

Utility 3rd Party Ownership Solar Program

Tennessee Solar Energy
Association

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The Solar Ownership is Shifting

- There are many Solar Investment companies across the country poised to enter Tennessee
- **Third-party-owned solar is more than 50 percent of the California home solar market in 2011.**
- Third-party financing of solar, lease or power purchase agreement (PPA), is becoming the leading method by which homeowners can afford to install solar

Some Are Already Here

- These are some of the companies that are now financing the upfront cost of solar PV



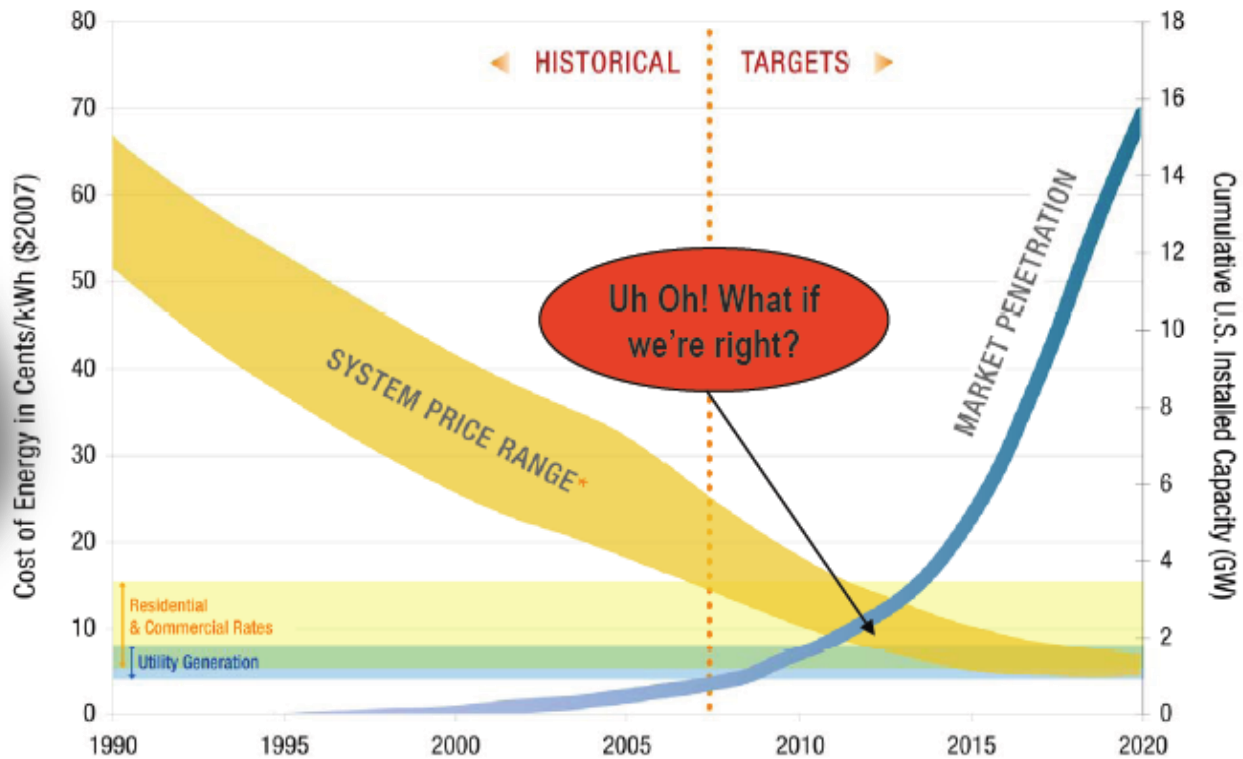
Impact on Electric Power Distributors

- Residential and Commercial businesses reduce their electric power bills
- Reduced income
- Left to manage the distribution power lines impacted by intermittent power changes
- May need ancillary equipment to stabilize these lines
- Result: The cost is past on to all consumers

It's coming...

The SETP is focused on enabling high penetration of solar energy technologies and achieving grid parity by 2015

U.S. DEPARTMENT OF
ENERGY



Market Sector	Current U.S. Market Price Range (¢/kWh)	Cost (¢/kWh) Benchmark 2005	Cost (¢/kWh) Target 2010	Cost (¢/kWh) Target 2015
Residential	5.8 - 16.7	23 - 32	13 - 18	8 - 10
Commercial	5.4 - 15.0	16 - 22	9 - 12	6 - 8
Utility	4.0 - 7.6	13 - 22	10 - 15	5 - 7

What Can Your Electric Power Distributor Do?

- Do nothing... Await the inevitable
- Downsize
- Fight against renewable energy on its lines
- Preserve some of the losses by partnering with a 3rd party
- Take affirmative action and make **money** off it!



Advantages

- Applies to any non-profit electric utility
- A distributor's 3rd party company installs, manages, and maintains solar systems
- Preserves the present utility residential customer base
 - Discourages outside solar providers from taking market share
 - Discounting electricity helps homeowners
 - Simplifies management of solar installations



How will this work?

