TerPV Market Analysis in MD

A data driven strategy for reducing cost and increasing solar power generation in Maryland.

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Our Team

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Objective

Maryland Location

Maximize ITC Tax Credit

Maximize Profit

Increase Use of Solar Energy

02
Analysis

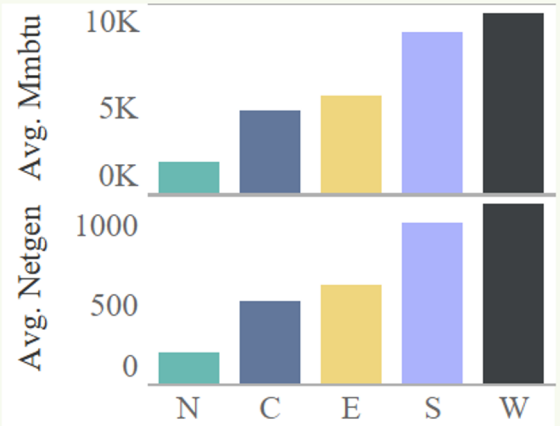
- Operation
- Market
- Finance
- Policy

Industry Overview

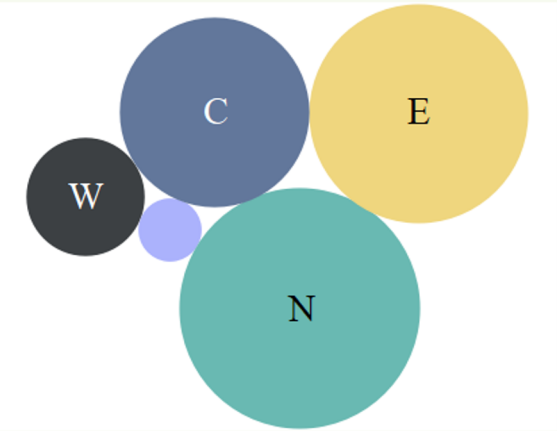
LIMITATION		OPPORTUNITY
High Capital Cost	→	Distributed Model
Scarce Land Option	→	Repurpose Land
Stagnant Capacity	→	Scalability for Growth

