How to Finance Solar at Your Church

Prepared by the Youth Carbon Analyst Program: 2/6/21

EXECUTIVE SUMMARY:

Every church has different gifts in terms of time, talent, and money. Accordingly, there are financing strategies for installing solar panels at your church to meet the unique challenges and opportunities given the gifts of your church. The Youth Carbon Analyst Program created this guide to help you understand the best fit among the three most common financing strategies for getting solar panels installed at your church:

Image A: Sunlight Intensity on National Presbyterian Church; 2/2/21 search on 'Project Sunroof'

TOP 3 Reasons Installing Solar at your church is a good idea

- **Reason #1:** Earth Care calling
- **Reason #2:** Reduced utility costs
- **Reason #3:** Witness to community; mainstreams technology through social normalizing & contributes to market expansion.

When installing solar at your church is not a good idea:

- **Reason #1:** No Sun Access
- **Reason #2:** If there isn't real dedication or enthusiasm from members

Barriers to installing solar at your church & how to overcome these barriers

- **Barrier #1:** High upfront cost
    - **Overcome How:** Financial models that place burden of upfront cost on external company that has tax advantages.
- **Barrier #2:** Geographic site has low GHI
    - **Overcome How?** Collaborations with churches with high GHI
- **Barrier #3:** Building Architecture: roof doesn't allow logistics

  Overcome How? Alternative location (if sunlight available)

The PROs (+) and CONS (-) of the top 3 financing strategies - from church perspective

- **PPA**
  - **+ Reason 1:** The solar leasing company maintains/repairs the system (although solar panel systems rarely need maintaining)
  - **+ Reason 2:** You can buy the system from the company at any time during the lease term
  - **+ Reason 3:** No upfront cost
  - **- Reason 1:** You have to have an investor
  - **- Reason 2:** You are under a contract with an outside solar leasing company
  - **- Reason 3:** You are not eligible for federal tax credit or incentives
- **LLC+PPA**
  - Same as PPA from church perspective, but an LLC allows private investors to receive benefits of the project; requisite tax appetite necessary for investor benefits.
- **Outright Purchase**
  - **+ Reason 1:** All electricity generated belongs to congregation
  - **+ Reason 2:** Don't have to go through third party buyer throughout process
  - **+ Reason 3:** clearer return on investment (SRECs go directly to congregation)
  - **- Reason 1:** High upfront cost
  - **- Reason 2:** May require loan, which means dealing with a bank and interest
  - **- Reason 3:** All risk and burden of repair is placed directly on congregation

CASE STUDIES of these financing strategies:

Congregation	**Our Lady Queen of Peace**	**Temple Emanuel**
Financing approach	**LLC+PPA**	**Outright Purchase**
Who paid the upfront cost?	A parishioner, a private investor, who created the dedicated LLC for the project	The Temple (w/ commercial line of credit and fundraising)
To whom are the benefits distributed over lifecycle?	LLC receives SRECs and income from church electricity. Church receives reduced costs.	SRECs go directly to congregation, all electricity generated belongs to them, but requires loan repayment
Roof size:	~1,000 m^2	979 m^2
System size:	259 m^2	~250 m^2
Estimated Annual	61,650 kWh/year (± 8,000 kWh/year based on a range	59,500 kWh/year (± 8,000 kWh/year based on 13-17% efficiency in

Electricity Production	of 13-17% efficiency in converting sun energy); For first year, but the production will decrease as panels age	converting sun energy). For the first year, will decrease as panels age
Avg. Annual Electricity Usage	~73,000 kWh (size of building: 1,450m^2)	~64,000 kWh (size of building: 1,224m^2)
PV of project versus status Quo (elec. payment)	We estimate a net present value of $29,000 from the project, and a ~$130,000 cost of status quo.	We estimate a net present value of $27,000 from the project, and a ~$130,000 cost of status quo.
Estimated # of Years to $ breakeven point:	With SRECs: ~13-23 years depending on discount rate; W/out SRECs: >24 years depending on discount rate	Does not break even, but Temple realizes electricity savings (also depends on loan repayment and electricity use)

Important Assumptions to consider in more detail when planning for solar at your congregation:

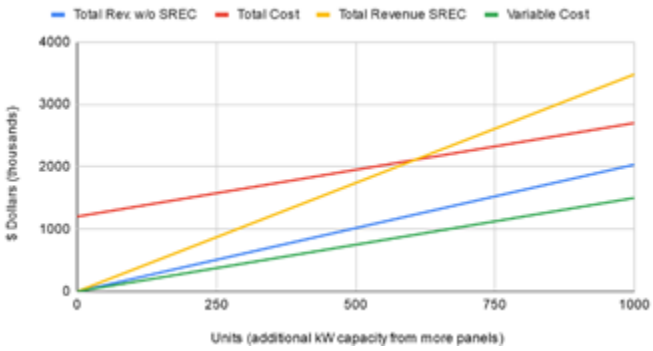
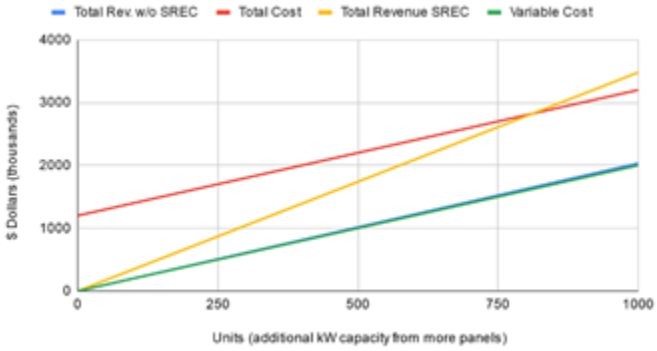
- There will be minimal repair costs (especially in the initial years) for the panels (taken care of by PPA, only really a concern for outright purchase)
- The rate of deterioration is a constant (1% per year)
- Conversion factor from solar production to solar panel electricity production is assumed to be 15%, depends greatly on the specific panels
- There is seasonality in our climate, but this variation is averaged out in our model and thus not reflected.
- There is a lot of variability in the cost of installed solar - and costs are decreasing over time. For instance, in 2016 the mean installed cost ($/kW) of systems sized between 10 to 100 kW was $3,463. Yet, there was a large standard deviation (+/- $947). (See NREL estimate A and B in references)
- There are cost reductions for installing larger systems - which is one reason large churches may helpfully partner with small churches to install solar. Price points below $2/watt are possible (after incentives, etc); For instance, Tesla's guaranteed lowest price of $1.49/watt applicable on their 4,8,12,16 kW residential models (Also see NREL estimate A and B in references)

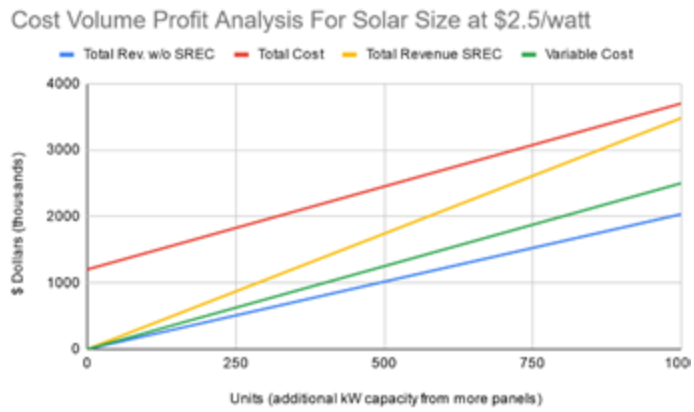
SCALING RENEWABLE ENERGY FOR THE 10 EARTH CARE NETWORK CHURCHES; 'Right sizing' installation size and energy bill savings with 'break-even' system size.

Without even considering the savings in electricity bills or the sale of SRECs (Solar Renewable Energy Certificates/Credits), if the system/s are installed on Presbyterian church roof/s, the total carbon footprint (645 metric tons) of the EarthCare congregations could be offset by annual

spending of less than 2% of the total EarthCare congregations budget [assuming a 1 MW solar cost of 2.4 million with 80k payments annualized. This represents a price ceiling, as we anticipate a 1MW system should be acquired for 1.5 million or less, due to economies of scale for 'commercial' sized systems. With usage reductions from efficiency among the 10 Earth Care Network congregations – to reach an estimated half of what similarly sized congregational would use (~$70,000/year total vs. ~$140,000/year), an initial estimate is that such offset efforts can aim to achieve an increased capacity of half a megawatt (~500 kW). However, as the analyses below suggest, while a 500 kW system would likely yield cost reductions, this system is unlikely to achieve *profits* within the $1.5-$2.5/watt range – even with SRECs, considering our assumptions.