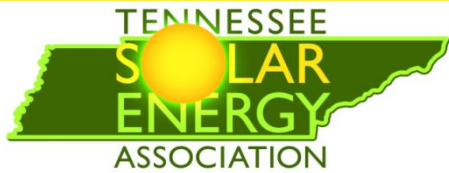
- The 3rd party owns 10 kW solar systems on residential customers roofs
- Homeowner receives a 20% discount on their monthly bill
- All additional electricity will be sold to the distributor at a 20% discount to sell over the grid
- All solar Renewable Energy Credits (RECs) will be split between the distributor and 3rd party
- System warrantied for 25 years
- Local installers bid on a contract to install a bundle of houses

What would the program look like?

- A fixed yearly investment of \$1,000,000 paid to the 3rd party
- Distributor gets a 20% margin for electricity sold over the grid
- They can sell solar RECs once a Renewable Portfolio Standard is passed
- Total revenues of **\$13 Million** over 25 year PV system warranty (could be much more)
- Return on Investment of 0.44

Initial Investments for Non-Profits

- Clean Renewable Energy Bonds (CREBS)
- Any utility, electric COOPs may issue CREBs
- It is a zero interest loan
- Lender will receive a tax credit from the Federal Gov't
- Projects **MUST** generate electricity and **MUST** be created from clean renewable sources
- CREB funds must be spent within 5 years

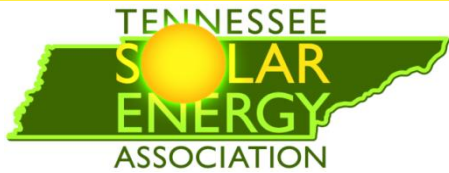


Key Assumptions

1. The size of the solar PV system for each home will be standard and set at 10 kilowatts.
2. We included single story, single family unattached homes in our study.
3. Knoxville's solar irradiance represents the entire state of Tennessee in solar production.
4. The cost of the installed solar system will drop from 10% (worst case) to 19% (optimistic case) per year.
5. The system is warrantied for 25 years, so the analysis is for 25 years. We also included up to 40 years expected life
6. The panels degrade at a rate of 0.5% per year.

Panel Degradation with Time

- Used a standard 25 year warranty for 80% maximum output
- Most recent studies show that crystalline silicon based modules degrade at the rate of 0.5% per year
- Reference: “Comparison of Degradation Rates of Individual Modules Held at Maximum Power” Osterwald et al; NREL/PR-520-39844, Presented at the 2006 IEEE 4th World Conference on Photovoltaic Energy Conversion (WCPEC-4) held May 7-12, 2006 in Waikoloa, Hawaii.



Key Assumptions (cont.)

7. The homeowner will receive their electricity usage at a 20% discount from retail price. (not to exceed the maximum output of the system)
8. All extra electricity generation will be sold at retail price through the grid.
9. Electricity prices are inflated from 2% (worst case) to 5% (optimistic) per year.
10. NREL's PVWatts version 1 was used to estimate the production of kilowatt-hours (.85 derate factor with 20° fixed tilt roof mount) which amounts to 13,231 kWh/yr.
11. The installed system cost currently is \$5.50 / Watt and declines to \$2.37/watt (worst case) and to \$1.00 /watt (optimistic) by 2020.
12. The budget size is fixed at \$1 Million per year with no financing charges.
13. A 30% tax credit is allotted by the Federal Government's Investment Tax Credit (\$300,000 per year)
14. All Solar Renewable Energy Credits (SRECs) will be split between the distributor and 3rd party.

What is Not Included

- The only incentive taken into account is the Investment Tax Credit (third party)
- No feed-in tariffs were included
- Does not participate in TVA's Generation Partners Program
- Does not include Time of Use pricing
- Does require solar renewable energy credits
- Do not need a "smart meter" or any other special meter

