

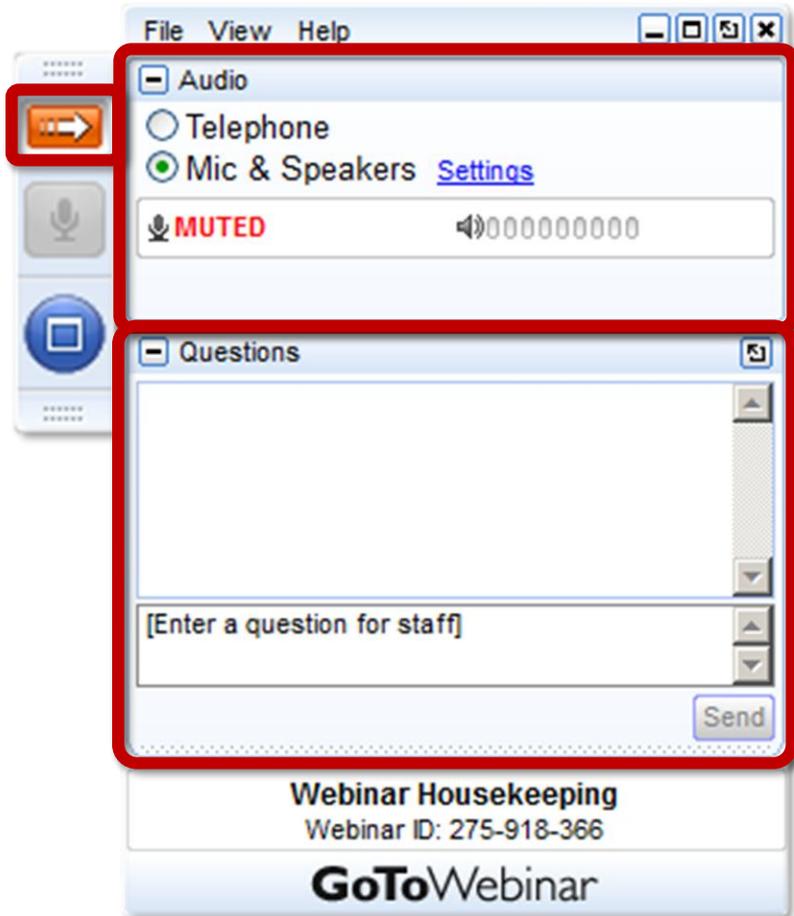
SUSTAINABLE SOLAR EDUCATION PROJECT

# Colorado's Low-Income Community Solar Demonstration Project

October 26, 2017



# Housekeeping



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# Clean Energy States Alliance



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Innovation is in our nature.



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# Sustainable Solar Education Project

A project to provide information to state and municipal officials on strategies to ensure distributed solar

- Remains consumer friendly
- Benefits low- and moderate-income households



The project is managed by the Clean Energy States Alliance (CESA) and is funded through the U.S. Department of Energy SunShot Initiative.



# Sustainable Solar Education Project Resources

The Sustainable Solar Education Project provides guides, webinars, and other resources.

A free **monthly e-newsletter** highlights solar equitability and consumer protection news from across the country.

[www.cesa.org/projects/sustainable-solar](http://www.cesa.org/projects/sustainable-solar)



The screenshot shows the header of the newsletter with the Clean Energy States Alliance logo and the title "SUSTAINABLE SOLAR EDUCATION PROJECT NEWSLETTER". The date "MAY 2017" is displayed in the top right. The main content area lists three webinar topics: "Sustainable Solar Education Project Webinars", "Bringing the Benefits of Solar to Low-Income Customers" (May 18th), and "Crowd Financing Solar for Nonprofits Serving Low-Income Communities" (May 25th). A fourth topic, "Community Solar for Low- and Moderate-Income Consumers" (June 1st), is partially visible. A sidebar on the right contains introductory text about the project and a link to the website.

**Clean Energy States Alliance**  
SUSTAINABLE SOLAR EDUCATION PROJECT  
**NEWSLETTER**

**MAY 2017**

The Sustainable Solar Education Project provides information and educational resources to state and municipal officials on strategies to ensure distributed solar electricity remains consumer friendly and benefits low- and moderate-income households. The project is managed by the Clean Energy States Alliance (CESA) and is funded through the U.S. Department of Energy SunShot Initiative's Solar Training and Education for Professionals program.

The Sustainable Solar Education Project Newsletter reports on issues related to solar equitability and consumer protection.

For more information about the Sustainable Solar Education Project, please visit our [website](http://www.cesa.org/projects/sustainable-solar).

[cesa.org/projects/sustainable-solar](http://www.cesa.org/projects/sustainable-solar)

**Clean Energy States Alliance**

**Sustainable Solar Education Project Webinars**

**Bringing the Benefits of Solar to Low-Income Customers**  
*Thursday, May 18th, 1-2 pm ET*  
CESA will conduct a webinar on low-income solar program and policy design. The webinar will be based on a recently released CESA guide authored by Bentham Paulos titled [Bringing the Benefits of Solar to Low-Income Consumers](#). The guide identifies successful and promising approaches, offers factors policymakers should consider, and provides policy and program design recommendations for bringing the benefits of solar to low-income consumers. [Register here](#).

**Crowd Financing Solar for Nonprofits Serving Low-Income Communities**  
*Thursday, May 25, 1-2 pm ET*  
Nonprofit community service providers that serve low-income communities have faced challenges in financing solar for their own facilities. One answer that has emerged is crowdfunding, in which many individuals each provide a small amount of money for a project. Crowdfunding can involve donations, or it can involve investments, in which the individuals who participate expect a financial return. In this webinar, Andreas Karelas, Executive Director of RE-volv, and Todd Bluechel, Vice President of Marketing and Sales at CollectiveSun, will present two models that rely on crowdfunding to enable nonprofits to adopt solar. [Register here](#).

**Community Solar for Low- and Moderate-Income Consumers**  
*Thursday, June 1, 1-2 pm ET*  
Because community solar can be made accessible to renters and can include flexible terms, it holds promise for spreading the benefits of solar to low- and moderate-income (LMI) consumers. In this webinar, Kelly Roache, Senior Program Manager at Solstice, and David Miller, Senior Vice President at Alpine Bank,

# Sustainable Solar Education Project Guides

1. [Solar Information for Consumers](#)
2. [Publicly Supported Solar Loan Programs](#)
3. [Standards and Regulations for Solar Equipment, Installation, and Licensing & Certification](#)
4. [Solar+Storage for Low- and Moderate-Income Communities](#)
5. [Bringing the Benefits of Solar Energy to Low-Income Consumers](#)
6. [Consumer Protections for Community Solar](#)



# Panelists

- **Joseph Pereira**, Director of Low-Income & Residential Energy Services, Colorado Energy Office
- **Emily Artale**, Principal Engineer and Co-owner, Lotus Engineering and Sustainability
- **Doug Gagne**, Energy Project Analyst, NREL





# *Colorado's Low-Income Community Solar Demonstration Project*

Clean Energy States Alliance (CESA) Webinar  
October 26, 2017

Colorado Energy Office, Lotus Engineering and Sustainability,  
National Renewable Energy Lab (NREL)