Plant Data per Region

Average Values

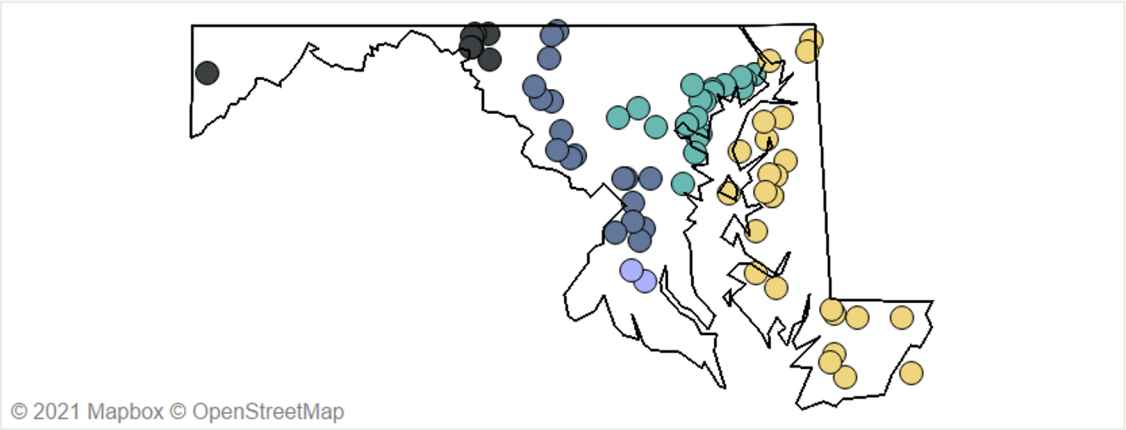


Amount of Unique Plants



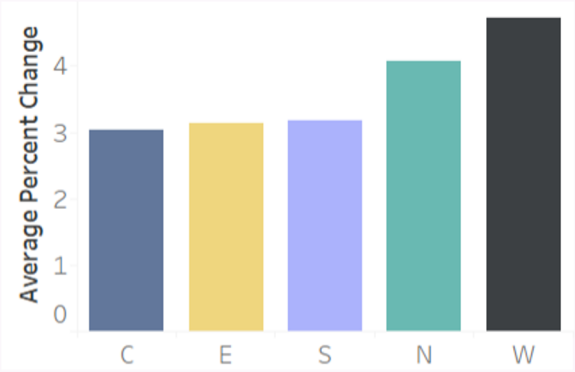
Plant Region
- C
- E
- N
- S
- W

Solar Plant Locations

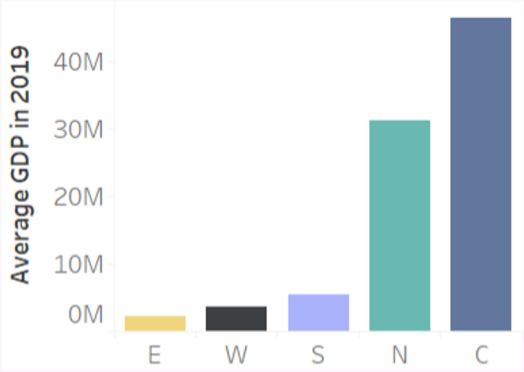


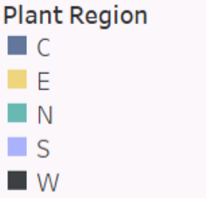
Financial Data

Income Percentage Change per Region

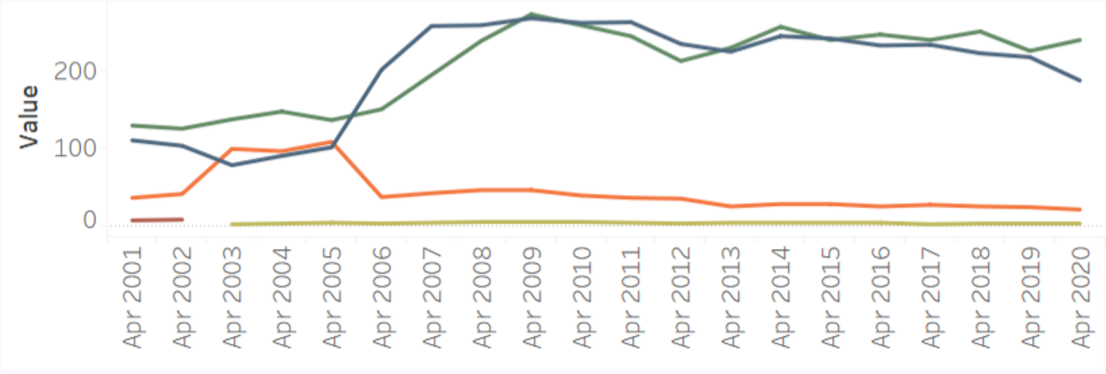


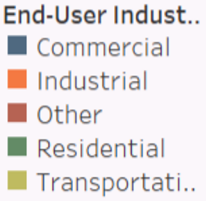
Average GDP in 2019 per Region





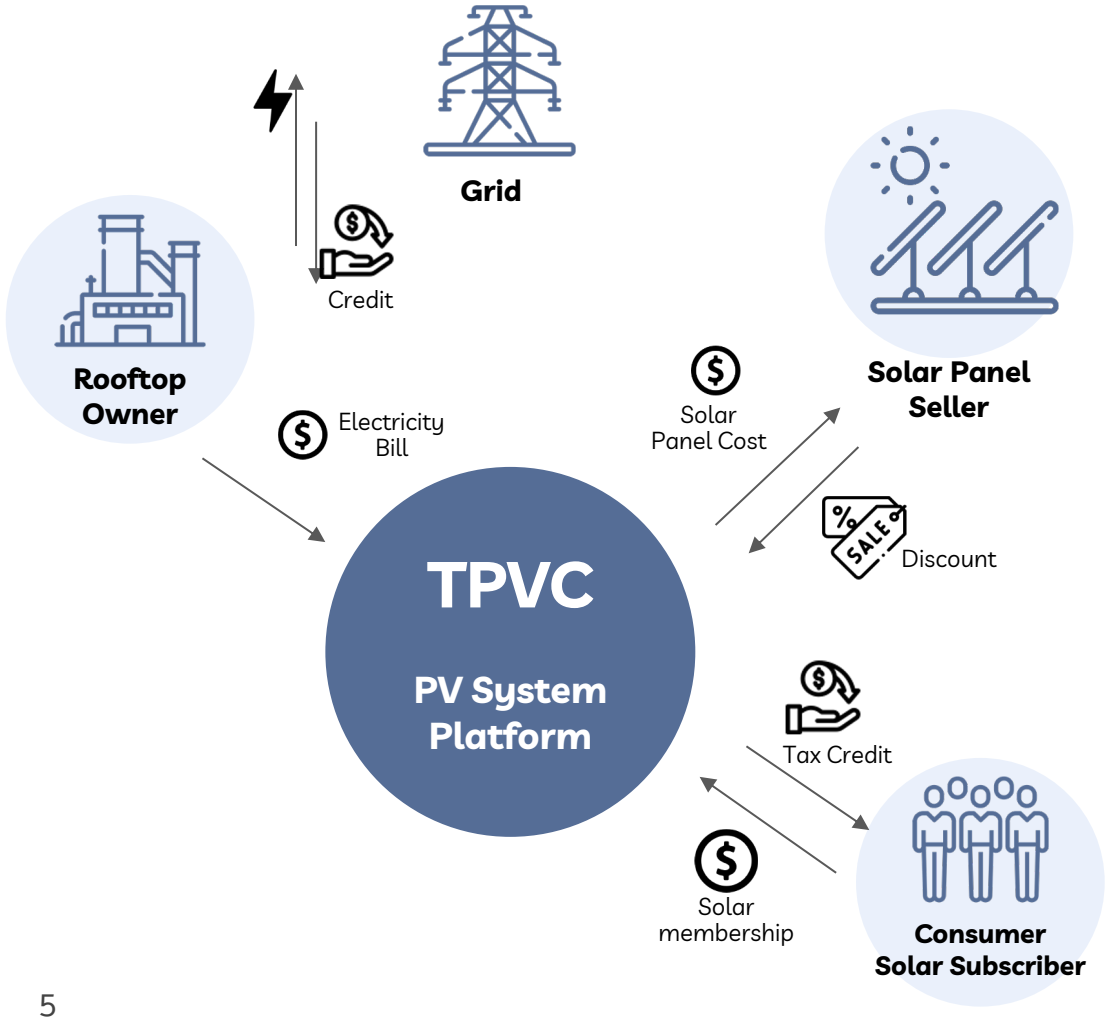
Electricity Revenue over Time in Maryland by End-User Industry





