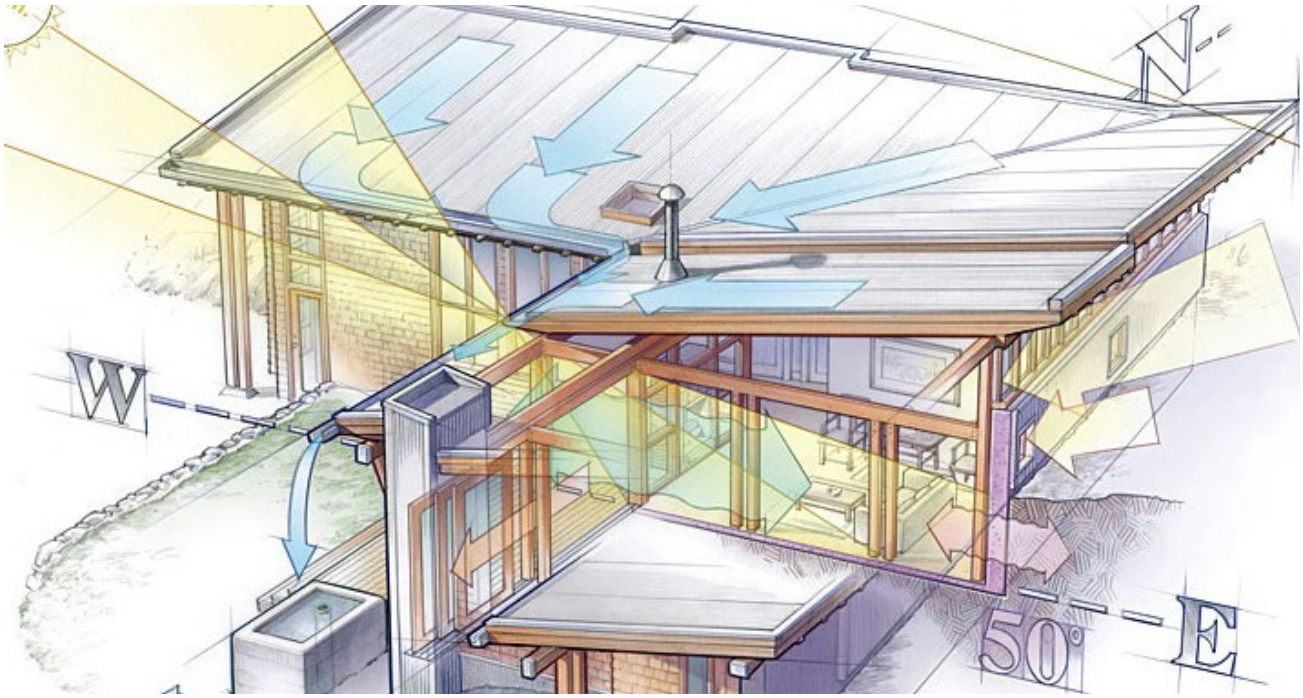

Clean Energy Solutions: Community Solar

Winter 2018 • MGMT 608
Lundquist College of Business

Joshua Skov • Professor

UNIVERSITY OF OREGON

TRIMET

SCI Sustainable Cities Initiative

SCYP Sustainable City Year Program

About SCI

The Sustainable Cities Initiative (SCI) is a cross-disciplinary organization at the University of Oregon that promotes education, service, public outreach, and research on the design and development of sustainable cities. We are redefining higher education for the public good and catalyzing community change toward sustainability. Our work addresses sustainability at multiple scales and emerges from the conviction that creating the sustainable city cannot happen within any single discipline. SCI is grounded in cross-disciplinary engagement as the key strategy for improving community sustainability. Our work connects student energy, faculty experience, and community needs to produce innovative, tangible solutions for the creation of a sustainable society.

About SCYP

The Sustainable City Year Program (SCYP) is a year-long partnership between SCI and a partner in Oregon, in which students and faculty in courses from across the university collaborate with a public entity on sustainability and livability projects. SCYP faculty and students work in collaboration with staff from the partner agency through a variety of studio projects and service-learning courses to provide students with real world projects to investigate. Students bring energy, enthusiasm, and innovative approaches to difficult, persistent problems. SCYP's primary value derives from collaborations resulting in on-the-ground impact and expanded conversations for a community ready to transition to a more sustainable and livable future.