**COLORADO**  
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SECTION 1

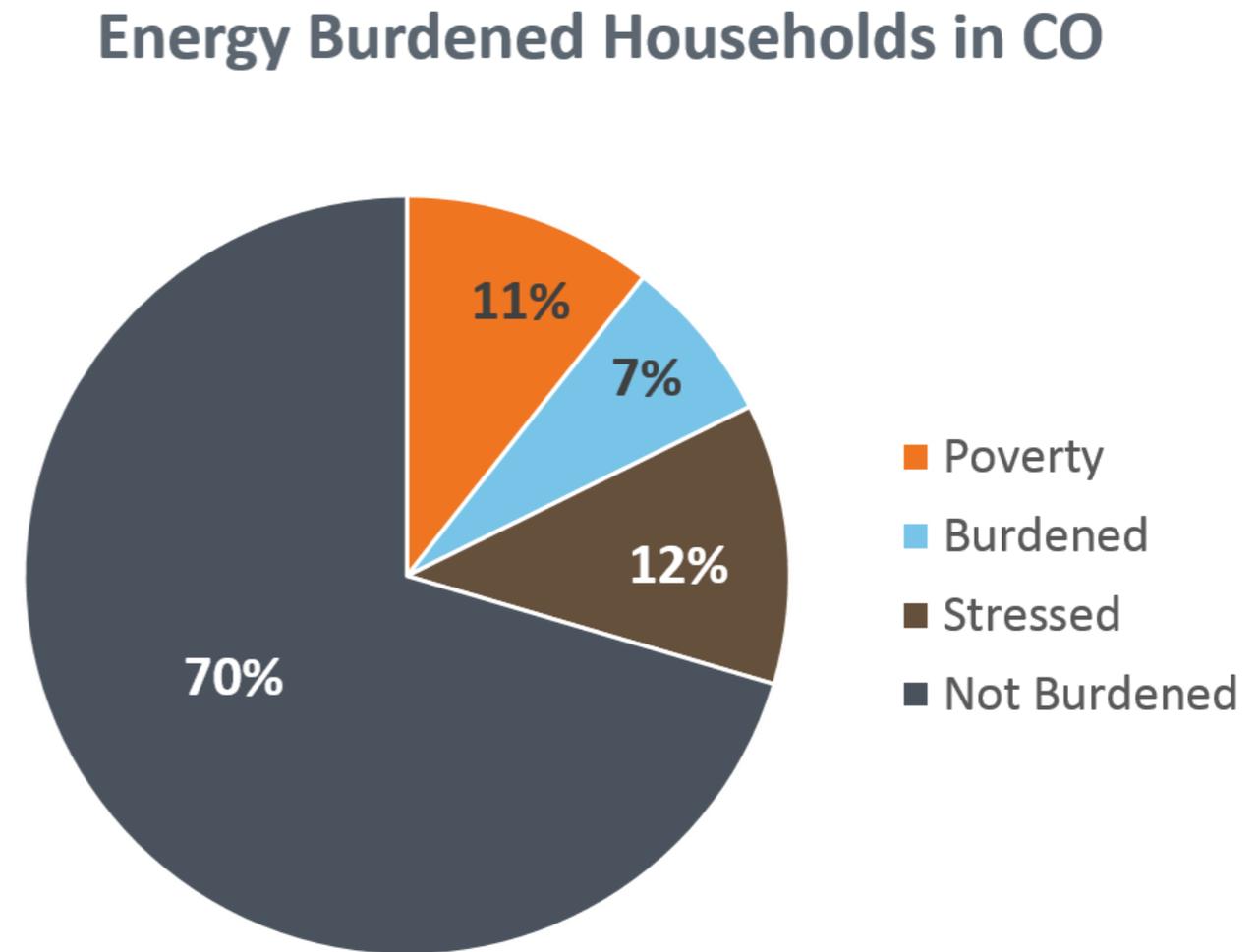
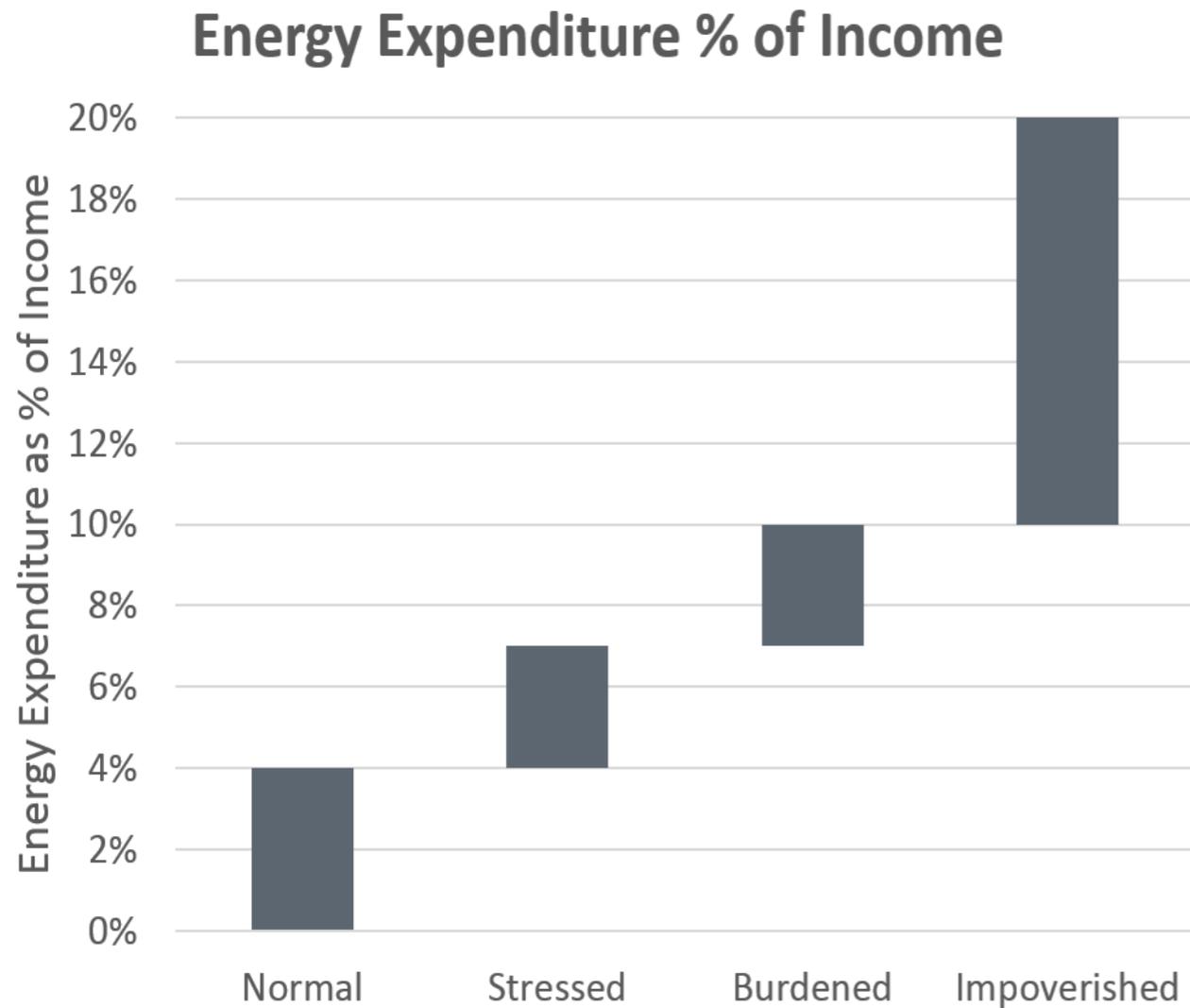
# *Energy Burden in Colorado*