03

Recommendations

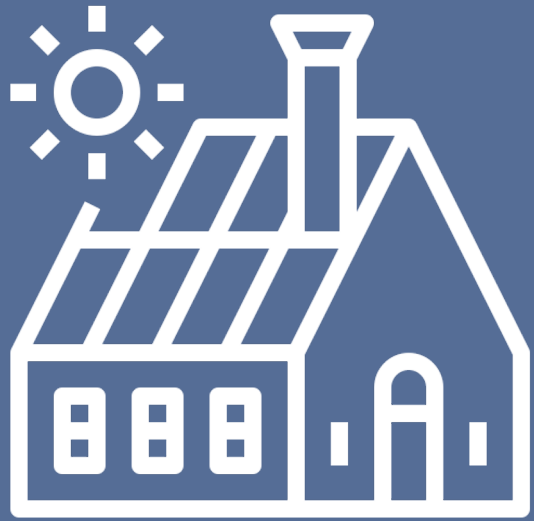


TPVC as a Platform

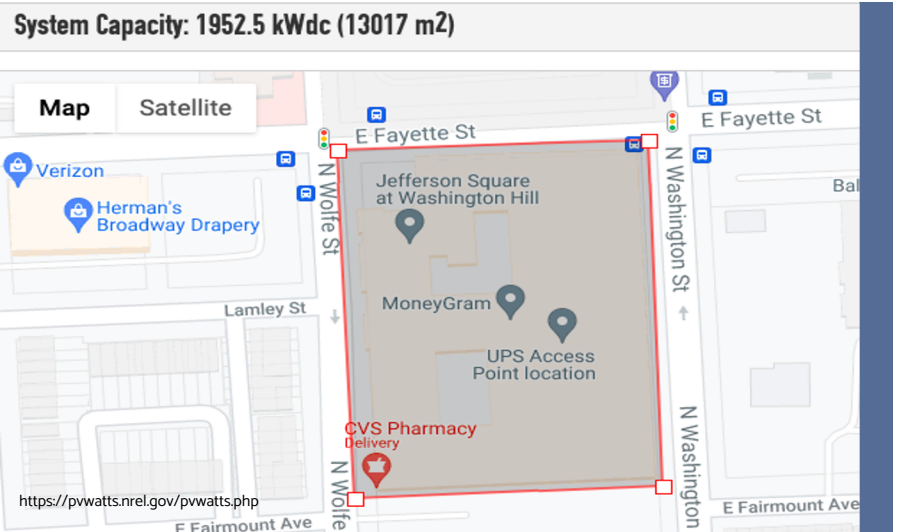
Connect Providers with Consumers

Leverage Roof Space

Community Subscription Model



Model Factory



USPS Distribution Center at E Fayette St, Baltimore City, Maryland 21202

Area	**13,000 m²**
Solar Panels	**94 panels**
Profit	**$208,000**

Projected 10-Year Financials for One Factory

10 Year Total Energy (kWh)

23275096

ROI

96.42%

+

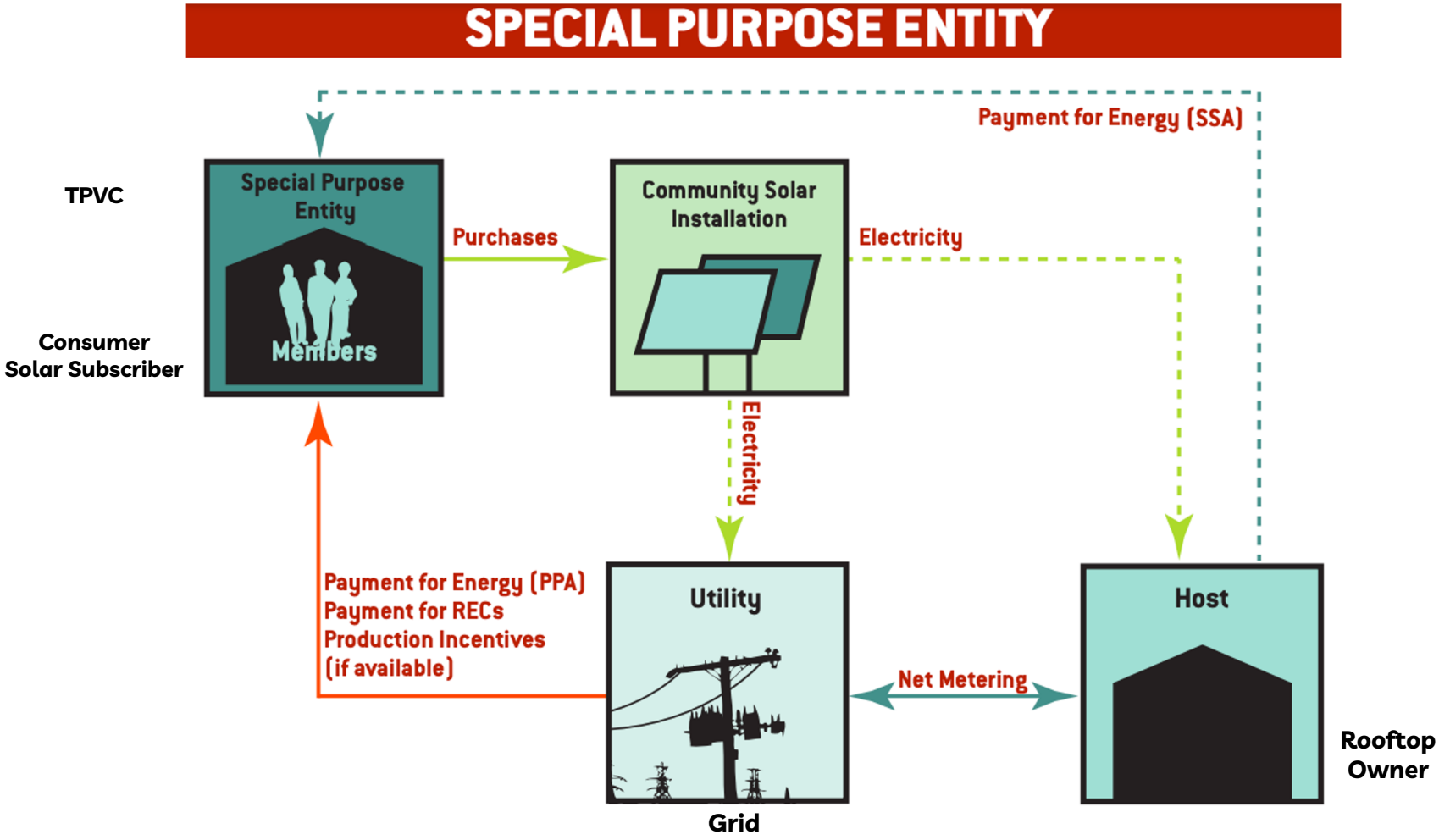
Break Even

$241,198

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Projected Revenue											
Irradiation (kWh)	2,327,566.39	2,327,876.66	2,327,550.01	2,327,468.95	2,327,457.83	2,327,457.06	2,327,457.12	2,327,457.15	2,327,457.16	2,327,457.16	2,327,457.16
Unpreventable energy loss in transition	14.08%	14.08%	14.08%	14.08%	14.08%	14.08%	14.08%	14.08%	14.08%	14.08%	14.08%
Sales price/kWh	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10
Sales Revenue	$174,567.48	$174,590.75	$174,566.25	$174,560.17	$174,559.34	$174,559.28	$174,559.28	$174,559.29	$174,559.29	$174,559.29	$174,559.29
SREC sold ($) 0.075/kWh	$199,984.50	$200,011.16	$199,983.10	$199,976.13	$199,975.18	$199,975.11	$199,975.12	$199,975.12	$199,975.12	$199,975.12	$199,975.12
Total revenue	$374,551.98	$374,601.91	$374,549.35	$374,536.30	$374,534.51	$374,534.39	$374,534.40	$374,534.40	$374,534.41	$374,534.41	$374,534.41
Veriable cost											
Maintance	$64,000.00	$64,000.00	$64,000.00	$64,000.00	$64,000.00	$64,000.00	$64,000.00	$64,000.00	$64,000.00	$64,000.00	$64,000.00