SCI Directors and Staff

Marc Schlossberg, SCI Co-Director, and Professor of Planning, Public Policy, and Management, University of Oregon
Nico Larco, SCI Co-Director, and Associate Professor of Architecture, University of Oregon
Megan Banks, SCYP Manager, University of Oregon

About TriMet

The Tri-County Metropolitan Transportation District of Oregon was created by the Oregon Legislature in 1969 to operate and oversee mass transit in the Portland Metropolitan region. This public entity was formed by the legislature as a municipal corporation to replace the multiple private interest mass transit companies that previously operated in Multnomah County, Clackamas County, and Washington County; the counties that make up TriMet.

In addition to operating bus lines, light rail, and paratransit in the defined Tri-Metropolitan district, TriMet also connects to external mass transit services to provide wider blanket coverage for the region. TriMet's nationally recognized transit system provides more than 100 million rides annually, and carries 45% of rush hour commuters going into the downtown Portland area. TriMet not only moves people, but helps build sustainable cities by improving public health; creating vibrant, walkable communities; supporting economic growth; and working to enhance the region's livability.

Several civic leaders have been highlighted as key Figures in the creation, establishment, and ultimate success of TriMet. Governor Tom McCall is credited with the initial call for the creation of the public corporation; other key contributors include Congressman Earl Blumenauer, Rick Gustafson, Dick Feeney, and Mayor Neil Goldschmidt. All were instrumental in shaping the organization itself, as well as the land use, civic development, and transformation policies that make TriMet the success that it is today.

The vision and efforts of these individuals and countless others have borne fruit. Recently, TriMet celebrated the second anniversary of the opening of its most recent light rail line. Since its inauguration the 7.3-mile MAX Orange Line has experienced continued growth, having a six percent year-to-year increase in ridership. Illustrating the holistic approach that has been a part of TriMet from its inception, there have been wider community benefits such as a positive impact on employment and a focus on sustainable practices such as bio-swales, eco-roofs, a first-in-the-nation eco-track segment, solar paneling, and regenerative energy systems.

TriMet is a key partner in the region's Southwest Corridor Plan and Shared Investment Strategy. Eleven partner agencies are participating in planning for a new 12-mile light rail line in southwest Portland and southeast Washington County that will also include bicycle, pedestrian, and roadway projects to improve safety and access to light rail stations. Southwest Corridor stakeholders include Metro (the regional government), Washington County, Oregon Department of Transportation, and the cities of Beaverton, Durham, King City, Portland, Sherwood, Tigard, and Tualatin. This collaborative approach strives to align local, regional, and state policies and investments in the Corridor, and will implement and support adopted regional and local plans. These initiatives and outcomes from participation with the UO's Sustainable City Year Program will help develop ideas that are cost effective to build and operate, provide safe and convenient access, and achieve sustainability goals while supporting the corridor's projected growth in population and employment.

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This report represents original student work and recommendations prepared by students in the University of Oregon's Sustainable City Year Program for TriMet's Southwest Corridor project. Text and images contained in this report may not be used without permission from the University of Oregon.

Community Solar

Solar power is growing in the US. By 2017 nearly 2% of the total US generation capacity was provided by solar power. The Solar Investment Tax Credit (ITC), has helped to grow the industry since 2006. Prices have been falling, more than 70% since 2010, attracting more interest as individuals look for ways to reduce their carbon footprint.[1] Residential rooftop solar is not always an option for individuals looking for clean energy options. Renters, homeowners with unsuitable property characteristics or who choose not to install on their property, and those not financially able to install their own systems can all benefit from community solar projects.[2] Community solar is a central solar array, where multiple individuals can purchase a portion of the energy produced by the system. Subscribers may purchase the output from a single panel – typically a one-time up-front cost, or a set production amount each month. The purchased solar output offsets the subscribers bill each month, typically lowering overall energy bills.[3] The solar array, and all subscribers need to be within the same utility service area. The utility is typically responsible for providing virtual net-metering, to account for subscriber's portion of the community solar array on each monthly bill.

