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April 1, 2020

DELIVERED VIA EMAIL

JIM CHISHOLM
OUR SAVIORS LUTHRAN CHURCH
N6450 530TH ST
BELDENVILLE WI 54003

Re: Account No. 1301001
Member No. 2018
Our Savior's Lutheran Church 4kW Solar Array Value Assessment *(updated 2020)*

Dear Jim:

At your request, I have reviewed the data for the church's 4 kW solar array and updated the graphs and other information to the end of 2019. As in the past, I have included a review back to 2007 so you have an overall view of the church's energy usage over time.

As you know, the church's solar array was installed in October 2010 and commissioned on October 7, 2010. As mentioned in the past, my analysis does not consider any energy efficiency efforts or equipment replacements that may have been completed during the period from 2010 to the present. This is important as I believe the impacts on the church's energy usage are largely the result of these improvements. And based on the additional data, it appears that the church has continued making energy efficient changes resulting in energy savings. Seasonal affects, such as temperature and sunshine, are also part of the equation that I do not take into consideration as it is beyond the scope of this evaluation. Temperature would affect the energy required to heat and cool the church, while the amount of sunshine, as well as the angle of the sun depending on the time of year, would affect the energy generated by the array. This means that I cannot state for fact that the results of this analysis are directly related to the addition of the solar array at the church. In fact, it is most likely a combination of several things with the church's energy efficiency efforts that have provided the *"biggest bang for your buck"*.

Graphs
Included in my analysis are several graphs for your review.

1. *2019 monthly usage graph*
    - The monthly average usage was 1,383 kWh, a drop of 1,640 from the 2009 monthly average of 3,023kWh.

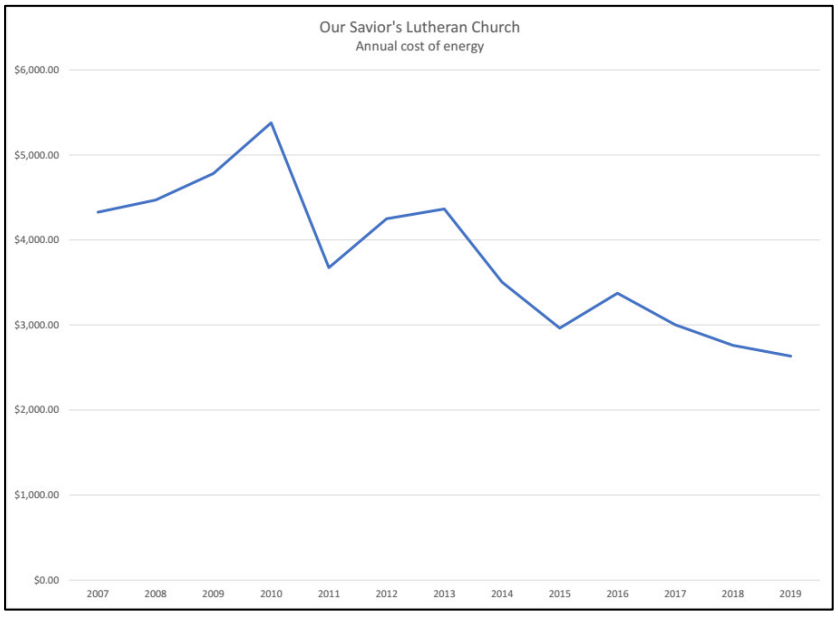
2. *Annual kWh Usage by Year graph*
    - This graph shows the annual energy consumption for the church from 2007 through 2019. In 2010, when we commissioned the array, I recall that there was some bathroom remodeling, etc., being done and I believe that a significant amount of the energy reduction can be attributed to that. And based on the continued downward trend, there have been other energy efficiency efforts implemented.
    - The trendline for 2007 through 2019 clearly shows a reduction in annual energy usage over this time period.

3. *Monthly Usage - Comparison*
    - This graph is busy but there is some very good data here for your review.
    - This graph shows a comparison of the monthly energy usage from the year's 2009, 2017, 2018 and 2019.
    - I used 2009 because it provides a full year of usage data before the solar array was installed.
    - It is difficult to get a clear picture as to why, for the reasons I stated above, but there has been a definite reduction in the church's annual energy usage.

4. *Annual cost of Energy graph*

Billing history
This table and graph are the church's billing data from 2007 through 2019 and, as expected, they show the drop in the church's energy usage over these 13 years. I have also provided a larger graph with the costs displayed.

