outside	3	14	20	63
CSUE	2	0	13	85
School roof				
Inside	6	28	32	33
Outside	4	27	27	41
CSUE	0	6	34	60
Large commercial roof				
Inside	2	10	21	63
Outside	1	11	20	66
CSUE	0	0	19	81
Small commercial roof				
Inside	1	7	19	69
Outside	1	9	23	65
CSUE	0	0	17	83
Empty city lot				
Inside	1	10	23	65
Outside	1	8	20	70
CSUE	0	4	28	68

Farm field				
Inside	1	9	15	68
Outside	1	8	18	71
CSUE	2	4	15	79
Brownfield site				
Inside	6	20	28	43
Outside	9	17	25	48
CSUE	0	17	37	46

VI. Financial Models for Community Solar Projects

Unlike location and site characteristics, the financial characteristics of a hypothetical project appear to be significant drivers of the participation decision, a perhaps unsurprising finding given the importance attached to the personal economic benefit provided by a project. There are two basic types of project financing: a) lump-sum, up-front financing that requires a subscriber to front the developer an amount of money with a specified pay-back period or b) a pay-as-you method that, at least in some cases, allows a subscriber to 'opt-out' after a given period of time. In the former, the most important contingency is the number of years a subscriber will accept as a condition of participation; in the latter, the percent change in a subscriber's bill is the controlling factor.

The results displayed in Table 12 clearly demonstrate the importance of a relatively quick pay-back period in the participation decision: while some 80 percent of the respondents indicate a very strong interest in a project with a payback of ten years or less, only 28 percent had a strong interest in a project with a payback period of between 11 and 15 years. Conversely, the percentage indicating a lack of interest increased as the payback period stretched further into the future. Colorado respondents were even more emphatic about the need for a quick payback period then were Minnesota residents.

TABLE 12

Required Lump-sum
Payback Period
CSUE % (Round 2 aggregate %)
shading indicates a 10% or greater difference

	Very LIKELY to be interested			**Very UNLIKELY to be interested**
6 – 10 years	81% (80%)	15% (13%)	2% (4%)	2% (3%)
11 – 15 years	17 (28)	46 (49)	25 (15)	12 (9)
16 – 20 years	2 (10)	19 (27)	34 (31)	45 (32)
21 – 25 years	0 (3)	8 (17)	16 (19)	77 (61)
26 – 30 years	0 (2)	4 (9)	16 (20)	81 (69)

A similar sort of demand curve is evident in regards to changes in bills when using the pay-as-you-go method. As seen in Table 13, the likelihood of being interested in a project decreases smoothly and markedly with the prospect of rising monthly bills. Thus, while more than eight out of ten respondents were very likely to be interested in participating should their bills decrease by five to eight percent, only one in ten would likely be interested if their bill would increase by a similar amount.

TABLE 13

Required Percent Change in Bill
With Pay-as-you-go Method
CSUE %/(Round 2 aggregate %)

	Very LIKELY to be interested			**Very UNLIKELY to be interested**
5 – 8% increase	11% (10%)	17% (17%)	15% (23%)	57% (41%)
1 – 4% increase	25 (33)	17 (22)	26 (23)	32 (22)
No change	51 (54)	32 (25)	6 (7)	11 (13)
1 – 4 % decrease	70 (69)	23 (21)	2 (5)	4 (5)
5 – 8% decrease	85 (82)	11 (10)	2 (4)	2 (4)

VII. Information and Trustworthiness

The final element of the survey concerns an issue of long-standing interest to both academic researchers and marketing executive, namely, the trustworthiness of information offered by various sources. Prior research has shown that peers and near-peers are often the most trusted source of information when it comes to the diffusion of new technologies or practices; conversely, distant and/or expert-dominated sources of information are the least trusted sources (Hoffman and High-Pippert, 2014, 2010). The results from the present survey reinforce these conclusions (Table 14). Thus, individuals representing either an investor-owned utility or a local unit of government are burdened by a heavy dose of suspicion while spokespersons from a cooperative or municipal utility fare much better, perhaps reflecting the sort of 'distant nearness' seen in the earlier discussion on motivations for participation. It is also the case that many respondents receive their electricity from a municipal or are members of a cooperative utility, both of which stress the idea, if not the reality, of local participation or engagement in the affairs of the organization. At the same time, while respondents may not express much of a desire to work directly with neighbors or affinity groups, they nonetheless trust, more than many other sources, the information they might receive from them. Indeed,

some of the very highest levels of trust are found within the affinity groups and the socializing opportunities they represent.