There are multiple benefits to a community solar project. More individuals can participate in purchasing solar energy due to economies of scale that decrease unit costs of site assessments, equipment and installation, and soft costs. Participation is open to people at a much lower investment, and allocations can be transferred to other utility customers if a subscriber moves out of the service territory. The community model also allows for optimization of site location, and is easier for utilities to manage than multiple rooftop arrays. By structuring project as reduced utility bills rather than investment expecting return – less likely to be classified as a security.[4]

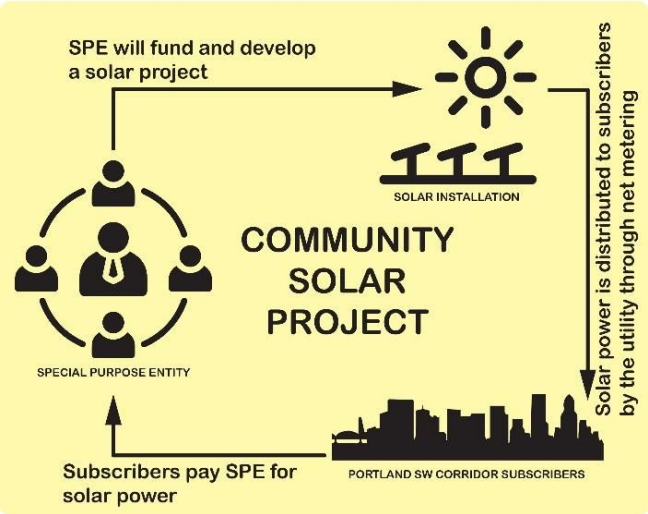

Figure 1. Basic structure of a community solar project

[1] Seia.org (2018). Solar Industry Research Data. [online] Available at: https://www.seia.org/solar-industry-research-data [Accessed 8 May 2018].
[2] Coughlin et al. (May 2012). A Guide to Community Shared Solar: Utility, Private, and Nonprofit Project Development. [online] Available at: https://www.nrel.gov/docs/fy12osti/54570.pdf [Accessed 8 May 2018].
[3] Et al.
[4] Energy.gov. Community and Shared Solar. [online] Available at: https://www.energy.gov/eere/solar/community-and-shared-solar [Accessed 10 May 2018].

Oregon has recently developed rules for community solar projects, as directed by Senate Bill 1547. As defined in this bill community solar projects must be located within the state, and projects and their subscribers must all be within the same utility service territory. A single subscriber is defined based on address, and some subscribers may have multiple addresses. Any single subscriber is allowed to buy in up to their average annual electricity consumption, but cannot exceed 2MW across the program. Any one participant (with multiple addresses) is allowed to be part of multiple projects, with limits of up to 40% of any single project, and a 4MW cap for the overall program. Each project has a maximum allowable size of 3MW. Additional allocation requirements include at least 50% of participation must come from residential or small commercial subscribers, and 10% of each project must be allocated to low-income households.[5]