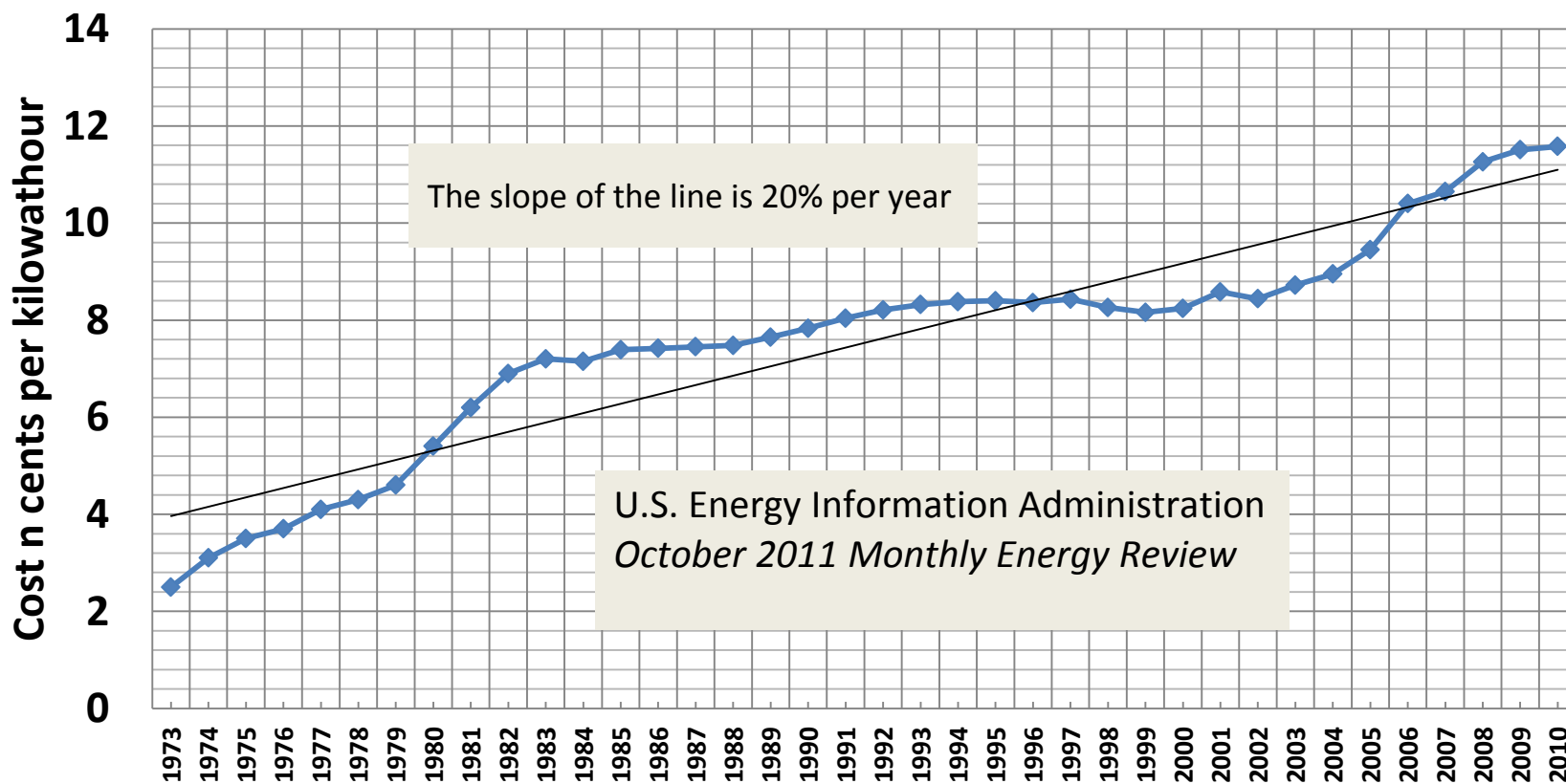
First Year Cost per kilowatt-hour

- In 2012, \$1 million installs solar on 18 homes
- The 18 homes generates 6 million kwh over 25 year period
- The cost to the 3rd party for the first year will be \$700,000 total
- Now take \$700,000 divided by 6 million kWh equals 12 cents per kWh



Electricity Cost Increases

National Average Retail Price of Electricity, Residential Sector
(Cents per Kilowatthour Including Taxes)