TABLE 14

Trustworthiness of Information
CSUEs % (Round 1 aggregate %)

	Very Trustworthy			**Not at all Trustworthy**
Spokesperson from a municipal or cooperative utility	**25%** (15%)	**42%** (47%)	**31%** (26%)	**2%** (7%)
Someone speaking for an affinity group	**23** (27)	**45** (51)	**30** (16)	**2** (2)
Neighbor with some experience in solar energy	**21** (22)	**46** (42)	**25** (29)	**8** (4)
Local installer or contractor	**19** (16)	**37** (50)	**37** (29)	**6** (2)
Positive media coverage	**9** (9)	**26** (36)	**36** (38)	**30** (10)
Spokesperson from a local unit of government	**9** (10)	**34** (46)	**40** (35)	**17** (6)
Spokesperson from an investor owned utility	**6** (7)	**30** (32)	**43** (39)	**21** (18)

VIII. Conclusion

As noted above, the respondents to this survey possess characteristics that set them apart from the general population. Also, given their membership in organizations that advocate on behalf of "green energy" options and/or work to involve individuals in environmentally beneficial energy activities and programs, it is reasonable to assume that respondents would be "early adopters" and hence, particularly receptive to programs perceived to advance their environmental values (Rogers 1983).

This would, of course, be problematic if the findings presented above were to serve as a guidepost for the creation of messages with appeal to the general public. However, given that awareness and knowledge of shared solar initiatives is minimal amongst the general public, marketers and developers must make their appeals to precisely the sorts of individuals who

responded to this survey, at least if they are to follow the well-worn path of innovation and diffusion characteristic of most emerging technologies (Berkowitz 1996; Rice 2009; Rogers 1983 and 1995; Weatherford 1982).

In this regard, while financial factors are clearly of great importance in affecting how even this pool of early adopters think about community solar projects, it is worth recalling that both environmental benefits and locally generated energy being brought to a community by local companies and workers were also relatively important. Also, while there is a rather low degree of importance attached to 'neighborhood' as a locational variable, to the extent that "neighborhood pride" does exist, it might well be activated by seeing, or knowing that, solar panels are sitting atop the roof of the local elementary school. When combined with a personal environmental agenda or the realization that personal economic benefits are available through participation, such a feeling could be enough to move an individual to become a subscriber. Failing their own participation, such a person might at least to speak positively about the project to a neighbor or acquaintance, which, in turn, might be enough to solicit participation by that other person.

In other words, while economics is never far from a potential subscriber's mind, the participation decision cannot be said to rest *solely* on the purely personal facts of investment and return. Instead, a mix of factors is implicated, including those that speak to both a sense of community and environmental benefit. While it would be naïve to think that people will abandon any concern with personal gain in deciding whether or not to subscribe to a project, it is equally naïve to ignore their sense of attachment to and concern for those that share a common space. While altruism may not *dictate* participation, it certainly plays a role in the overall decision process, a fact that developers and advocates should remember when constructing the messages that will inform their recruitment and advertising campaigns.

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[i] The survey instruments used in this work are available upon request from the authors.

[ii] The Fresh Energy survey was divided into two pools, one asking the questions in reference to "neighborhood" and the other in reference to "community". Two assumptions were in play here, first that the former denotes a more proximate location while the latter evokes a potentially more distant or less immediate sense of space and second, that proximity might well influence attitudes towards a proposed initiative. While some differences were observed in the responses, the number of responses, 13 in the case of "neighborhood" and 24 for "community", prevents a more robust analysis of this issue. For purposes of the present analysis, therefore, the FE responses were combined.

[iii] All percentages may not add up to 100 percent due to rounding errors and a few "no opinion" responses throughout the survey.

[iv] The assumption here is that when a factor is rated as 'not at all important' the respondent has a high degree of certainty regarding this issue.

[v] In most cases, there is no direct relationship between a subscriber's participation in a project and the consumption of the electrons flowing from that project. Thus, particularly in the case of energy independence, this finding speaks more to the *perceptions* of respondents rather than the reality of a shared solar project.

[vi] It is assumed here that respondents would perceive a solar garden either as relatively small and thus probably unobtrusive or so sympathetic to their personal agendas that the presence of a project would be accepted.

[vii] The project site was specified as a commercial building, school, etc., a consideration explored in more detail in subsequent questions.

[viii] Respondents were also asked about their willingness-to-pay for a project that guaranteed access to low-income households. Less than 10 percent of respondents indicate a willingness-to-pay a great deal more for such access. While a higher percentage of respondents indicated *some* willingness-to-pay a modest premium, they were overwhelmed by those indicating that they would pay only slightly more and, in most cases, by those unwilling to pay *any* additional amount.