Parties in Community Solar

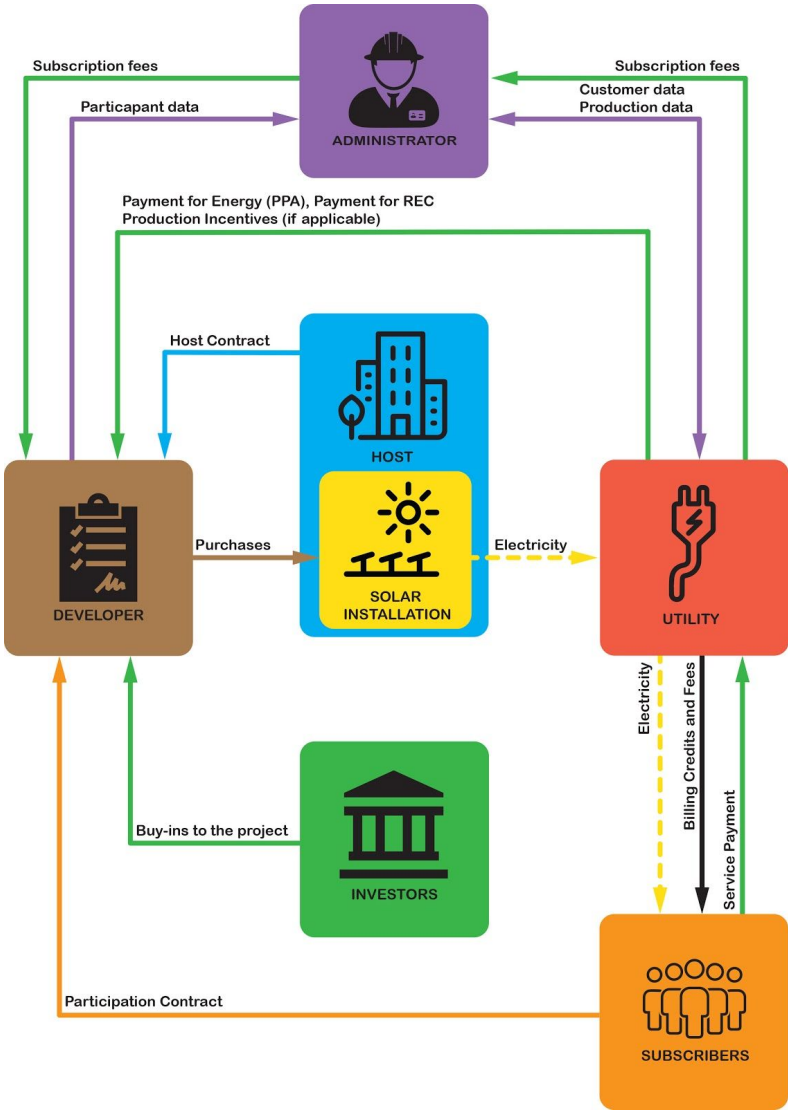

Figure 2. Energy and monetary flows in a typical community solar project

[5] Apps.puc.state.or.us (29 June 2017). In the Matter of Rules Regarding Community Solar Projects. [online] Available at: http://apps.puc.state.or.us/orders/2017ords/17-232.pdf [Accessed 30 April 2018].

Subscribers: Individuals who buy, or subscribe to, a portion of the output from the solar array. A subscriber may be a residential or commercial customer, and is defined by address under the OR bill. A subscriber may only participate in community solar projects within their utility service territory. Each subscriber signs an agreement with the project developer for their subscribed portion of the project.[6] The subscriber is billed the agreed upon fee, and provided bill credits for the energy produced on their utility bill.

Developer/Owner: A developer organizes the community solar project, bringing together the parties involved. A developer may be considered the project owner, and/or be responsible for creating a Special Purpose Entity (SPE). The developer organizes the financing and contracting, hires the installer, manages the system operation, and enlists subscribers.[7]

Host Site: The community solar system is installed at the host site. The host may also be an investor, and/or a subscriber to the project. The site host contracts with the developer through a Solar Services Agreement (SSA).[8]

Finance/Investors: There are multiple ways the project may be financed. Some portion of tax-equity financing allows the project to take advantage of the ITC and depreciation. Passive income rules limit the individual subscribers who would be able to take advantage of the ITC. Other sources may include subscriber fees, debt financing, or cash purchase by owner. Each financing option carries different risks, and associated legal issues.[9]

Utility: Provider of electricity where solar project is installed. The utility signs a Power Purchase Agreement (PPA) with the project owner to off-take the electricity produced from the community solar array. The PPA is between the utility and the developer/owner. In Oregon, the PPA is designated for 20 years, and is purchased at retail cost. The utility is also responsible for billing subscribers, and crediting bills for energy produced.[10]

Program Administrator: Overseer of the entire program. They work with staff and stakeholders to create an implementation plan. Some of their other duties are making sure that the pre-certification and certification applications are processed. The program administrator provides the necessary infrastructure to facilitate data and financial flows between the utility and the project developer/owner.[11]

Low-Income Facilitator: Point of contact that ensures that the low-income targets and requirements are met for the project. This person interacts directly with the Program Administrator certifies low-income individual participation and ensures that the project's finances and infrastructure function in a way that achieve the low-income goals.[12]

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[6] Coughlin et al. (May 2012). A Guide to Community Shared Solar: Utility, Private, and Nonprofit Project Development. [online] Available at: https://www.nrel.gov/docs/fy12osti/54570.pdf [Accessed 8 May 2018].
[7] Et al.
[8] Et al.
[9] Et al.
[10] Et al.
[11] Oregon Solar Energy Industries Association. (2 May 2018) A New Market for Oregon: Community Solar Project Development and Implementation. [pdf file]
[12] Et al.