Gross Margin	$310,551.98	$310,601.91	$310,549.35	$310,536.30	$310,534.51	$310,534.39	$310,534.40	$310,534.40	$310,534.41	$310,534.41	$310,534.41
Fixed cost											
Solar panels	$63,884.89	$63,884.89	$63,884.89	$63,884.89	$63,884.89	$63,884.89	$63,884.89	$63,884.89	$63,884.89	$63,884.89	$63,884.89
EBIT	$246,667.09	$246,717.02	$246,664.46	$246,651.41	$246,649.62	$246,649.50	$246,649.51	$246,649.51	$246,649.51	$246,649.51	$246,649.51
Estimated tax (21% federal, 8.25% for state)	$72,150.12	$72,164.73	$72,149.35	$72,145.54	$72,145.01	$72,144.98	$72,144.98	$72,144.98	$72,144.98	$72,144.98	$72,144.98
Tax credit (26% ITC)	$431,861.87	$359,711.75	$287,547.02	$215,397.66	$143,252.13	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Net tax	-$359,711.75	-$287,547.02	-$215,397.66	-$143,252.13	-$71,107.11	$72,144.98	$72,144.98	$72,144.98	$72,144.98	$72,144.98	$72,144.98
Net Income	$246,667.09	$246,717.02	$246,664.46	$246,651.41	$246,649.62	$174,504.52	$174,504.53	$174,504.53	$174,504.53	$174,504.53	$174,504.53

Thank You!

Appendix 1: Community Solar / Business Model



Appendix 1: Community Solar - Use Case

PROJECT HIGHLIGHTS

- System Owner: University Park Community Solar LLC
- System Host: Church of the Brethren, University Park, MD
- Installed Capacity: 22 kW
- Participant Agreement: LLC passes net revenues (after expenses) and tax credits to members
- Electricity: LLC sells power to church below retail rate. Rate escalates approx 3.5%/yr. Host net meters. Annual net excess generation is compensated by the utility.
- RECs: LLC is currently negotiating the sale of RECs to the installer
- Number of Participants: 36 LLC Members