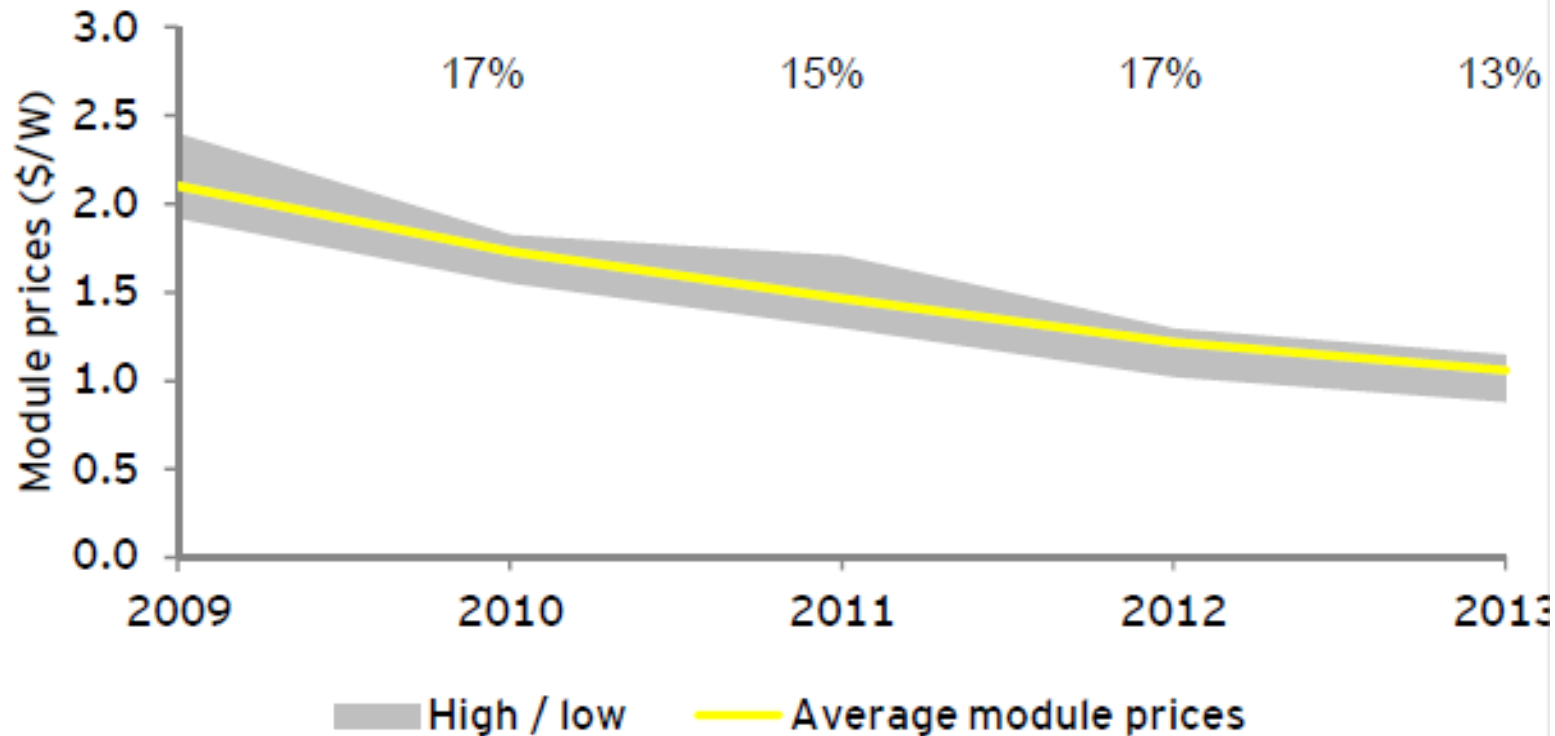
Electricity Output and Price

- Output of a 10 kW system in Knoxville, TN is 13,231 kWh annually
- Average TN household use is 6,363 kWh per year
 - 6,363 kWh sold to the homeowner
 - 6,868 kWh sold to the distributor
- Retail price increases 3% annually
- As retail prices go up, the program becomes more profitable

Module Price Decreasing

Module price evolution

- ▶ Analysis of broker reports shows range of expectations of module average selling price (ASP) to 2013.
- ▶ Average year on year percentage reductions are also shown.
- ▶ We note that modules are priced in US dollars and we have not included the impact of future foreign exchange movements in our analysis.



Source: HSBC, Numora, Morgan Stanley, Rolf, JP Morgan, EY analysis

PV System Cost

- PV system cost declines from 10 to 19% per year
 - The number of homes that can participate increases
 - More houses = more revenue
 - Lower cost of systems = lower cost per kWh

Year	\$/watt Installed Cost	# of 10kW Systems	Cost of kWh Over 25 Years
2012	\$ 5.50	18	\$ 0.12
2013	\$ 4.68	21	\$ 0.10
2014	\$ 3.97	25	\$ 0.08
2015	\$ 3.38	30	\$ 0.07
2016	\$ 2.87	35	\$ 0.06
2017	\$ 2.44	41	\$ 0.05
2018	\$ 2.07	48	\$ 0.04
2019	\$ 1.76	57	\$ 0.04
2020	\$ 1.50	67	\$ 0.03
		<i>Total: 342</i>	<i>Average: \$0.06</i>

Why It Works?

- Install more solar PV on roof than homeowner uses
- The revenue of the PV generated energy keeps increasing as the price of electricity rises
- For the worst case the revenue is positive in the 8th year
- For the optimistic case, the revenue is positive in the 5th year

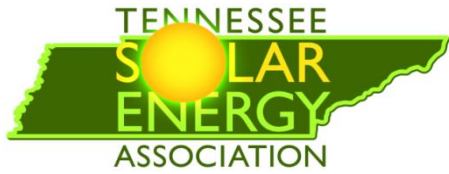
Solar Installations

- Each year the invested \$1 million buys more systems as the installed price of solar goes down.
- For example, the end of the fifth year the investment will net 41 home installations
- At the 8th year we have 342 homes with installed solar



Why Stop at the Eighth Year?