Parties Setup and the Implications of Different Composition

There are multiple ways to setup the financing, ownership, and participation structure of a community solar project. Each configuration incorporates different levels of risk, and return. NREL describes three primary options including (1) utility-sponsored, (2) non-profit, and (3) special purpose entity (SPE). A SPE will be the most likely model for a project with TriMet participation and/or hosting.

The SPE model adds complexity, and requires work upfront to ensure appropriate legal considerations for business setup and operation, contracting among owners, participants, site host and utility, and adherence to securities regulations. Each of these will affect available financing and subscriber options. The SPE is typically setup as an LLC, and may include a combination of investors, and/or subscribers. The goal of the SPE is to provide an ownership structure that can take advantage of the ITC and depreciation, to provide returns for investors, or savings to subscribers. Due to recent amendments to the ITC, this is very relevant to TriMet's decision whether to be an investor. In 2020 the ITC will drop from 30 percent to 26 percent of the project costs, and in 2021 it will drop from 26 percent to 22 percent.[13] Finally, in 2022 it will drop from 22 percent to 10 percent, and remain 10 percent for the future years to come.[14]

One potential model includes the members as direct owners of the project through the formation of an LLC. The LLC acts as the agent/management company, taking the tax credits and passing the savings along to the members. Other modes include flip, or sales/leaseback where ownership changes between developer and investors on a timeline that allows monetization of tax credits while conforming to securities rules.[15]

Partnership Flip: In this scenario, the developer builds the project, and is 100% owner of the SPE until right before the project comes online. The SPE is the owner of the project, and is considered a "pass-through entity". Tax equity investor(s) become partial owners of the SPE right before the project starts producing electricity to take advantage of the tax benefits, limiting risk. After tax benefits are realized, ownership flips back to majority with the developer (6-year period for tax recapture does not allow ownership changes during that time).[16]

Sales/Leaseback: The sales/leaseback model specifies the tax equity investor(s) as the owner of the project, and the developer as the power provider. The developer initially owns the project through the SPE. After the project is online, the developer sells the project to the investor. The investor leases the project back to the sponsor, who is responsible for O&M and makes lease payments to the investor/lessor. This option allows the investor(s) to take advantage of tax credits and depreciation, without the operational risk.[17]

Potential Community Solar Scenarios For TriMet

[13] Apps.puc.state.or.us (29 June 2017). In the Matter of Rules Regarding Community Solar Projects. [online] Available at: http://apps.puc.state.or.us/orders/2017ords/17-232.pdf [Accessed 30 April 2018].
[14] Et al.
[15] Coughlin et al. (May 2012). A Guide to Community Shared Solar: Utility, Private, and Nonprofit Project Development. [online] Available at: https://www.nrel.gov/docs/fy12osti/54570.pdf [Accessed 8 May 2018].
[16] Solar City. Financing Structures: Partnership Flip, Sale-Leaseback and Lease Pass Through. [pdf file]
[17] Et al.

Owner, Host & Subscriber Scenario: TriMet owns a portion of a community solar array that is installed on owned property along the Southwest Corridor. This could be an array on the roof of the maintenance facility, panels on the new Max line shelters, or a combination of several areas.

Benefits: Additional savings may be realized by owning and installing on owned property. A custom project similar to the shelters of the Orange Line would increase the cost of the project by seven times the standard rooftop project. A rooftop solar array would be a less expensive option, which can be adjusted in the proforma.