Joseph Pereira

Director of Low-Income Energy Services

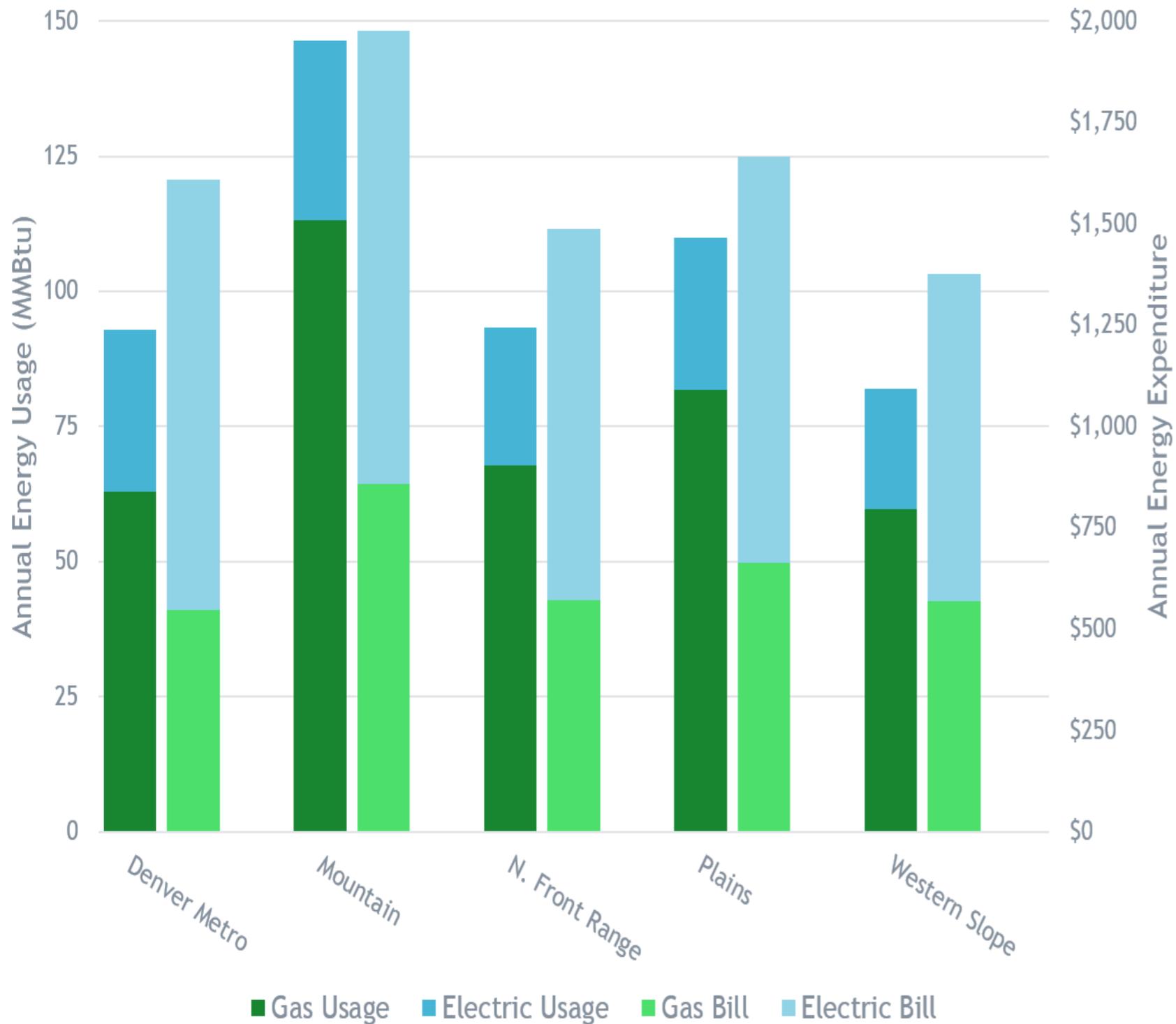
Colorado Energy Office

# Energy Burden in Colorado



Source: Census.gov American Community Survey

## Energy Usage and Expenditure by Region

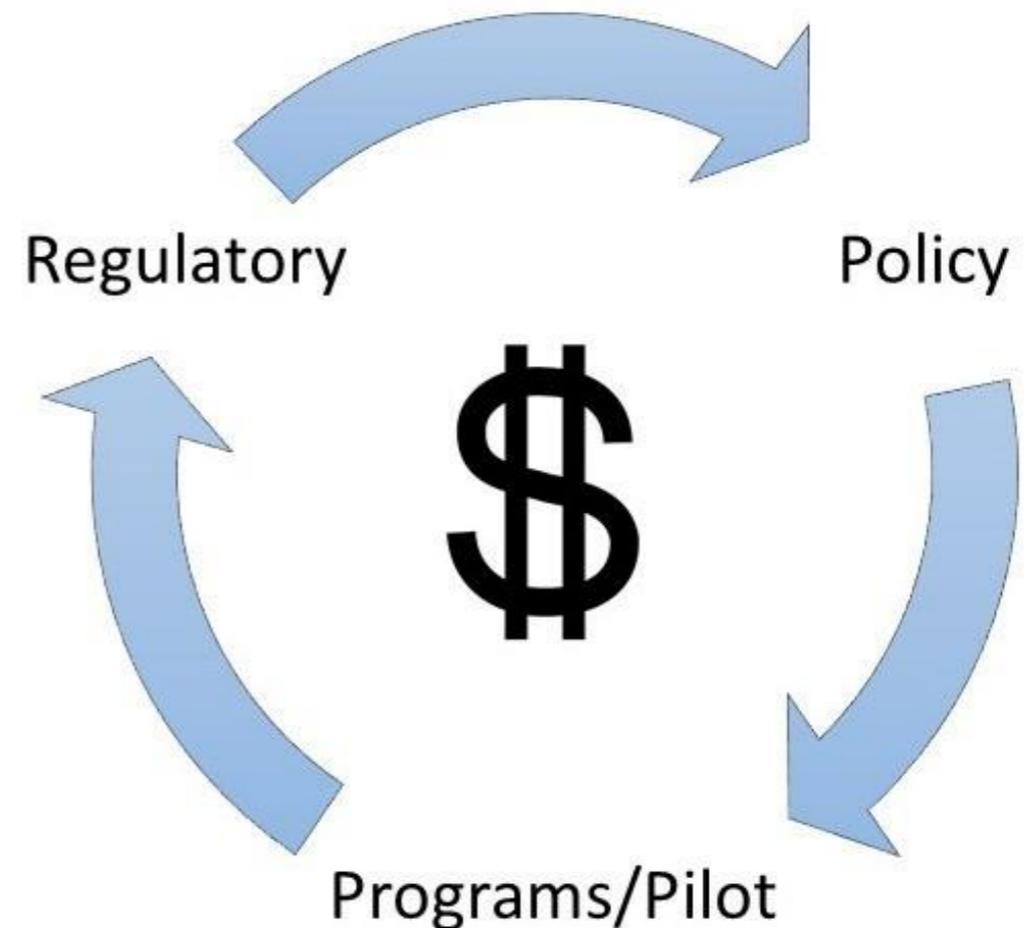


## Energy Usage

- Denver Metro, N. Front Range, and Plains have similar energy usage
- Mountain has higher energy usage
- Western Slope has lower energy usage
- Gas makes up more than 70% of usage, but accounts for less than 40% of expenditure
- Gas is relatively inexpensive compared to electricity (and vice-versa)

# *Enabling Solar Equity and Access*

- Understand current legal framework
- Develop policy well founded in need
- Test applications and approaches
- Evaluate lessons learned
- Develop regulatory strategy
- Implement results



# *CO Community Solar Landscape*

Colorado currently has over 60 community solar projects in operation, totaling over 31 MW of installed capacity

Projects are distributed across electric cooperatives, municipal and investor owned utilities.

Low-income user subscriptions are fully subscribed to approximately 2.4 MW of developer/utility based generation

Trajectory of investor owned community solar offerings expected to grow exponentially

# Colorado Community Solar

- Colorado passed HB10-1432 Community Solar Gardens Act (CSGA) in 2010
  - First legislation passed in the nation that supports community solar for investor owned utilities
  - Requires that 5% of all CSG projects reserved for low-income subscribers
- CSGA - Low-Income Requirement:
  - CEO commissioned a report\* in 2015 to evaluate CSGA 5% low-income requirement
  - Key findings show:
    - Community solar has been very active in CO and continues to expand at rapid pace
    - Growing market suggests there is significant potential to expand community solar market with low income stakeholders
    - The low-income 5% carve out requirement is being met, but there is room for improvement

\*Report: <https://www.colorado.gov/pacific/sites/default/files/atoms/files/Low-Income%20Community%20Solar%20Report-CEO.pdf>

# *Low-Income Community Solar Demonstration Project*

- Launched by the Colorado Energy Office in 2015
- GRID Alternatives awarded \$1.2 million grant to implement project
- Two overarching goals:
  - Reduce household electric costs by enhancing low-income access to solar
  - Demonstrate the scalability and viability of low-income community solar arrays
- Two project phases:
  - Phase 1: Partner with Rural Electric Cooperatives and Municipal Utilities
  - Phase 2: Partner with Investor Owned Utilities



## SECTION 2

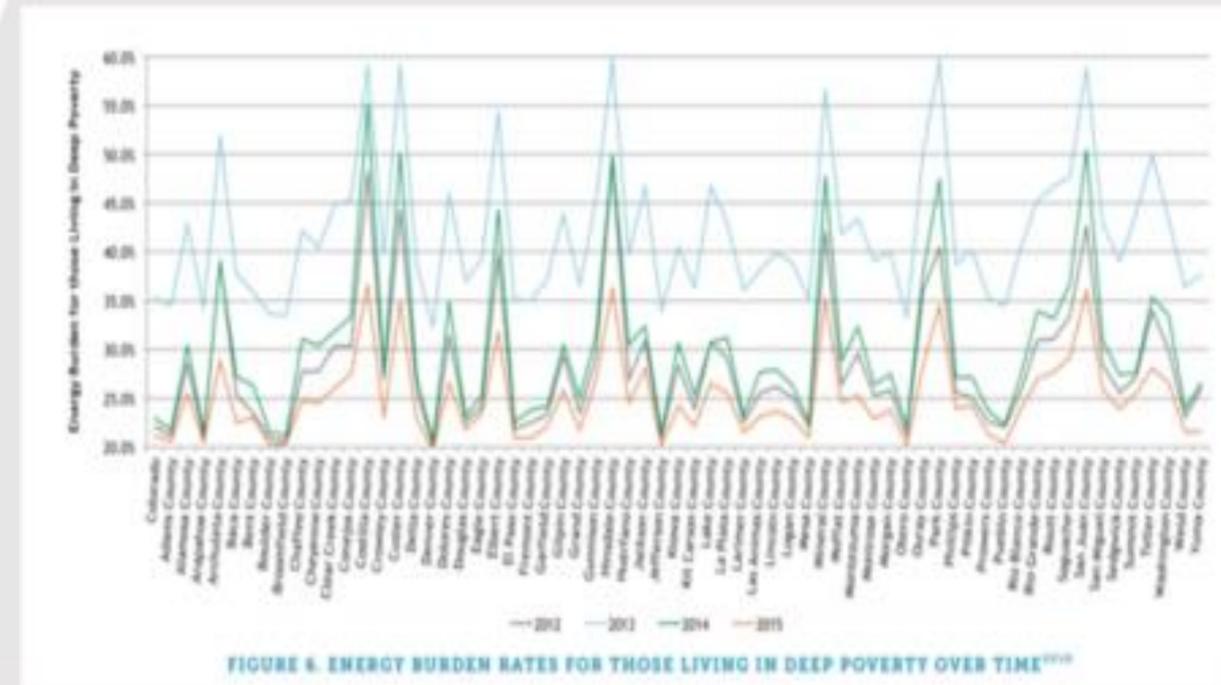
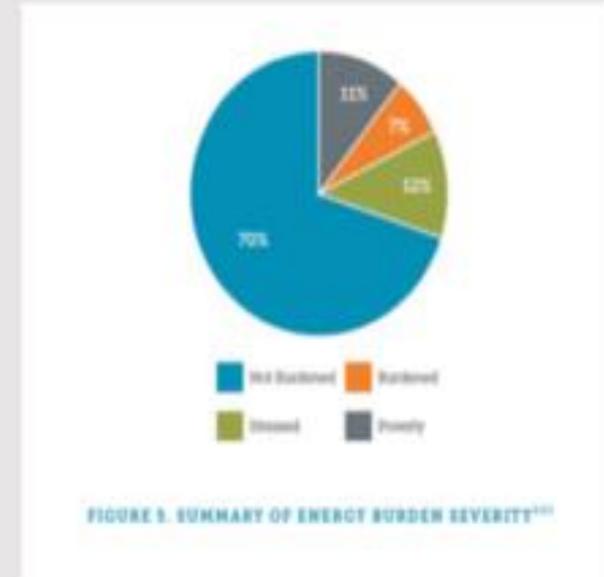
# *Project Evaluation*