- We stopped the investments in solar installations due to the uncertainty of the market
- After 8 years the solar system price for a 10 kW system will be so attractive that the residents may begin to install their own solar systems
- At this point the distributor can adjust the incentive to continue the program



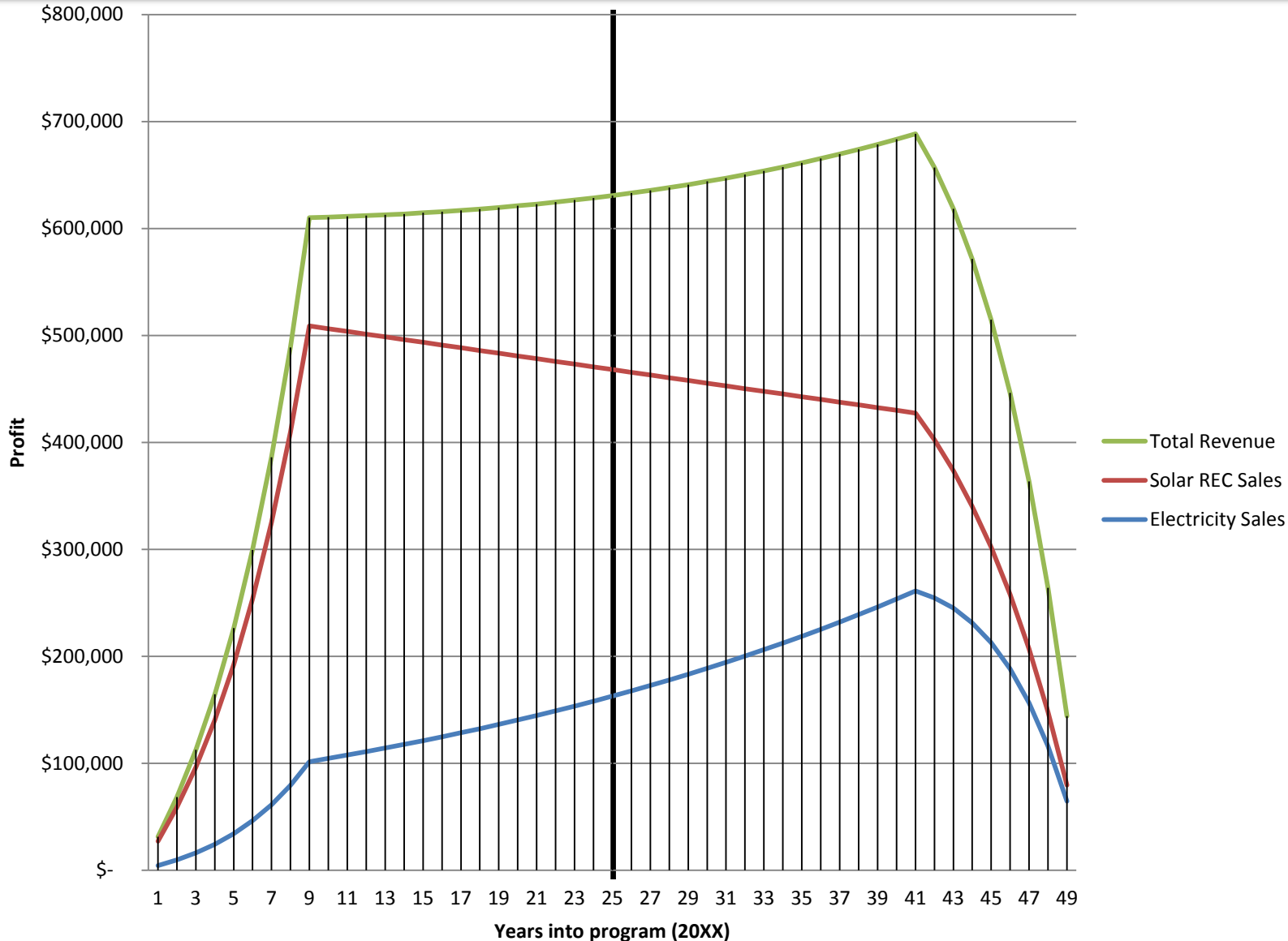
Conservative Estimate of Income

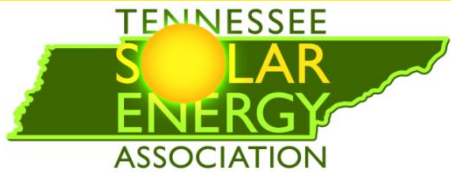
25 Year Totals:

\$ 12,920,118
\$ 10,271,343
\$ 2,648,775

40 Year Totals:

\$ 26,387,515
\$ 19,059,026
\$ 7,328,489





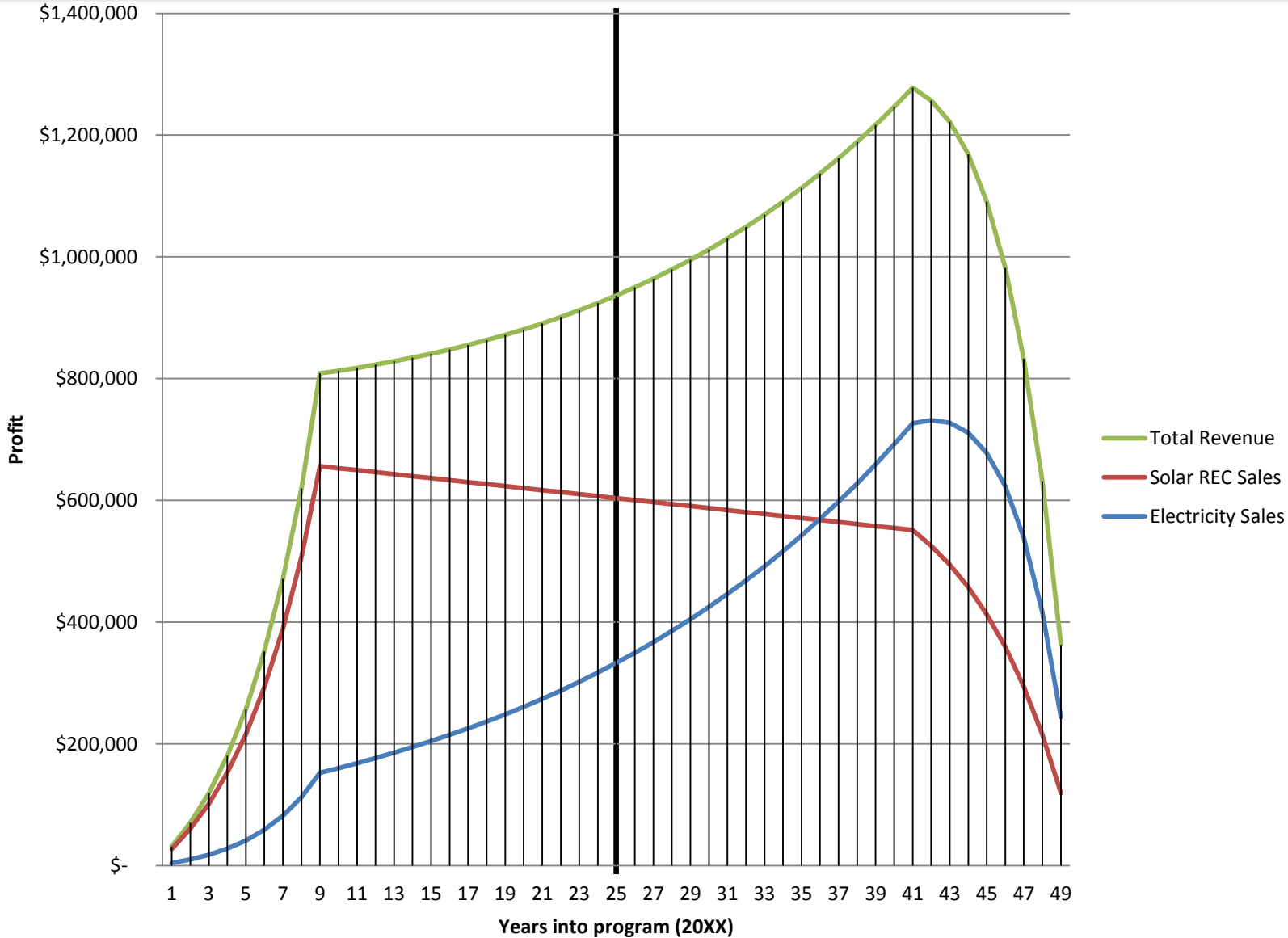
Optimistic Estimate of Income

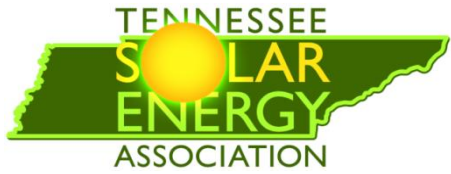
25 Year Totals:

\$ 17,699,488
\$ 13,054,814
\$ 4,644,675

40 Year Totals:

\$ 41,777,413
\$ 19,059,026
\$ 7,328,489





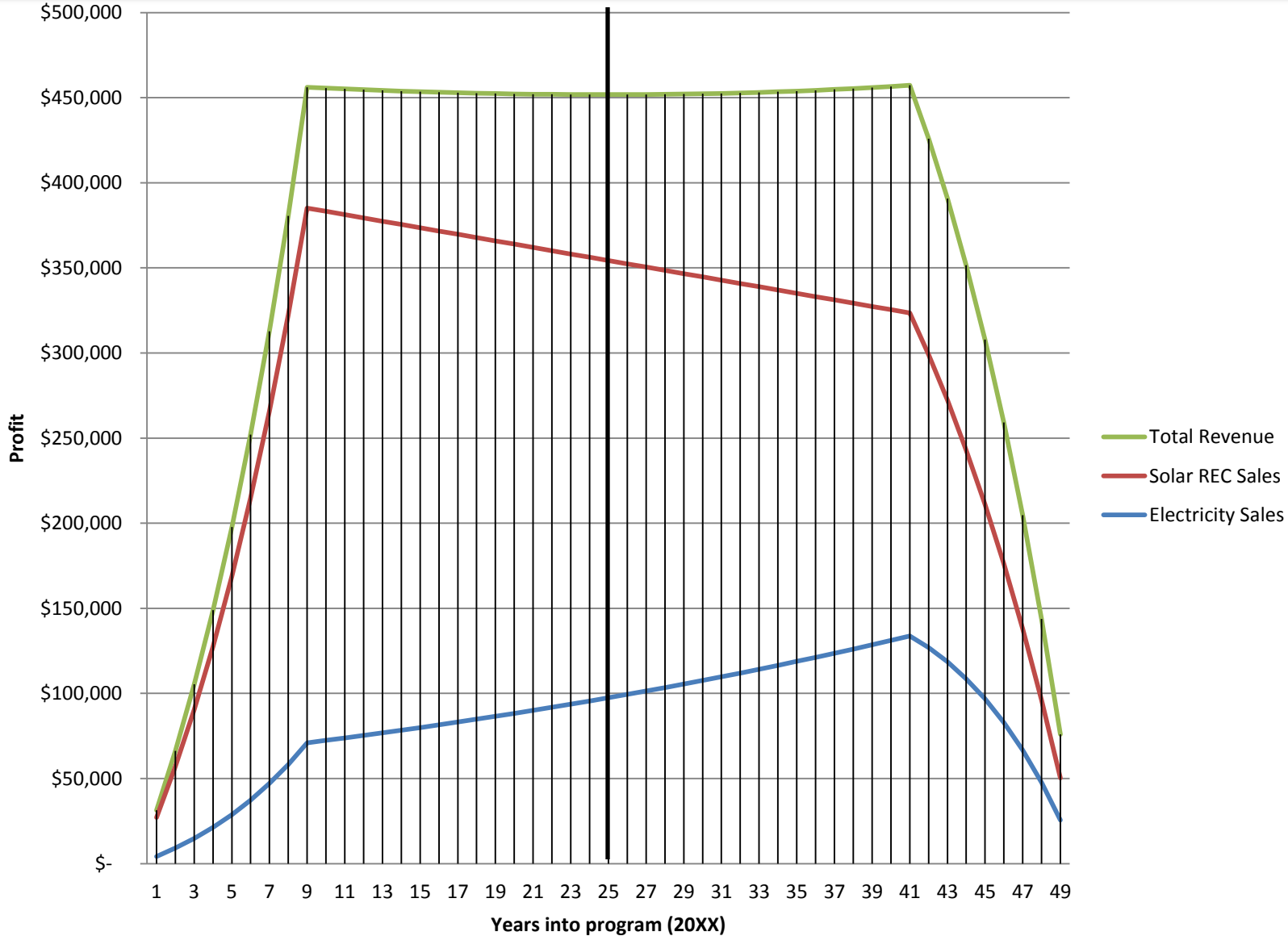
Worst Case Scenario

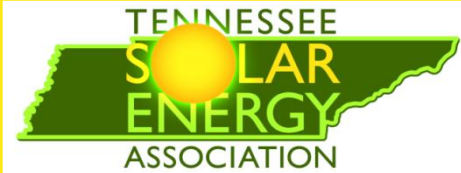
25 Year Totals:

\$ 9,652,806
\$ 7,911,692
\$ 1,741,114

40 Year Totals:

\$ 18,620,850
\$ 14,452,532
\$ 4,168,318





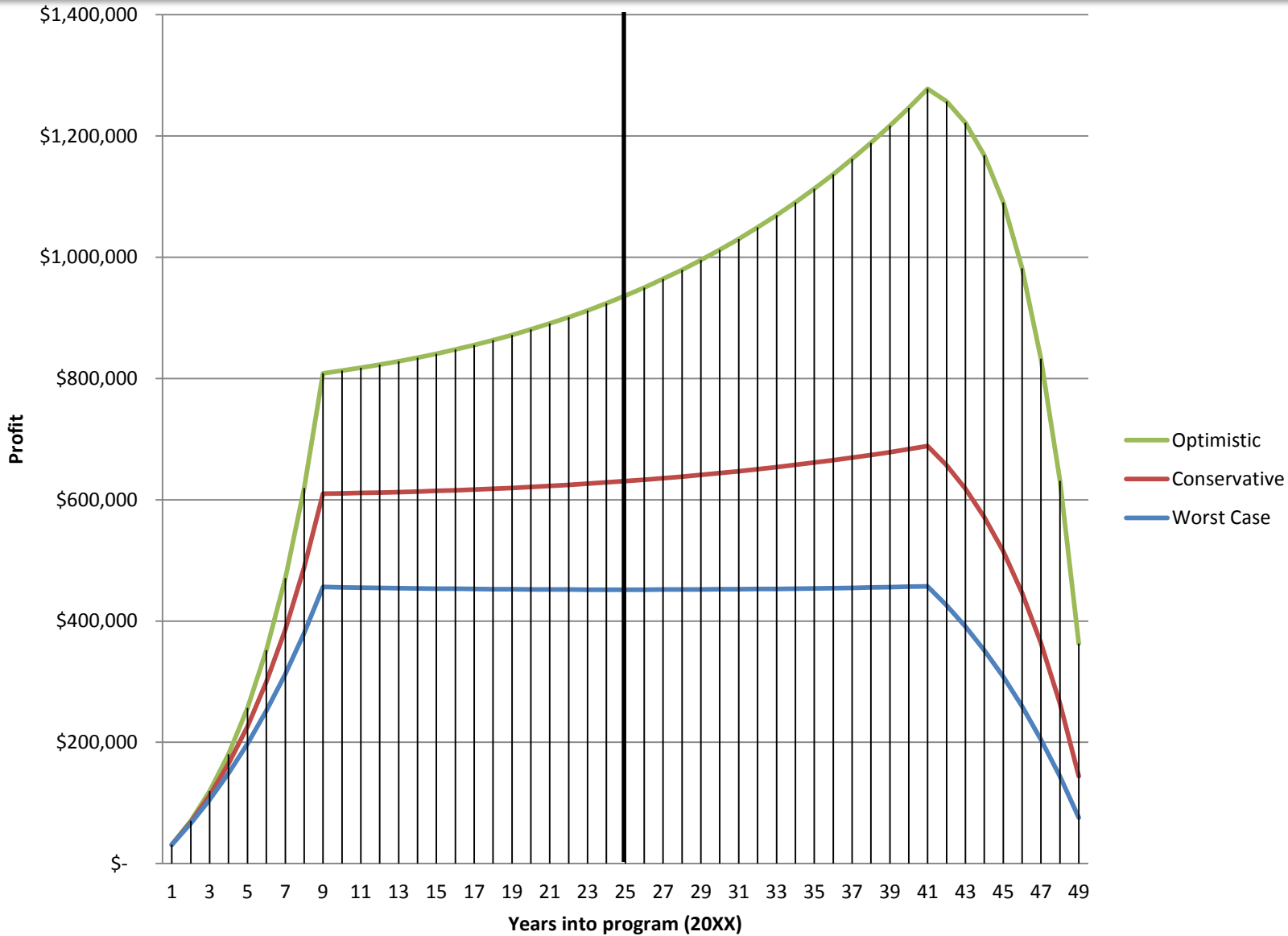
Comparing Revenue Streams

25 Year Totals:

\$ 17,699,488
\$ 12,920,118
\$ 9,652,806

40 Year Totals:

\$ 41,777,413
\$ 26,387,515
\$ 18,620,850



Total Electricity Generation

- Total of 113 Gigawatt Hours over the 25 years of the warranty
- Systems may last many years longer than 25

Year	Total # of 10kW Systems	kWh Generated Per Year	Total kWh Over Warranty (25 yrs)	Cost of kWh Over 25 Years
2012	18	240,564	6,014,091	\$ 0.12
2013	21	283,016	7,075,401	\$ 0.10
2014	25	332,960	8,324,001	\$ 0.08
2015	30	391,718	9,792,943	\$ 0.07
2016	35	460,844	11,521,109	\$ 0.06
2017	41	542,170	13,554,246	\$ 0.05
2018	48	637,847	15,946,172	\$ 0.04
2019	57	750,408	18,760,202	\$ 0.04
2020	67	882,833	22,070,826	\$ 0.03
		4,522,360	113,058,990	\$ 0.06

Optimistic Analysis

- Electricity prices rise 5% annually
- DOE's SunShot goal of \$1 / Watt by 2020 is reached
- All the installed systems continue to produce energy with some degradation
- \$6.3 Million program yields **\$17.7 Million** profit over 25 years and **\$41.7 Million** profit over 40 years
- ROI of **.97** over 25 years and **3.64** over 40 years

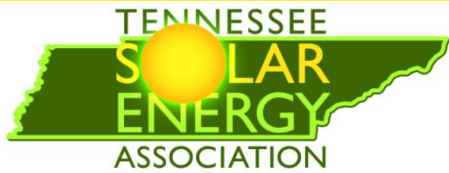
Worst Case Analysis

- Electricity prices rise 2% annually
- Lowest installation price reaches \$2.37 per watt by 2020
- All the installed systems continue to produce energy with some degradation
- \$6.3 Million program yields \$9.65 Million profit over 25 years and \$18.6 Million profit over 40 years
- ROI of .07 over 25 years and 1.07 over 40 years

Legal and Legislative Issues

- Renewable Portfolio Standard must be passed to create a market for additional revenue by selling solar RECs.
- Net-metering may be needed
 - TVA may allow a company similar to the Seven States Power Corp. to be formed
- Uniform state-wide solar Installation codes





Homeowner Requirements

- Must have suitable roof space
- Must agree to a 25 year contract
 - If the owner moves, the contract transfers to the new owner
- Must allow for maintenance crews to stop by as needed
- KUB is not liable for any damages during installation
 - Installer warranties against damages

Advantages

- Applies to any electric utility
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