Concerns: As a public entity, TriMet will need an equity investor(s) to take advantage of the ITC, and depreciation. This will require sales/leaseback, or a partnership flip project design to realize the tax credits and depreciation, and to maintain ownership. At minimum, 42% of the project must be funded by tax equity to break even.

Host & Subscriber Scenario: TriMet hosts the community solar array on land or buildings they own, and subscribes to a portion of the array.

Benefits: TriMet shows their support for the community through hosting a community solar array, without the complications of ownership. As an anchor subscriber (subscribed to 40% of project), TriMet gives visibility and may help increase subscriptions to meet the 50% subscribed minimum.

Concerns: TriMet may be able to provide ample space along the Southwest Corridor to site a solar PV array. But it may be more difficult to fully fund the project, without some investment from TriMet.

Recommendation

The best scenario based on TriMet's stated goals, is the Owner & Subscriber model. Hosting the project along the Southwest Corridor project allows for visibility, and opportunities for TriMet to communicate with their customers, and garner support for community solar projects. Fifty percent of the project must be individuals or small businesses, so attracting subscribers from local, small businesses along the SW Corridor aligns with TriMet's community goals.

Owner/Subscriber Scenarios

Owner/Investor	%	Subscribers	%
Tax Equity Investor	75%	Households	25%
Business(es)	10%	Local Business	25%
Individual Investors	5%	Low-Income Individuals	≥ 10%
TriMet	10%	TriMet	≤ 40%

Table 1. Tax equity investment example of community solar

A rooftop installation without custom components can be completed quickly, and with lower unit costs. If operating before 2020, this would allow the project to take advantage of maximum ITC rates, which will help keep subscription rates low, and lower investment risk. TriMet has identified an existing

maintenance facility that could potentially host a rooftop installation larger than 400 kW. An example of a 400 kW project is shown in Table 2, but a larger sized project can be estimated using the proforma.

Assumptions	
$/Watt	$2.85
(includes all Install Costs)	
Size of Project in kW	400
Useful Life	30
Inflation Rate	0.02
O&M Cost / kWy	$20.00
Discount Rate	0.04
Loan Interest Rate	0.0288
Inverter Cost/W	$ 0.235
ITC	0.30
Subscription Rate	0.95

Source NREL

Financing	
Tax Equity Investment	0.75
Percentage of TriMet Loan	0.1
Amount of Generation	0.4840763

Investor Return	10%
IRR	8%

Investing in Solar		
Rooftop Solar On Flat Roof		
Installation Costs		
Cost / kW		$2,850.00
Units (kW)		400
Variable Cost of Installation	$	1,140,000.00
Owner's Equity	$	285,000.00
Admin. + O&M Costs	PV	
y1 O&M		$8,000.00
O&M PV	$	176,609.36
Inverter Costs PV		
Inverter Replacement y10	$	66,043.15
Inverter Replacement y20	$	42,900.37
Upfront Cost	$	285,000.00
Total Cost (Present Value)	$	570,552.89
Profit	$	383,223.91

Table 2. Recommended community solar scenario

Going forward with one community solar project completed, TriMet would have the experience to better pursue a more complex custom project. The proforma provides adjustable variables to better understand the implications of different sized projects, loan percentages and the changing ITC rates. Based on current rule the proforma assumes a retail rate of $0.11 per kWh for subscribed offtake, any unsubscribed offtake will be purchased at wholesale rates of $0.0138 per kWh (Table 3).

Assumptions		
Project Size		400
Price/kWh Retail	$	0.11
Price/kWh Wholesale	$	0.01
Capacity Factor		0.13
Useful Life		30
Subscription Rate		95%
ITC		0.30

Revenue		
Production in kWh/year		455520
Revenue in y1 (subscribers)	$	47,731.66
Revenue in y1 (Wholesale)	$	314.31
Revenue PV	$	953,776.80
Profit	$	383,223.91

Table 3. Offtake pricing relative to subscription rate

Community solar projects are complex. There are many parties involved, and the new Oregon regulation will change over time. TriMet could be a catalyst for advancing community solar in the region, starting with the Southwest Corridor. As the second largest consumer of energy in the region, involvement in a community solar project will raise awareness and enable more community members to benefit from clean energy.