Emily Artale

Principal Engineer and Co-Owner  
Lotus Engineering & Sustainability

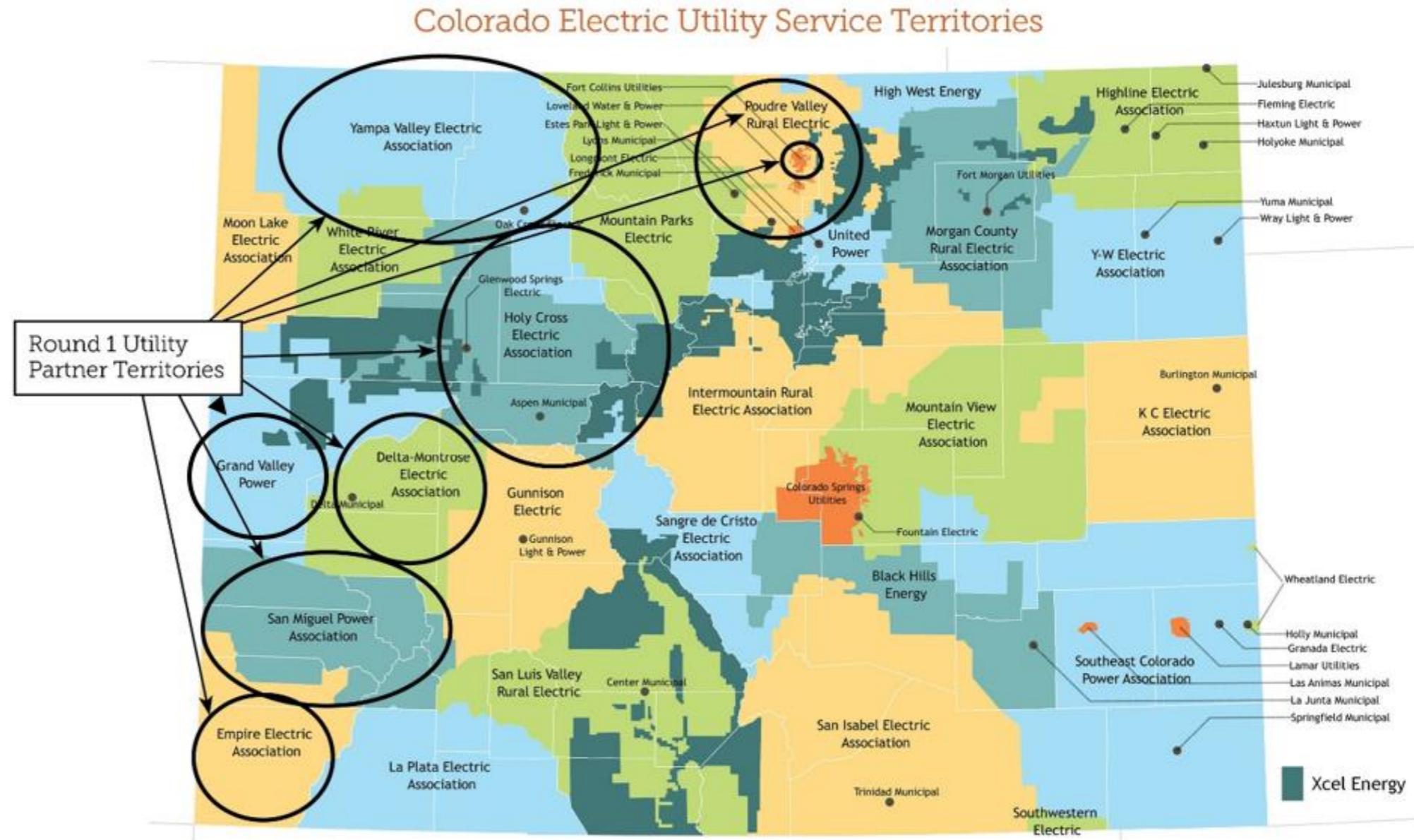
# Colorado Community Solar

- 30% of Colorado households pay more than 4% of annual income on energy bills
  - 11% of the population pays more than 10% of annual income on energy bills
- Current programs serve a need, but there exists a gap in services in addressing high electricity costs
- Community solar can fill the gap



# Community Solar Demonstration Projects

- 8 projects with local utilities
- 300 households
- 1.5 MW Community Solar installed
- Subscribers must earn 80% of AMI or less



| Utility Provider                         | Project Size (kW) | Counties Served                                | Number of Subscribers | Key Demonstration Aspect   | Year Built |
|--|-------------------|--|-----------------------|--|------------|
| Empire Electric Association              | 26                | Montezuma, Dolores, San Miguel                 | 9                     | Integrated with utility-owned stranded asset                     | 2016       |
| Delta Montrose Electric Association      | 151               | Delta, Gunnison, Montrose                      | 45                    | Largest 100% low-income array in nation                          | 2016       |
| Holy Cross Energy                        | 145               | Rifle, Pitkin, Eagle, Gunnison                 | 43                    | Project driven by community                                      | 2016       |
| Yampa Valley Electric Association        | 148               | Routt, Moffat, Eagle                           | 47                    | Diverse demographics   | 2016       |
| Fort Collins Utilities                   | 65                | Larimer  | 20                    | First municipal utility partner; model built on roof of building | 2016       |
| San Miguel Power Association             | 125               | San Miguel, Montrose, Ouray, San Juan, Dolores | 33                    | Built on a former landfill site                                  | 2016       |
| Poudre Valley Rural Electric Association | 700               | Larimer, Weld                                  | 180                   | Largest low-income offering to date                              | 2017       |
| Grand Valley Power                       | 36                | Mesa, Garfield, Delta, Montrose                | 10                    | Key partnership with weatherization provider                     | 2017       |
| <b>Total</b>                             | <b>1396</b>       |  | <b>377</b>            |  |            |



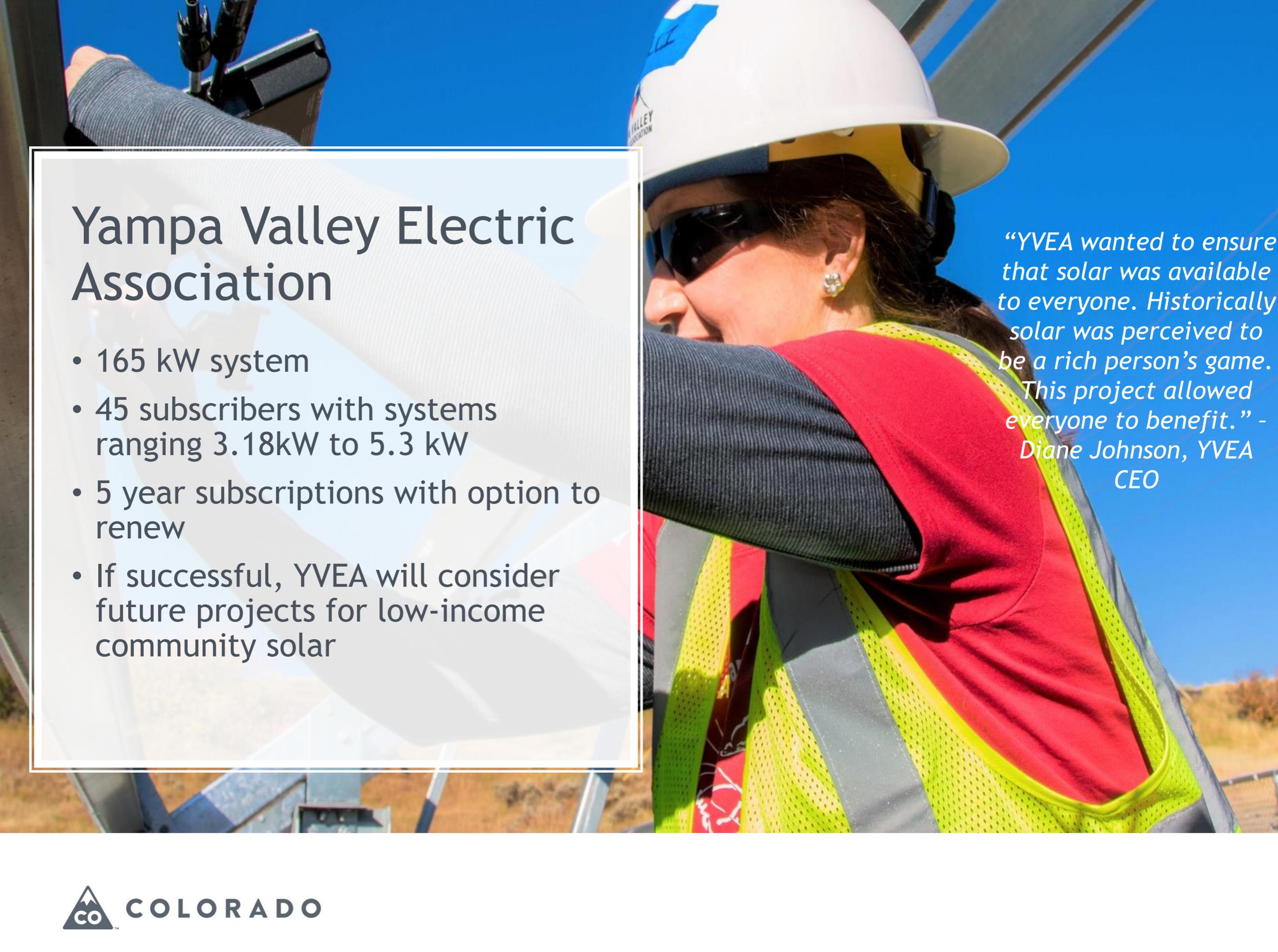
# Two Sample Case Studies in Review

- Delta Montrose Electric Association
  - Achieved 50% cost savings
  - Serves a very conservative part of the state
  - Driven by energy independence
  - Wholesale electric providers – Tri-State Generation and Distribution
- Yampa Valley Electric Association
  - Savings range from 15% to 50%
  - Service area is very diverse
  - Integrated into holistic energy strategy
  - Wholesale electric providers – Xcel Energy

*“One of the greatest aspects of this program is locking in [electric] rates. The cost of electricity will be fixed even with inflation.” Jim Heneghan, DMEA’s Renewable Energy Engineer*

## Delta-Montrose Electric Authority

- 151 kW Solar Garden
- 43 subscriber households with systems ranging from 2.4kW to 4.8 kW
- 5 year subscriptions with a fixed solar payment at \$0.04/kWh
- Subscriber savings anticipated to be approximately \$312/year; 50% of electric costs

A woman wearing a white hard hat with a logo, safety glasses, and a red shirt with a yellow safety vest is working on solar panels. She is looking down at her work. The background is a clear blue sky.