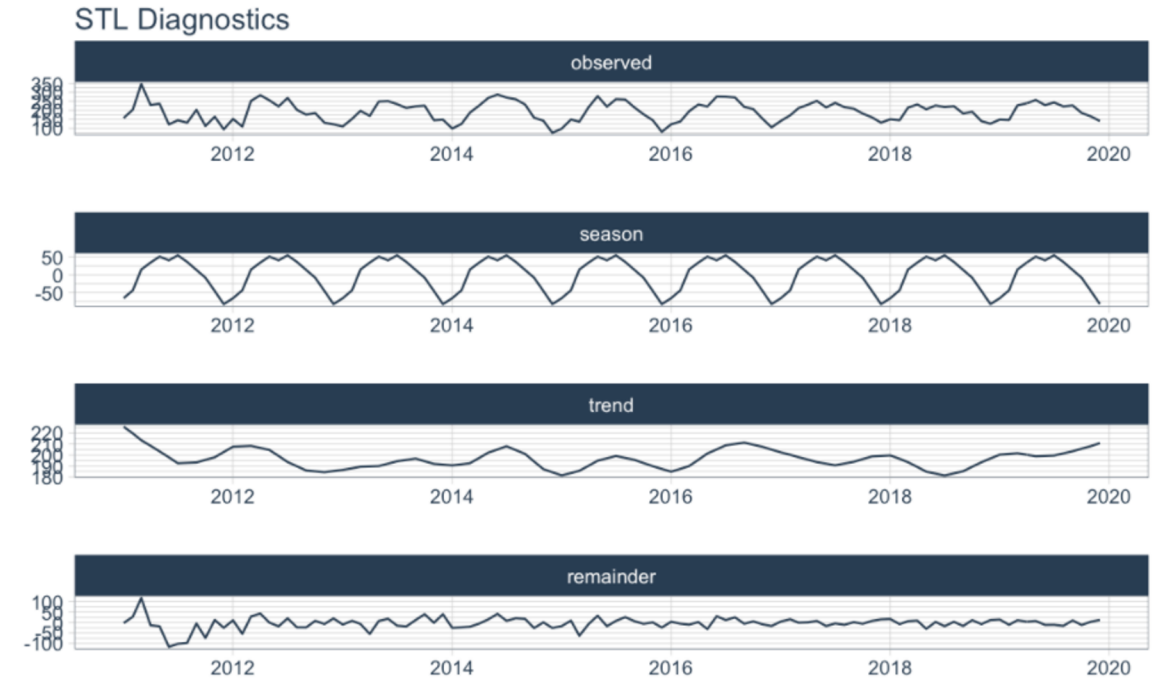
FINANCIAL DETAILS

- Installed Cost: $5.90/watt
- Capital Financing: Member financed
- Tax Credits: 30% federal ITC equivalent to $39,000
- Grants: $10,000 from State of MD
- MACRS: Will depreciate 85% of cost over six years
- Estimated Annual Income from Power Sales: $3,600 in year 1, rising 3.5% per year

Appendix 2: Time Series Modeling -STL

```
# STL decomposition plot
df_mci %>%
  plot_stl_diagnostics(
          Month_Year, Netgen,
          # Set features to return, desired frequency and trend
          .feature_set = c("observed", "season", "trend", "remainder"),
          .interactive = FALSE)
```

```
frequency = 12 observations per 1 year
trend = 12 observations per 1 year
```



Findings

- Strong seasonality
- Summer months can generate more electricity
- Upward trend

Implication

- Spring Implementation

RStudio

Appendix 2: Time Series ARIMA Forecast

```
# choose ARIMUA model
fit_table <- modeltime_table(mci_arima)

mci_arima
```

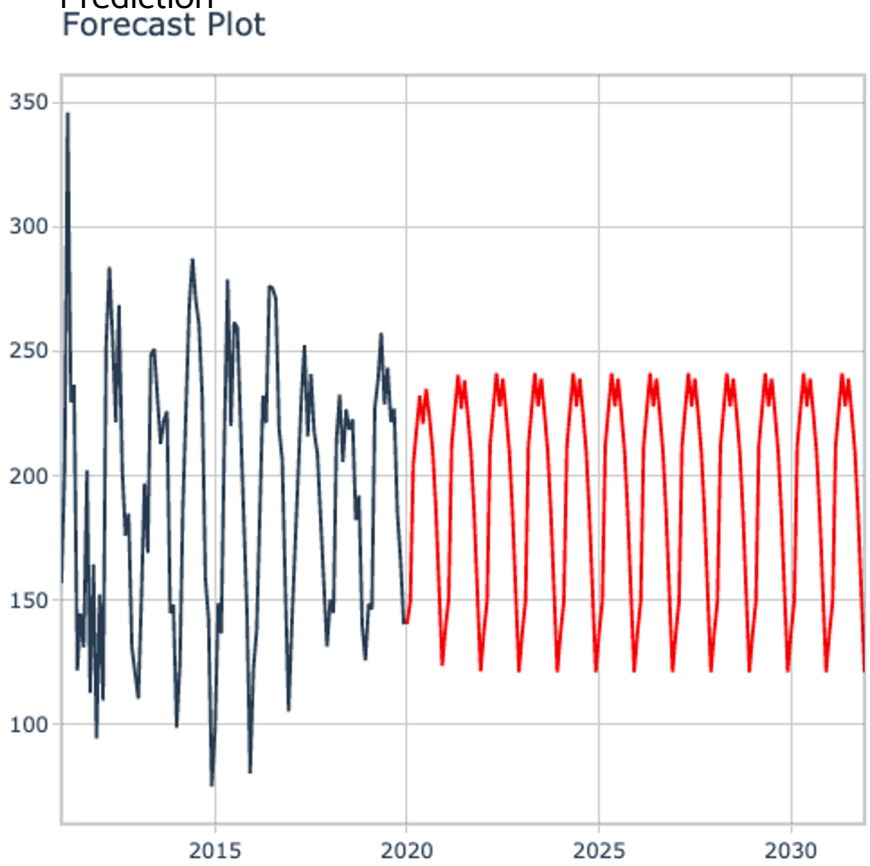
```
parsnip model object

Fit time:  14.1s
Series: outcome
ARIMA(3,0,1)(1,1,1)[12]

Coefficients:
         ar1     ar2      ar3      ma1     sar1     sma1
      1.0249  0.0307  -0.3598  -0.7721  -0.0139  -0.7813
s.e.  0.1386  0.1481   0.1049   0.1343   0.2199   0.3086

sigma^2 estimated as 1046:  log likelihood=-472.82
AIC=959.64   AICc=960.91   BIC=977.59
```