Year	Cost of energy
2007	*$4,325.96*
2008	*$4,468.23*
2009	*$4,781.78*
2010	*$5,378.24*
2011	*$3,673.48*
2012	*$4,248.20*
2013	*$4,364.56*
2014	*$3,503.59*
2015	*$2,962.09*
2016	*$3,373.67*
2017	*$3,001.36*
2018	*$2,759.42*
2019	*$2,633.87*



Capacity Factor
The net capacity factor is the unitless ratio of an actual energy output over a given timeline to the maximum possible energy output over the same timeline, which is typically a year. The estimated annual output of your array, per the DG Application dated 10/7/2010, is 5,000kWh. This factor is affected by many things, but primarily the amount of sunlight is the obvious one. The capacity factor for your solar array is slightly over 14 percent. Which means that it produces energy about 14 percent of the time.

$$\frac{\textbf{5,000 kWh}}{\textbf{(365 days) x (24 hours/day) x (4 kW)}} = \textbf{0.1427} = \textbf{14.27\%}$$

Summary
While the 4-kW solar array has provided some reduction in your energy usage, I continue to believe that the main reason for the overall reduction over this time period is due to other energy efficiency efforts that the church has accomplished.

For the period from 2007 to 2010, the average annual energy usage was 37,090 kWh and for 2011 to 2016 it was 26,173 kWh.

However, in the last three years the average was 17,543 kWh, which reflects a drop of 8,720 kWh in that time and an overall drop of 19,637 kWh since 2007. This is almost 4 times the estimated annual output of the solar array and clearly indicates that your energy reduction is not the result of your solar array.

In short, your church's efforts to reduce your energy usage have been very successful and the data reflects that.

If you have any questions or would like to meet to discuss this further, please let me know.

Sincerely,

PIERCE PEPIN COOPERATIVE SERVICES

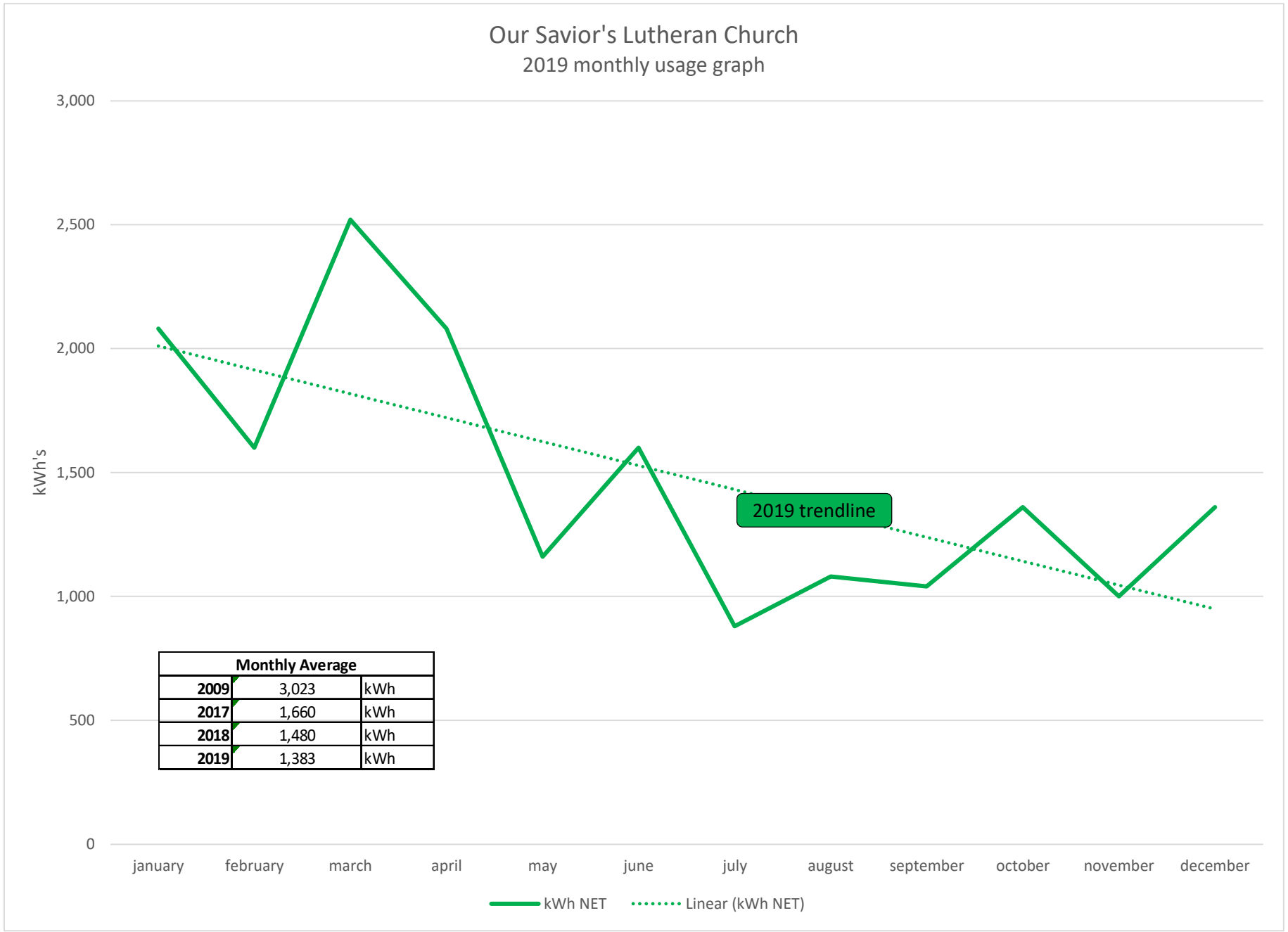
Jeffrey S. Olson
Vice President, Engineering