Table 1: Cost Volume Profit Analysis: Finding the 'break-even' system size

	**$1.5/watt;** $70k electricity bill Installation of ~600 kW is the break-even point w/ SRECs. Variable Cost here considered as cost of additional solar capacity; Total cost inc. electricity
	**$2/watt**; $70k electricity bill Installation of ~800 kW is the break-even point w/ SRECs. Note: here the cost of additional solar capacity (variable cost) equals the total revenue without SRECs. This suggests $2/watt is the max price to yield electricity savings without SRECs or any incentives



$2.5/watt; $70k electricity bill

Installation of >1MW is the break-even point w/ SRECs.

We estimate that $2/watt is the max price to yield electricity savings without SRECs or any incentives. When considering SRECs, we observed savings in each of the above price categories ($1.5/watt - $2.5/watt). Further, we observed profits in the $1.5 - $2.0/watt price range when systems were sized over 600 and 800 kW, respectively.

When selecting the system size in any setting, a key factor is the current and future electricity bill. Compare the results of our analysis for the Earth Care Network congregations (n=10) example and one of its medium sized congregations:

Table 2: 'Break-even' system sizing depends on many factors: Impact of electricity bill size shown below, (in the SREC example)

Price per Watt for Installation	Mid Atlantic System Size to Break even w/ $70k//year electricity bill (Earth Care Network n=10)	Mid Atlantic System Size to break even w/ $8k/year electricity bill (Medium Congregation Size)
$1.5/watt	~600 kW	~ 75 kW
$2/watt	~800 kW	~100 kW
$2.5/watt	>1 MW	~150 kW

<u>Glossary of Terms:</u>

<u>Financing strategies & financial terms</u>

PPA: You enter into an agreement with a solar leasing company that entitles you to the benefits of the system during the time the contract lasts

LLC + PPA: Paid for by an investor (outside or inside the congregation) and you enter into an agreement with a solar leasing company.

Outright Purchase: Solar panels are paid for by the church directly, with no third party between the congregation and the installation company. Money raised through loans or fundraising.

SREC: stands for **Solar Renewable Energy Certificate**; incentives to encourage the use of solar energy. Comprised on 1000 kilowatt-hours and are generally worth ~ $70-80 in MD
NPV: stands for **Net Present Value**; We use NPV to calculate the value of future income (or savings) from a solar installation over its lifetime and considering the upfront cost.
Present Value: Present value is the same as NPV except it doesn't consider costs.
Discount rate: Money in the future is less valuable than money in the present. Discount rate allows us to specify this in our estimates. We have selected a discount rate of 5%.

Electricity Terms:
Watt: unit of power (1 joule / second)
kW: kilowatt, unit of power (one thousand watts / second)
kWh: kilowatt-hour, unit of energy that measures the amount of energy you would use if you kept a 1,000 watt appliance running for an hour

Solar Energy related terms:
Degradation: The decrease in solar panel efficiency (light to electricity conversion) over time
GHI: Global Horizontal Irradiance
Daily Sun Hours: (equivalent to GHI). Note this is an average over the course of the year, expressed in daily terms. Therefore, this is reliable for our total estimates, but doesn't depict daily variation or patterns of seasonal change.

Other Resources

MD/DC/VA - Interfaith Power and Light, Going Solar Guide for Congregations.
https://ipldmv.org/go-green/solar/

EnergySage.com - Has great information about the finances and details of solar installation

Folsom Labs charges $1000 a year for access to its modeling software for solar design.

Explore the Renewable Energy Resource Hub | Better Buildings Initiative

- Includes a list of other calculators for determining the right financing strategy for you
    - https://www.nrel.gov/docs/fy18osti/71817.pdf

NREL A: cost estimate for installed solar on a per kW basis from 2016,
https://www.nrel.gov/analysis/tech-lcoe-re-cost-est.html

NREL B: cost estimate for installed solar on a per watt basis from 2018,
https://www.nrel.gov/analysis/solar-installed-system-cost.html

Case Study Narrative of First Presbyterian Church of Seneca Falls, NY - using the LLC model: https://www.fltimes.com/lifestyle/let-there-be-light-sf-church-goes-solar/article_148796e4-8e4e-5e01-9838-ca9bf487ce96.html

Case Study Narrative of Florida Ave. Baptist Church of Washington, DC - using the LLC model w/ a 15 year term: https://webcache.googleusercontent.com/search?q=cache:kayNj8MaBYYJ:https://energydemocracy.centerforsocialinclusion.org/florida-avenue-baptist-church-solar-project/+&cd=4&hl=en&ct=clnk&gl=us