# Yampa Valley Electric Association

- 165 kW system
- 45 subscribers with systems ranging 3.18kW to 5.3 kW
- 5 year subscriptions with option to renew
- If successful, YVEA will consider future projects for low-income community solar

*“YVEA wanted to ensure that solar was available to everyone. Historically solar was perceived to be a rich person’s game. This project allowed everyone to benefit.” - Diane Johnson, YVEA CEO*

# *Subscriber Experiences: Variability in Impact*

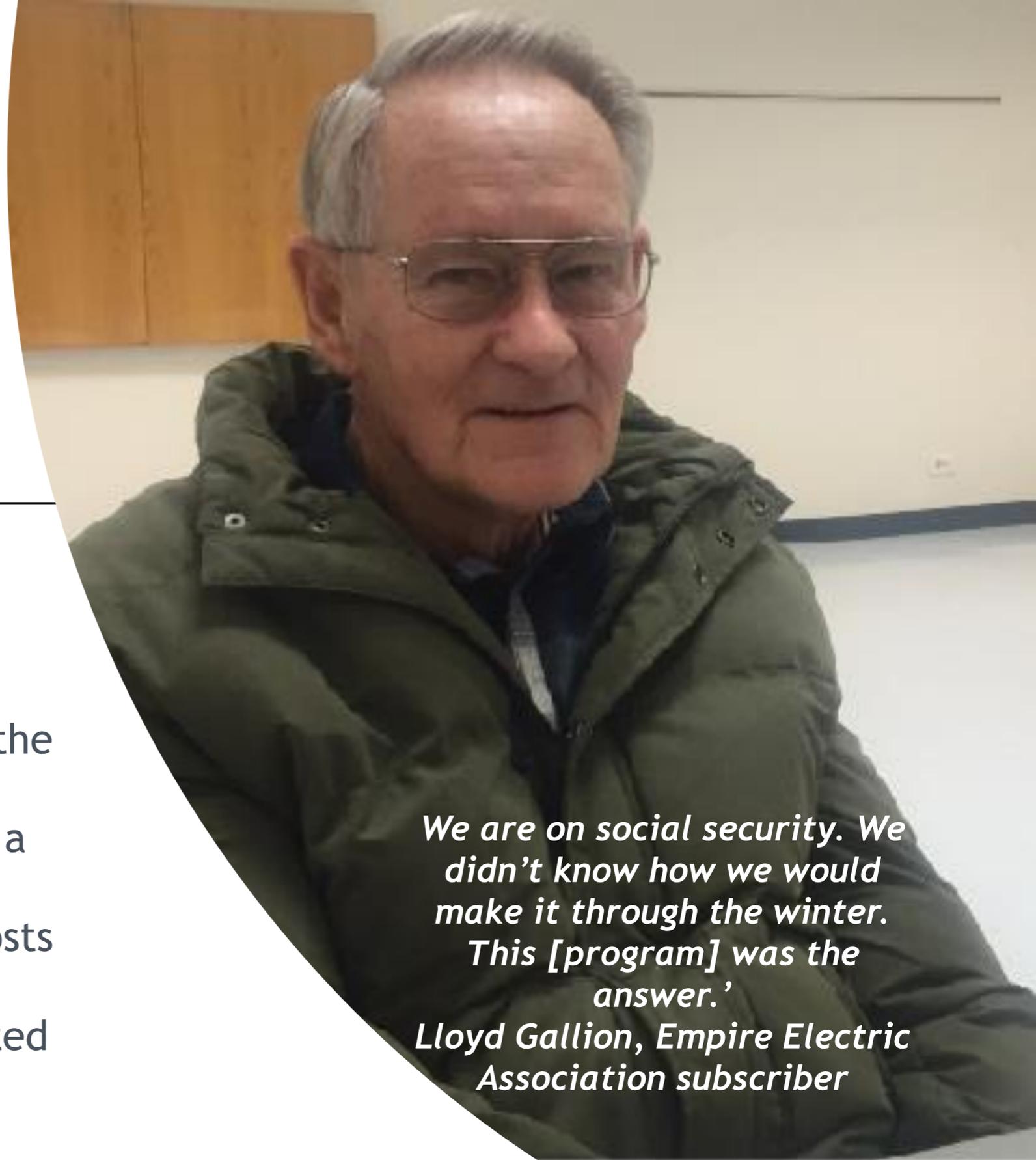
- Fixed charges on bills limits the potential savings for subscribers; even if a system offset 100% of usage only 50% of the costs could be offset
- Level of benefit varied based on each subscriber's energy use: electric heat vs. program caps
- Cap on program participation varied by utility co-op and determined whether the program had broad or deep impact
- Contractual limits to program participation impacted long-term savings per household, but allowed for utility co-ops to impact a greater number of households
- Program structure regarding solar payments varied and impacted subscriber savings



# *Subscriber Experiences: Successes*

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- Majority of low-income customers were on a fixed income
- Helped preserve community character by ensuring that all populations are able to remain in the community
- Even \$50 in monthly savings made a HUGE difference!
- Being able to budget for energy costs was significant
- Most subscribers have always wanted solar - couldn't afford it
- Arrays performed as expected



*We are on social security. We didn't know how we would make it through the winter. This [program] was the answer.'*  
*Lloyd Gallion, Empire Electric Association subscriber*



## *Utility Co-Op Experience: Unique Aspects*

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- Brownfields to Brightfields
- Prevented NIMBYism
- Utilized local labor
- Integrated with existing energy programs

*“Local folks helped out logistically. In one instance, we found a local farmer and were able to call upon him for trenching equipment. In another case, we employed a neighbor’s relatives to help with concrete work. Part of the success of this project was due to the fortitude of the locals.”*

*Kam Jaspal, GRID Alternative’s Land and Project  
Development Manager*

# *Utility Co-Op Experience: Successes*

- Save costs by using utility-owned land and interconnect the project to the grid
- Potential to connect to ‘stranded assets’ already in the portfolio
- Subscribers more apt to pay bills because late payments may get them removed from the program
- Opportunity to gain solar experience
- Opportunity to learn new billing software
- All projects recognized as qualifying facilities under PURPA
- Meet utility goals; very well received!





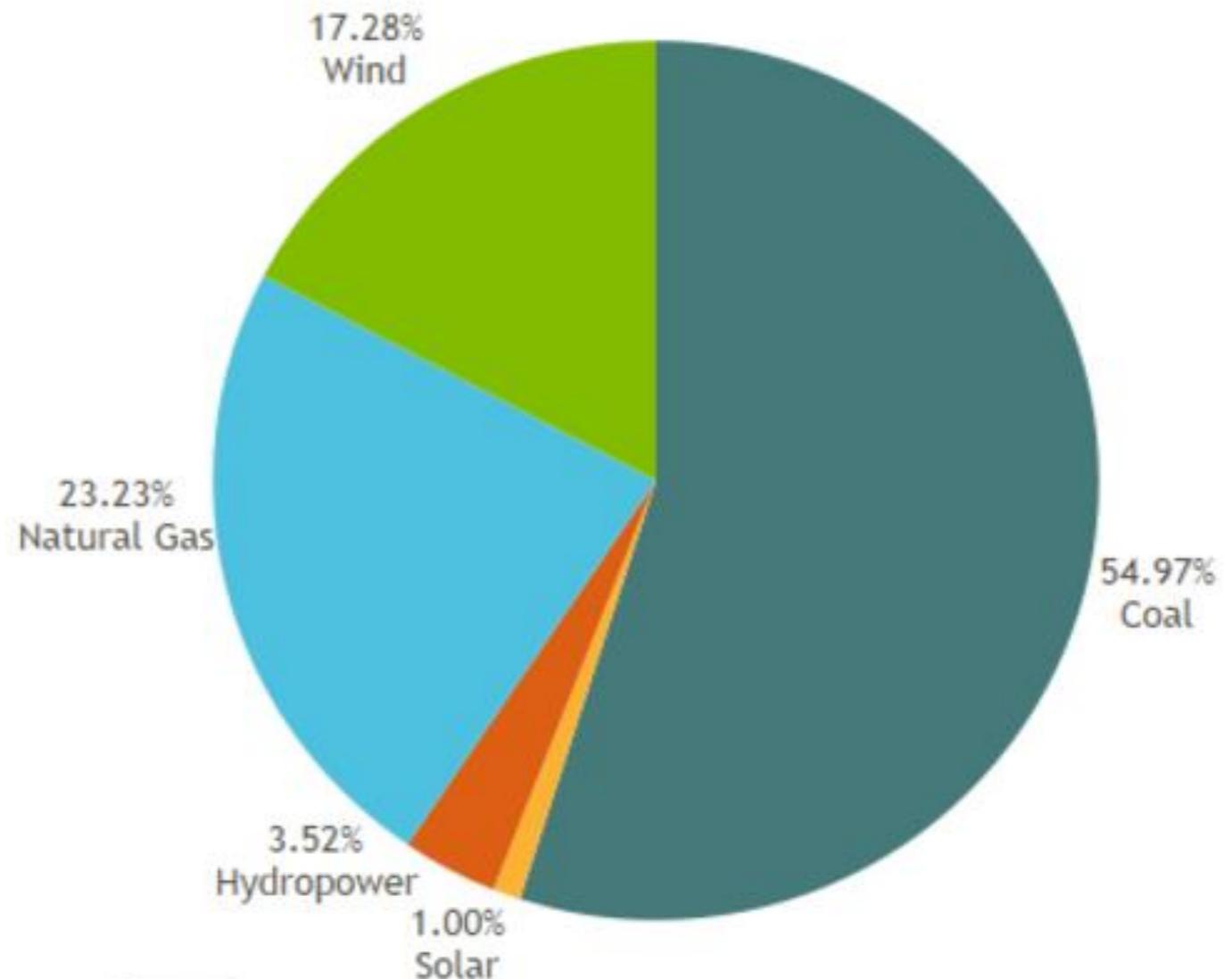
## *Utility Co-Op Experience: Challenges*