Netgen
Prediction



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Appendix 3: Cost Breakdown

40% Cost Saving Overtime

Residential Solar PV

Fixed Retail Price	
Panel Cost	$3.38/W
Labor Cost	$20/hr
Total Cost	$260,000

Decentralized Solar PV Platform

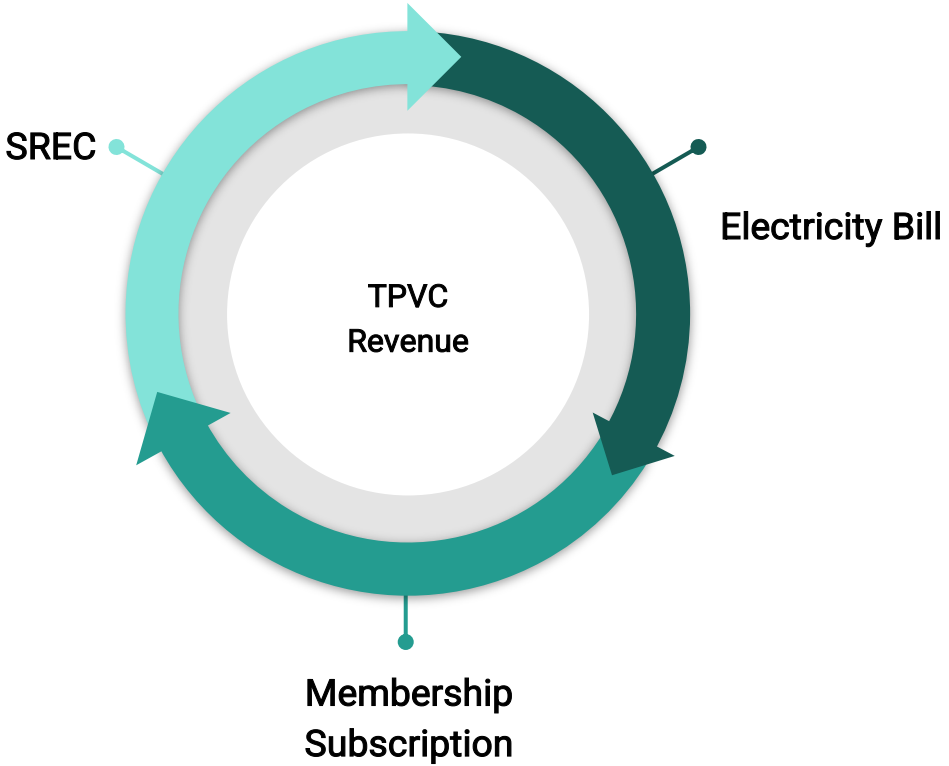
Platform Formation	
Panel Cost	$2.37/W
Labor Cost	$20/hr
Total Cost	$203,392