JSO

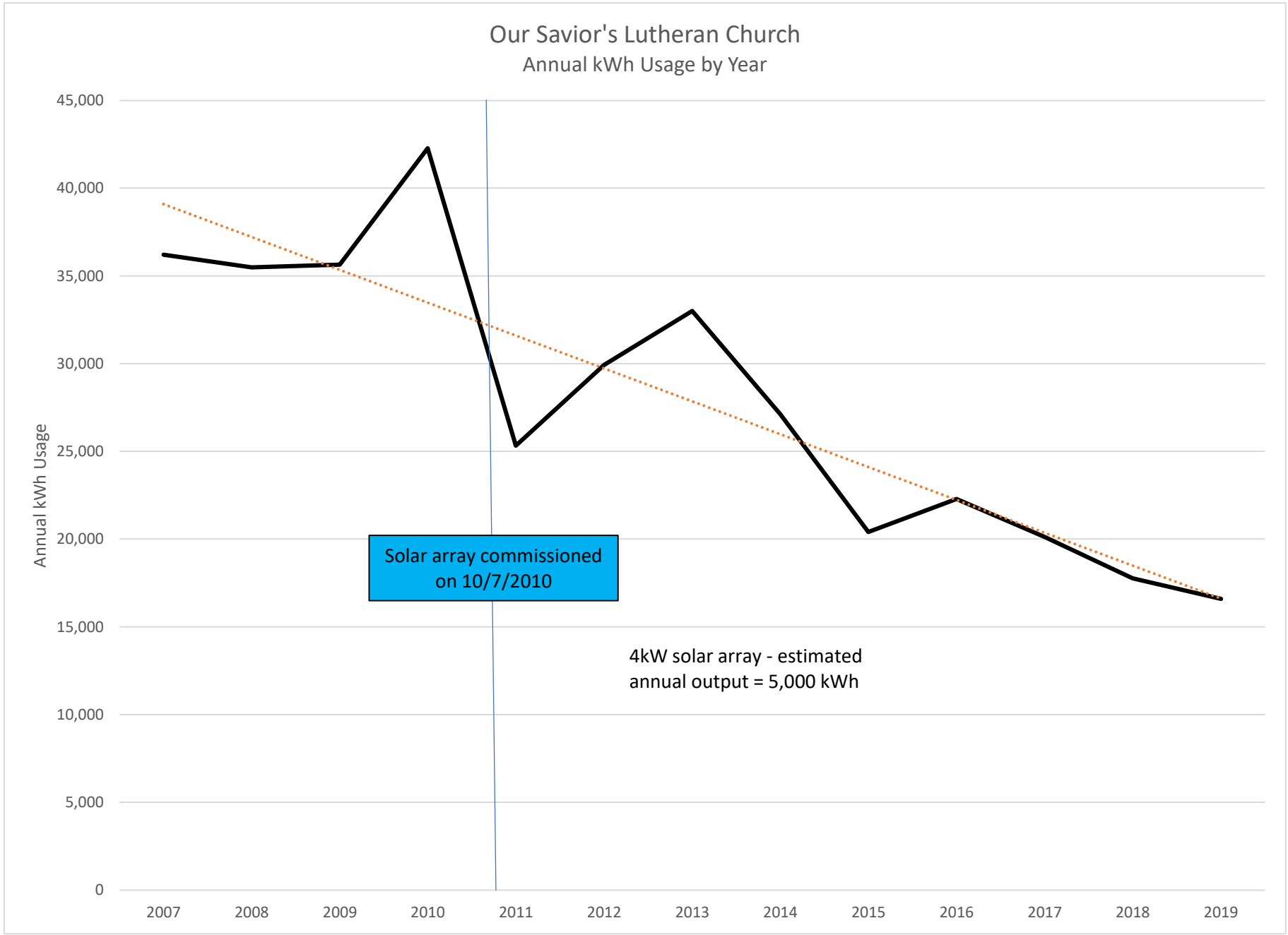
Enclosures