- Utilities under Tri-State limited by 5% cap
- Some utilities did a pass through credit from wholesale providers to subscribers
  - Bill credit not enough to reach 50% cost savings - subscribers saw smaller savings
- Many utilities had to subsidize program so that subscribers could realize 50% cost savings
- High capital costs; low O&M

# Key Findings

- Many utilities are limited to no more than 5% generation
- These utilities CANNOT build any more projects once they meet the cap
- Utilities must be able to exceed this cap if they are to continue renewable energy programs

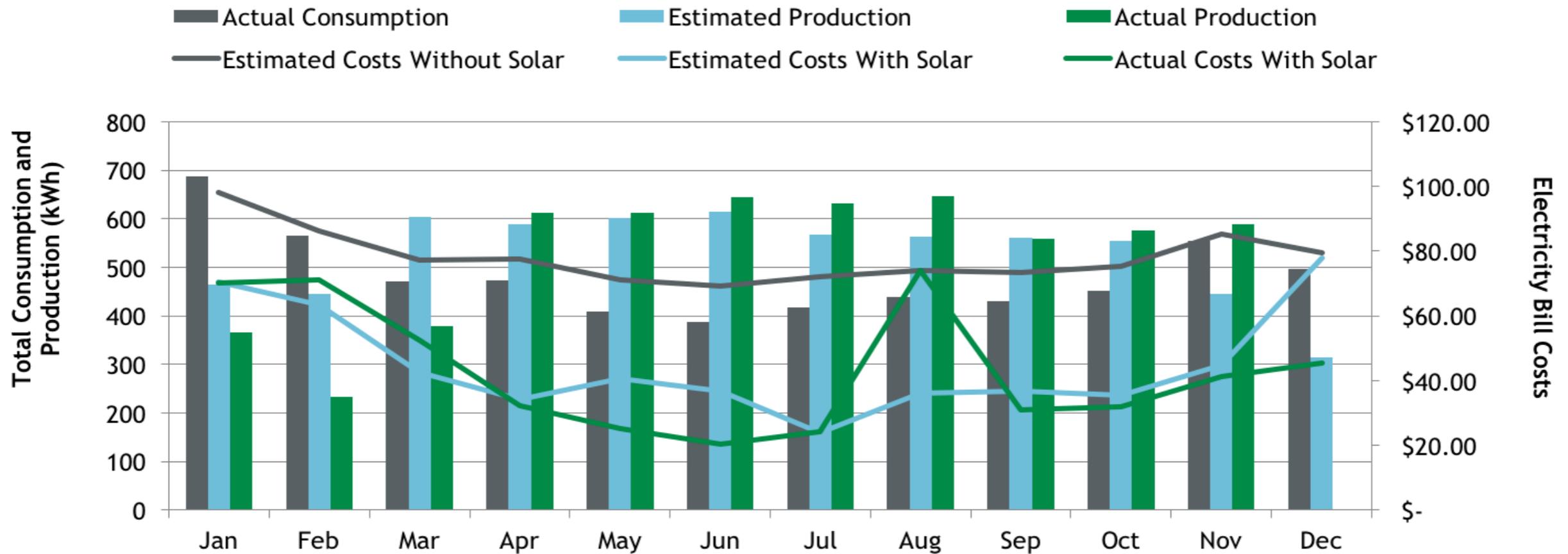
## CO Electricity Generation (2016, Thousand MWh)



Source: Energy Information Administration

# Key Findings

- Fixed vs. variable costs limit subscriber savings and impact utility paybacks
- Some utilities indicated that they anticipate that the more renewables enter the grid, the higher likelihood that they will have to increase these fixed costs to recoup expenses



# Key Findings

- Carry-over credits can create more long-term savings for subscribers that need it the most
  - Credit banking is a benefit to these folks
- Locked in bill rates are beneficial to low-income customers, especially those on a fixed income



*“It is a big thing to know what our bill costs will be for the next few years. It helps us with budgeting.”*

*Steve Sidebottom, Delta-Montrose Electric Association subscriber*

SECTION 3

*Solar Technical Assistance  
Team (STAT) Evaluation*

Douglas Gagne

Project Development and Finance

National Renewable Energy Laboratory

# *Utility Return on Investment*

# *Introduction*

- The objective of this analysis is to identify project structures that make low-income community solar (LICS) projects more **cost-effective, replicable, and scalable**.
- Finding ways for LICS projects to generate a slight return, or at least avoid large financial losses, may help to encourage utility interest and participation in LICS projects and reduce projects' dependence on grants or excess capital to fund projects.
- This analysis examined six of the eight LICS projects, which were undertaken by rural cooperatives. Data is outstanding for the two remaining projects.

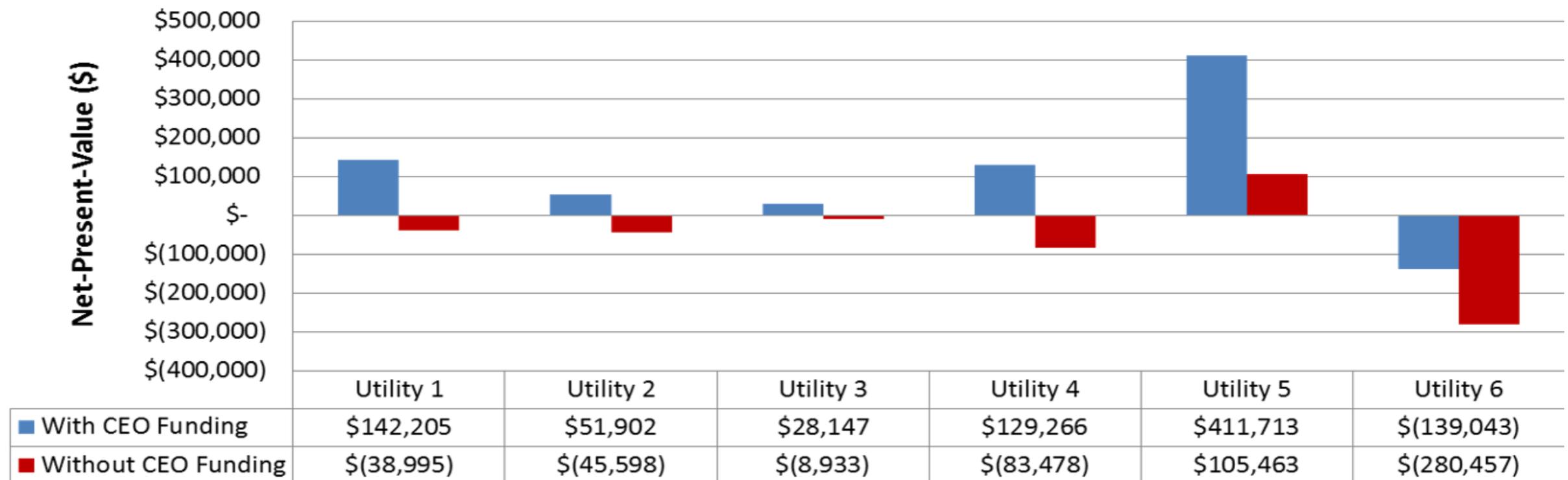
# *Methodology*

- Financial models of the project returns were developed for each cooperative project to examine their revenues under the community solar case, as well as a business-as-usual case.
- To compare the projects, we used net present value (NPV).
  - One shortcoming of this metric is that it's purely financial - ancillary benefits of solar (e.g. air quality, reliability, consumer cost stability) - are not included.