Platform Mature	
Panel Cost	$1.50/W
Labor Cost	$20/hr
Total Cost	$154,572

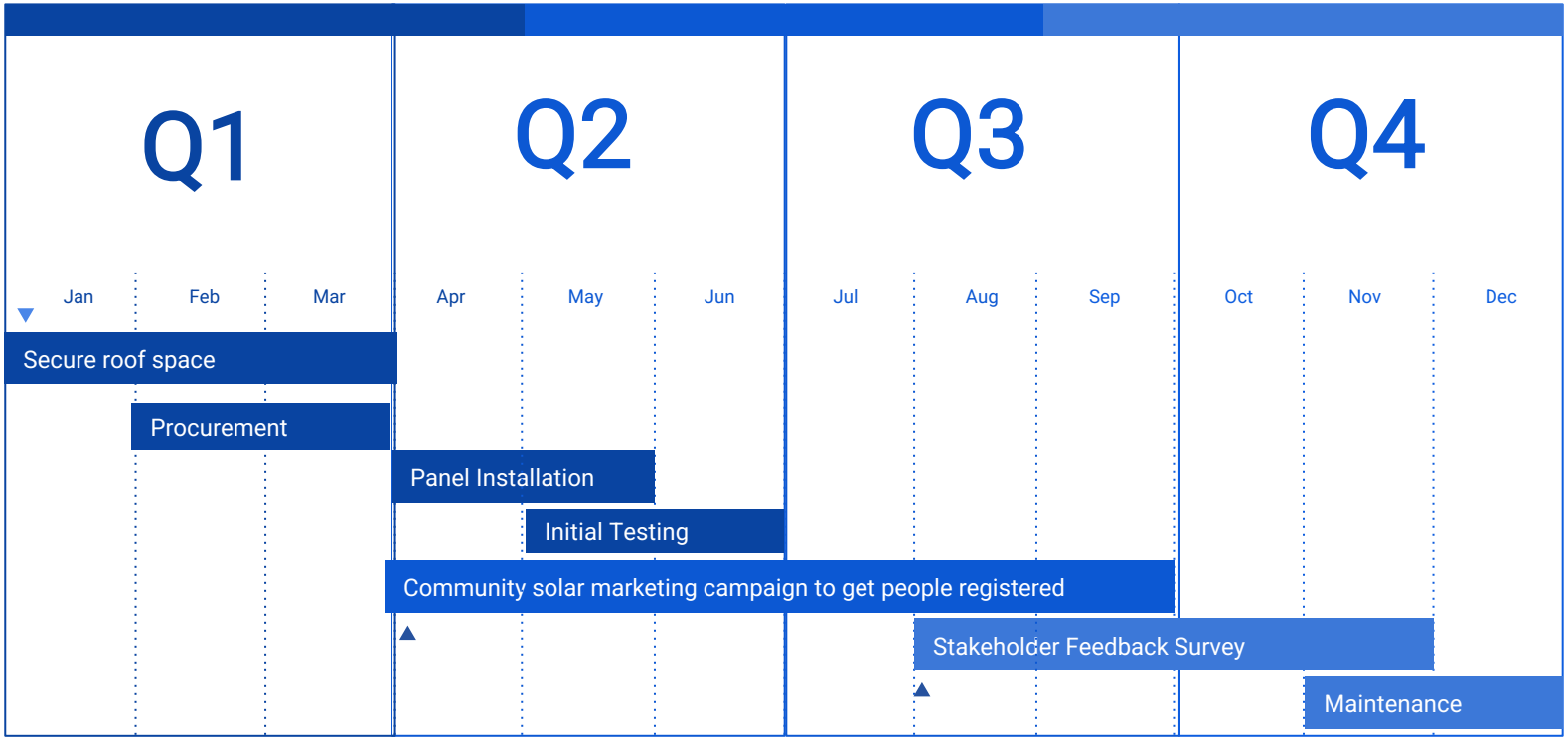
Appendix 4: Revenue from Subscription

- $10/month for each household
- #of households in Baltimore: 239,000
- Early stage: 5% sign up
- Revenue: ($10*12)*(239,000 *0.05) = $1,434,000 (1.4M)
- Total market size: $28680000 (28.68M)

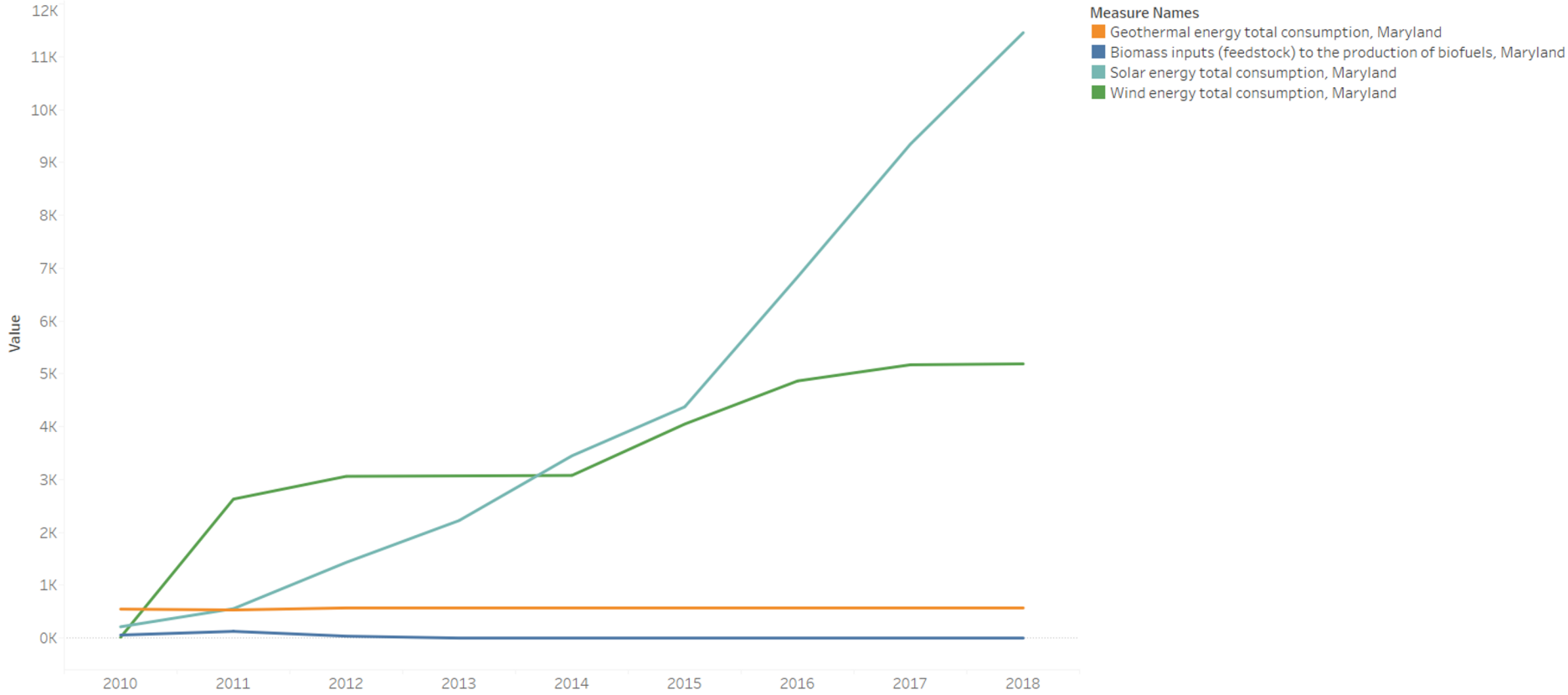
Appendix 4: Revenue Breakdown



Appendix 4: Implementation Plan



Renewable Energy Consumption per Type over Time in Maryland (2010-2017)