# *Project Results*

# Cooperatives' Project Return on Investment

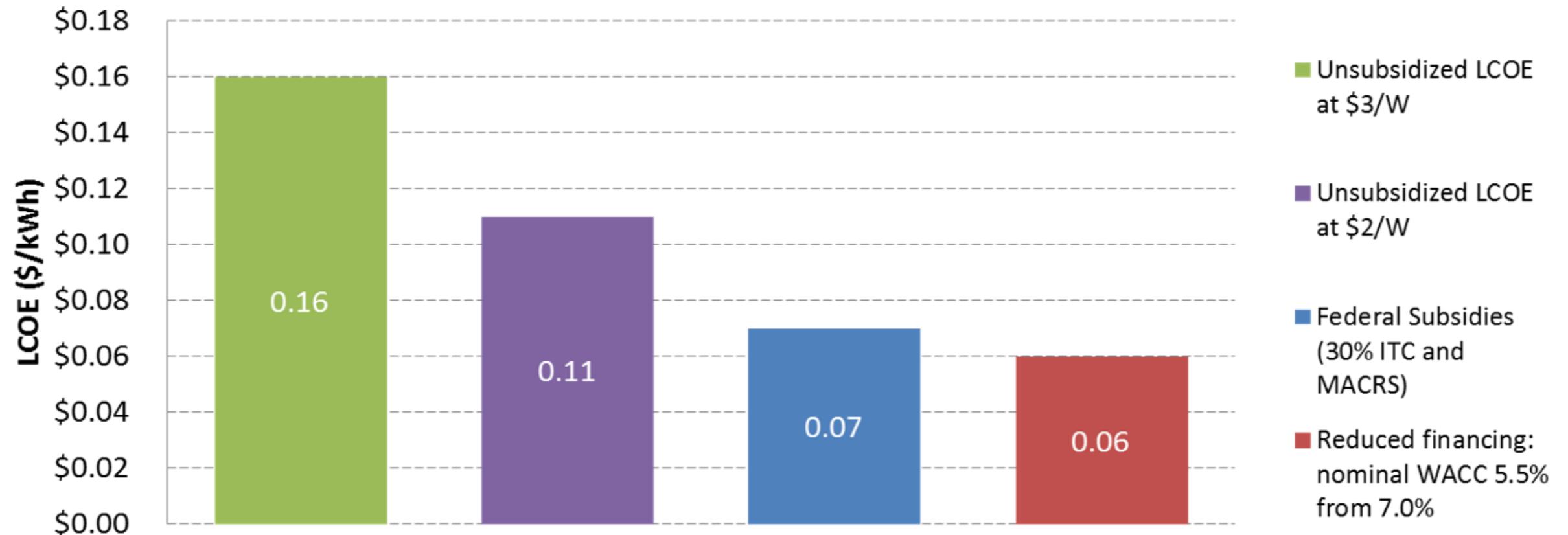
**Low-Income Community Solar  
Project Returns (With/Without CEO Funding)**



- CEO's funding (which ranged from \$0.60/W to \$3.75/W) played a crucial role in making projects economically viable. Without CEO, the projects generally lost money.
- Cooperatives' low-income customer savings and project costs varied considerably, which contributed to the wide range in returns between the projects.
- The cooperatives contributed between \$0.60- \$2/W of the project costs, and also provided in-kind contributions, such as land for the solar system, interconnection labor, client outreach, and billing management.

# *Variables Impacting Utility Return*

# Variables that Impact Utility Return on Community Solar Projects



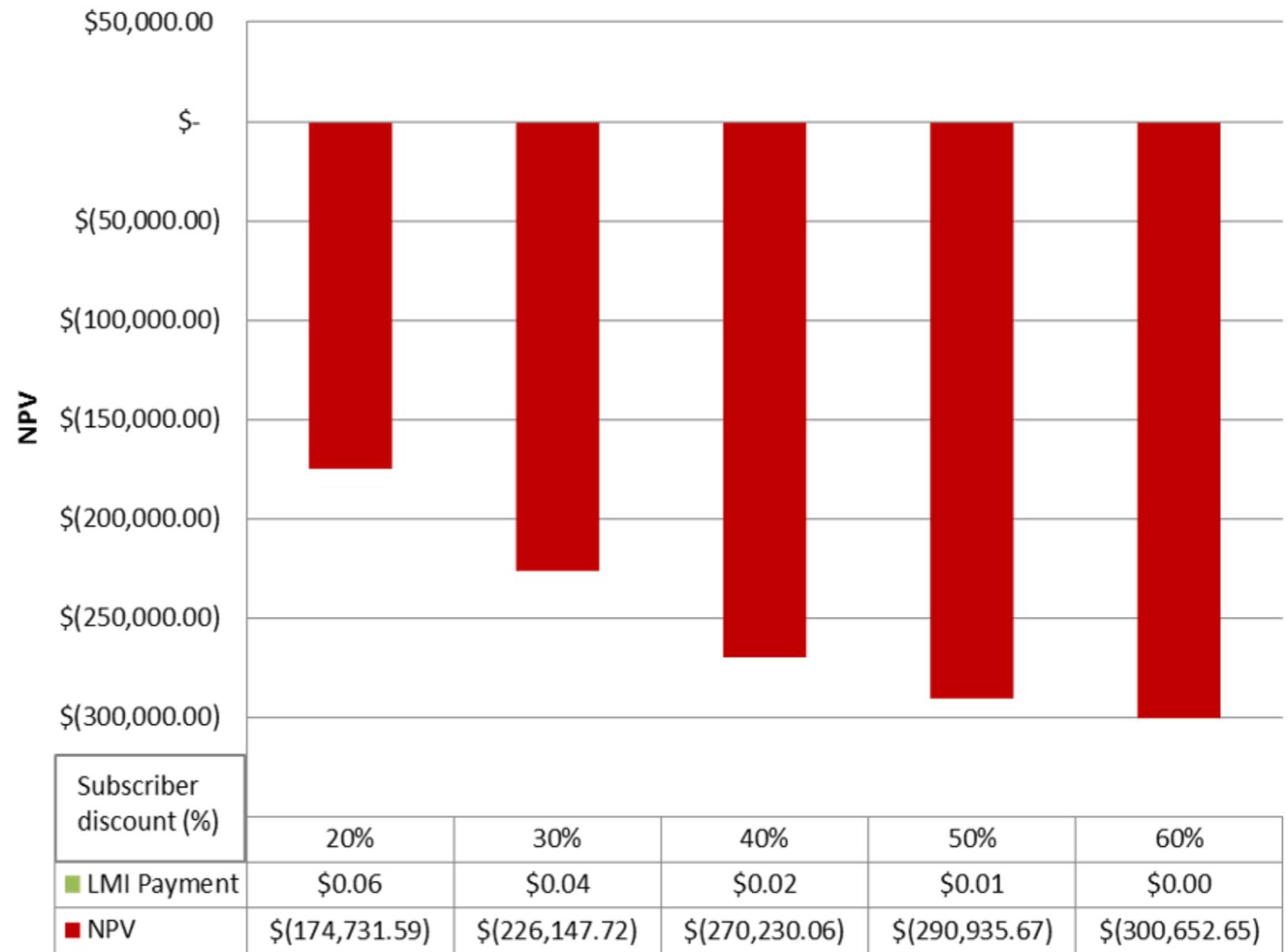
- Projects' initial capital costs, and the availability of incentives, are major drivers of a solar project's levelized cost of energy (LCOE).
- However, cost is only half of the picture. Utility returns are also largely determined by the revenues earned by the project (in this case, subscriber payments and renewable energy credits).

# *Sensitivity Analysis of Variables Impacting Project Return*

- **Capital Costs** - Assessed the impact of future reductions in capital costs from 0-50%, this resulted in an increase of up to \$50,000 in project returns.
- **Federal Incentives (ITC/MACRS)** - The cooperatives in the project were not taxable entities, and could not use the federal tax incentives. If these incentives could have been utilized, project returns would increase by \$123,000 on average.
- **LMI Subscriber Bill Credit** - Cooperatives provided bill credits between 15-55% of low-income subscribers' total bill cost. The difference in utility return between a 20% and 60% low-income subscriber bill credit was \$126,000.

# Impact of Credit Discount

- Although capital costs were an important component to the overall project returns, the level of bill credit played the most significant role in determining the overall return for the projects.
- Balancing the level of subscriber discount against the overall return is key to future project replicability