Sources:

- U.S Energy Information Administration (EIA)
- State Energy Data System (SEDS)

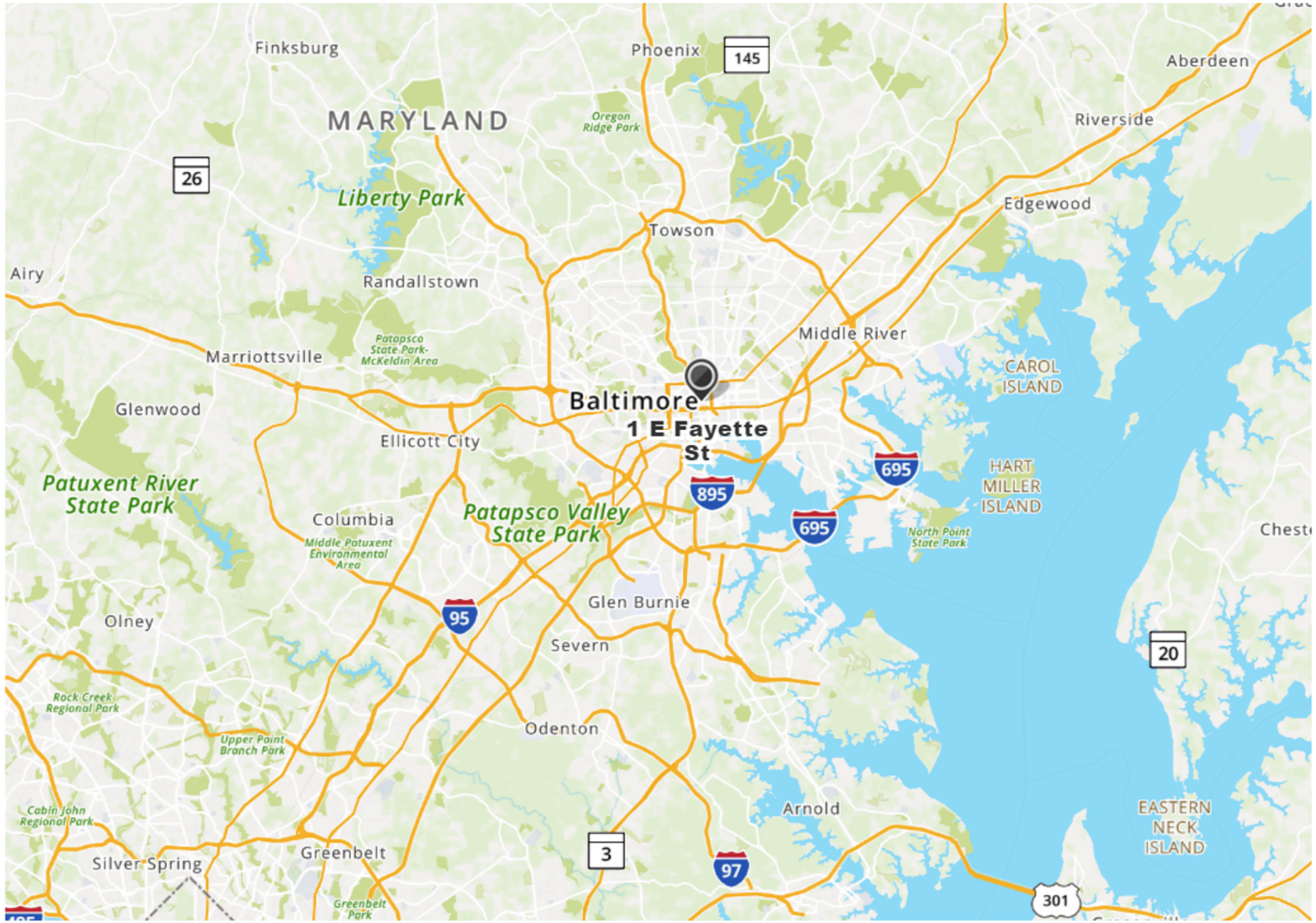

Finksburg
Phoenix
145
Aberdeen
MARYLAND
Oregon Ridge Park
Riverside
26
Liberty Park
Edgewood
Towson
Airy
Randallstown
Middle River
Patapsco State Park-McKeldin Area
Marriottsville
CAROL ISLAND
Baltimore
1 E Fayette St
Glenwood
Ellicott City
695
HART MILLER ISLAND
Patuxent River State Park
895
Columbia
Patapsco Valley State Park
695
North Point State Park
Middle Patuxent Environmental Area
Glen Burnie
95
Olney
Severn
20
Rock Creek Regional Park
Upper Paint Branch Park
Odenton
Arnold
Cabin John Regional Park
EASTERN NECK ISLAND
Greenbelt
3
Silver Spring
97
Greenbelt Park
301

Figure 2-16 Transmission Lines (>115,000 Volts)