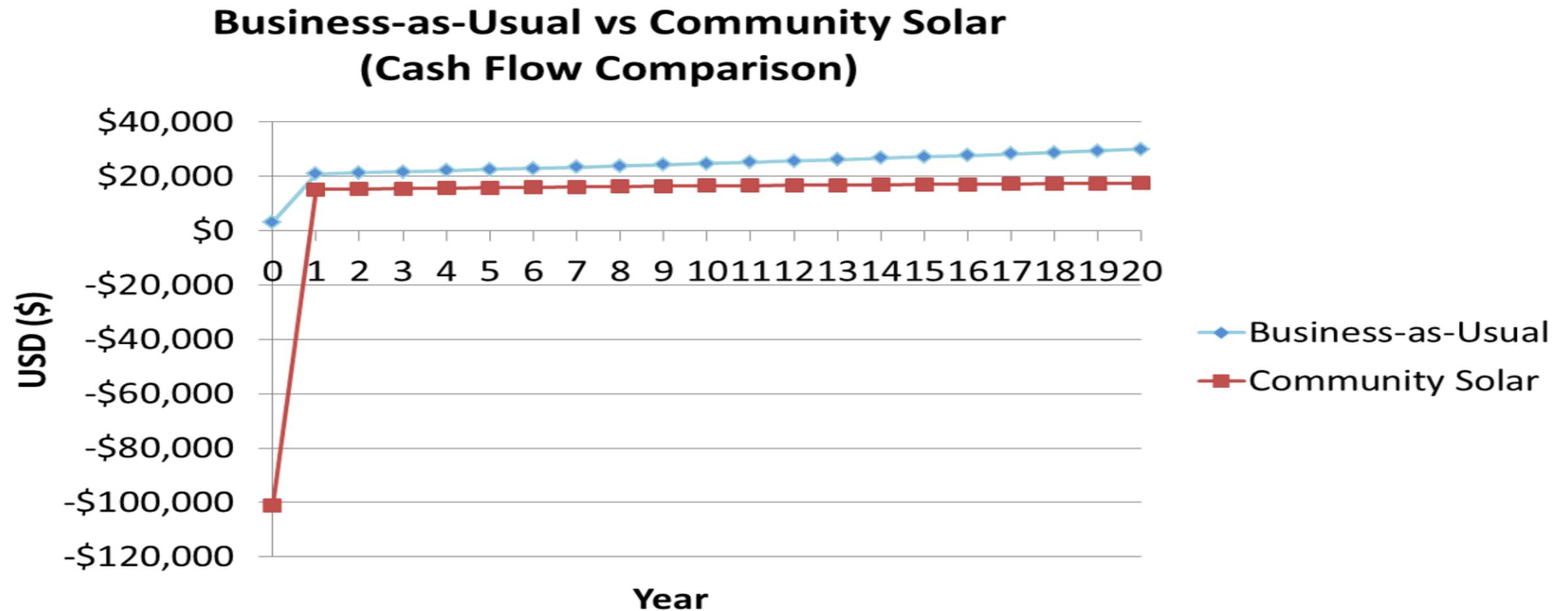


Decrease in Net Income (\$) vs Subscriber discount (%)

The average change in return between a 20% and 60% subscriber bill credit was (\$126,000).

# *Opportunity Cost of Community Solar*

# Utility Impacts: Opportunity Cost of Business-as-Usual

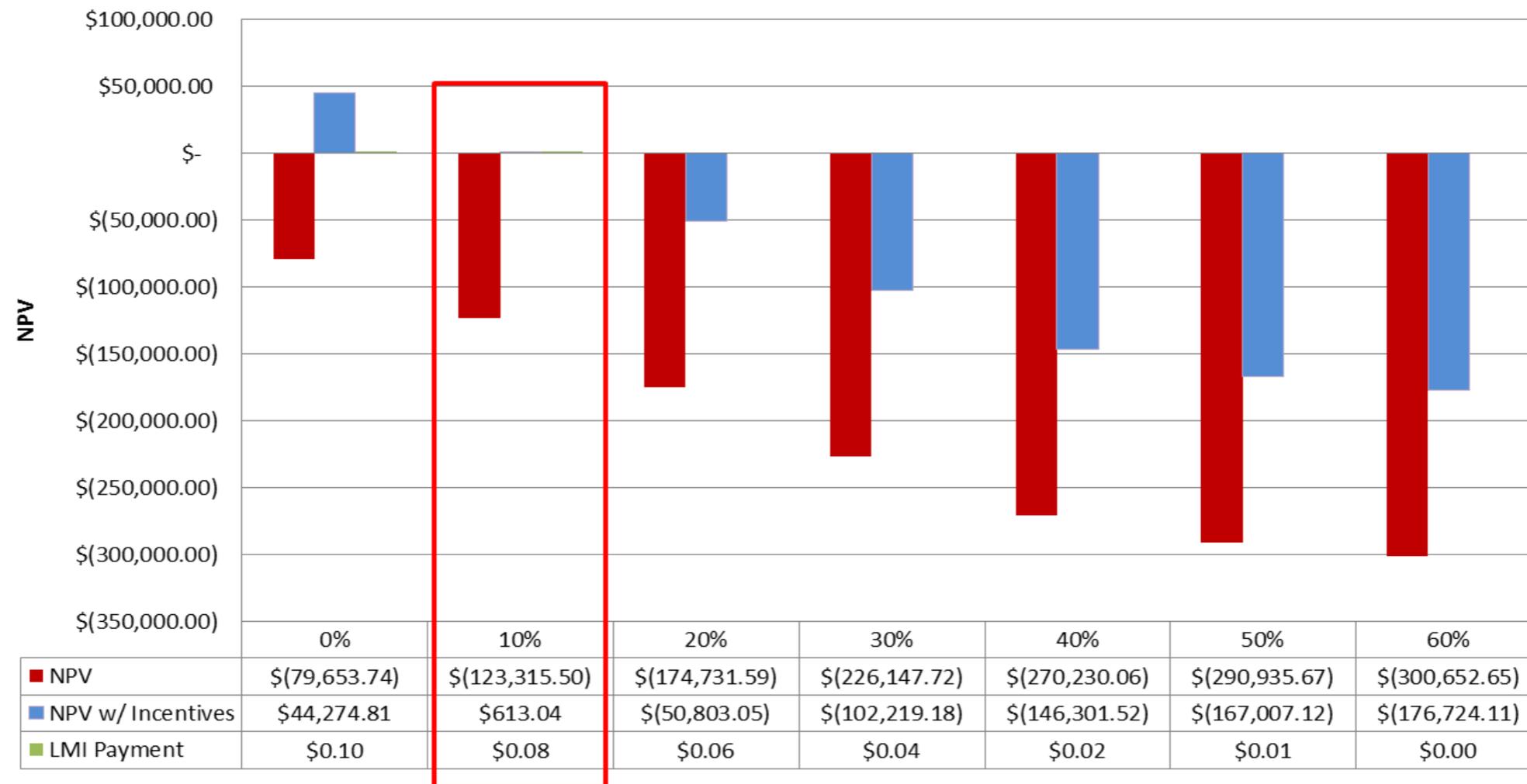


- The returns of the community solar project are smaller than under the business as usual case for two reasons:
  1. Cooperatives spent money to purchase the solar system upfront.
  2. For 20 years, cooperatives will charge less for the solar electricity (in kWh terms) than they would have charged under their standard rates.

# *Opportunity Cost in Context*

- When comparing against a business-as-usual case, the projects' NPV over 20 years, including the cost to purchase the system, was on average \$205,000 less than the cooperatives' net income if they had not done the projects (business as usual), and sold power at the normal rates.
- Spread over 20 years, this equates to \$10,250 a year in lower utility net income. A future analysis could compare these projects' returns with the net cost of other bill assistance or weatherization programs.

# Community Solar NPV Break even with Incentives



- Including federal incentives (ITC at 30% and 5 year MACRS), and providing a 10% discount to subscribers would result in an NPV break-even for utilities (including the same level of CEO funding).
- The blue, “NPV w/ Incentives” bars could represent additional funding required for utilities to break even at larger subscriber discounts (or an acceptable annual utility contribution to the project).

# *Project Challenges*

- The six cooperatives analyzed to date were not taxable entities, and therefore were unable to take the tax incentives or depreciation.
  - With the inclusion of the federal tax incentives, the average project returns increased by \$123,000. This equates to the same savings as the difference between a 20% and 60% subscriber utility bill discount.
- The terms of wholesale power purchase agreements affect a cooperative utility's ability to develop community solar.
  - In some cases, cooperatives were required to pay their wholesale electricity provider for electricity consumed by its members even though that consumption is offset by the LICCS project (e.g. take-or-pay contract).
- No external financing was utilized. Project debt could increase returns, albeit with additional project risk.

# *Recommendations for Further Study*

- Evaluating the effectiveness of low-income community solar in comparison to existing bill assistance and weatherization programs
  - Is there a better way to leverage LICS investments to assist the same target population?
- Exploring the impact of avoided wholesale costs on low-income community solar project viability

# *State Policy Discussion*

- Impact of fixed fees on low-income customer savings
- Impact of net metered credit on low-income customer savings
- Influence of wholesaler production caps and conditions on project development
- Models for project financial viability



# Q&A

- **Joseph Pereira**, Director of Low-Income & Residential Energy Services, Colorado Energy Office
- **Gillian Weaver**, Weatherization Program Associate, Colorado Energy Office
- **Alexandra Aznar**, Project Leader, NREL
- **Doug Gagne**, Energy Project Analyst, NREL
- **Emily Artale**, Principal Engineer and Co-owner, Lotus Engineering and Sustainability
- **Tom Figel**, Policy and Regulatory Manager - Community Solar, Grid Alternatives
- **Nate Hausman**, Project Director, Clean Energy States Alliance



COLORADO  
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# Solar Technical Assistance Team (STAT) Network

The STAT Network provides unbiased, time-sensitive technical assistance on solar policies and issues for state and local government decision makers, regulators, and utilities.



Staff of state or municipal bodies or the bodies themselves may request state solar technical assistance. For more information, visit: [www.nrel.gov/tech\\_deployment/state\\_local\\_governments/stat.html](http://www.nrel.gov/tech_deployment/state_local_governments/stat.html)

# Upcoming Webinar

## **Principles and Policies for Low and Moderate Income Solar, Part 2**

*Friday, November 17, 12-2pm ET*

This is the second in a two-part webinar course on low and moderate income (LMI) solar policy and principles. Speakers from CESA and Vote Solar will present.

Read more and register at [www.cesa.org/webinars](http://www.cesa.org/webinars)



# Contact Information

## SUSTAINABLE SOLAR EDUCATION PROJECT

Nate Hausman  
Project Director, CESA  
[nate@cleanegroup.org](mailto:nate@cleanegroup.org)

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