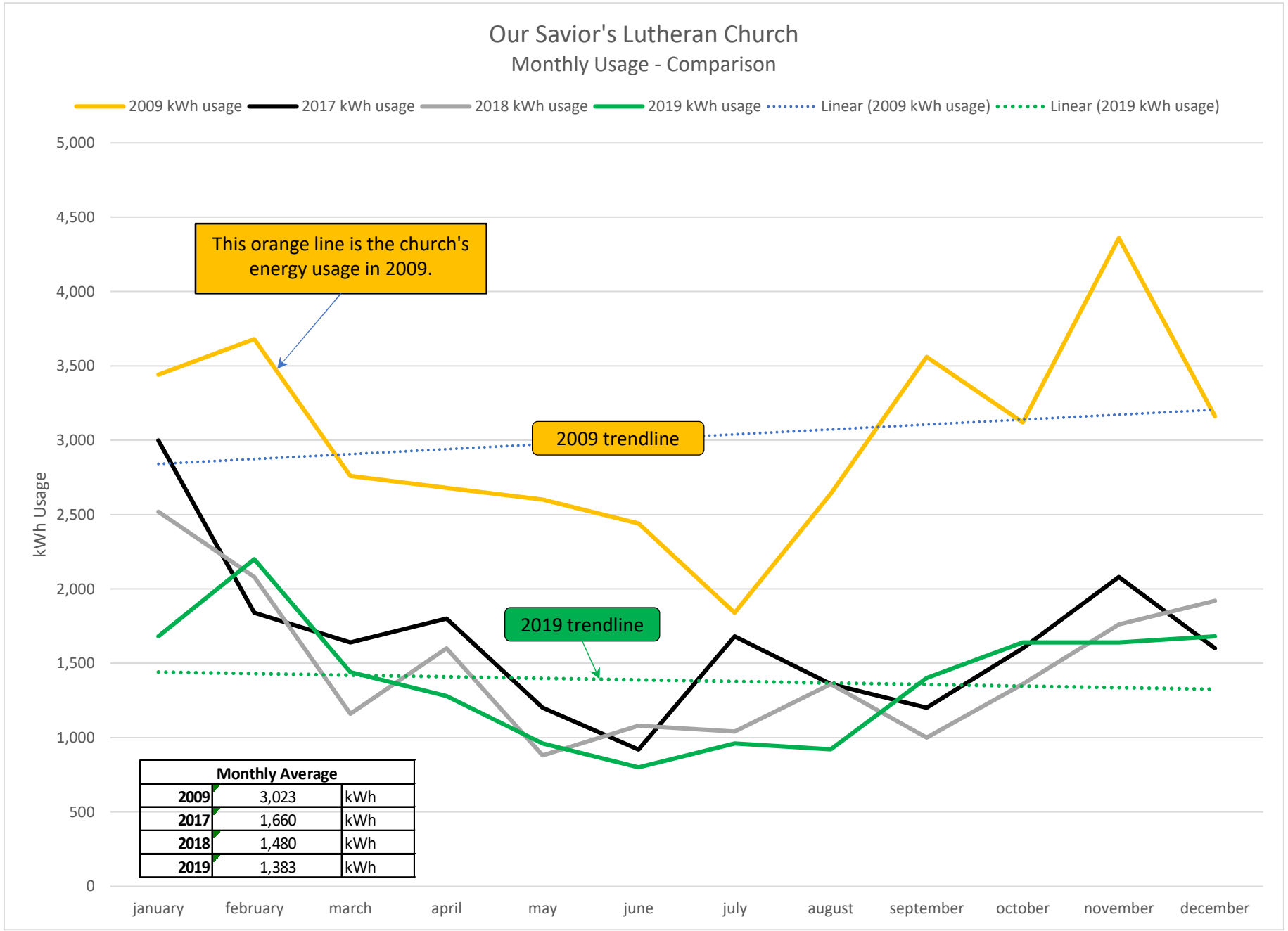
cc/enc: Our Savior's Lutheran Church

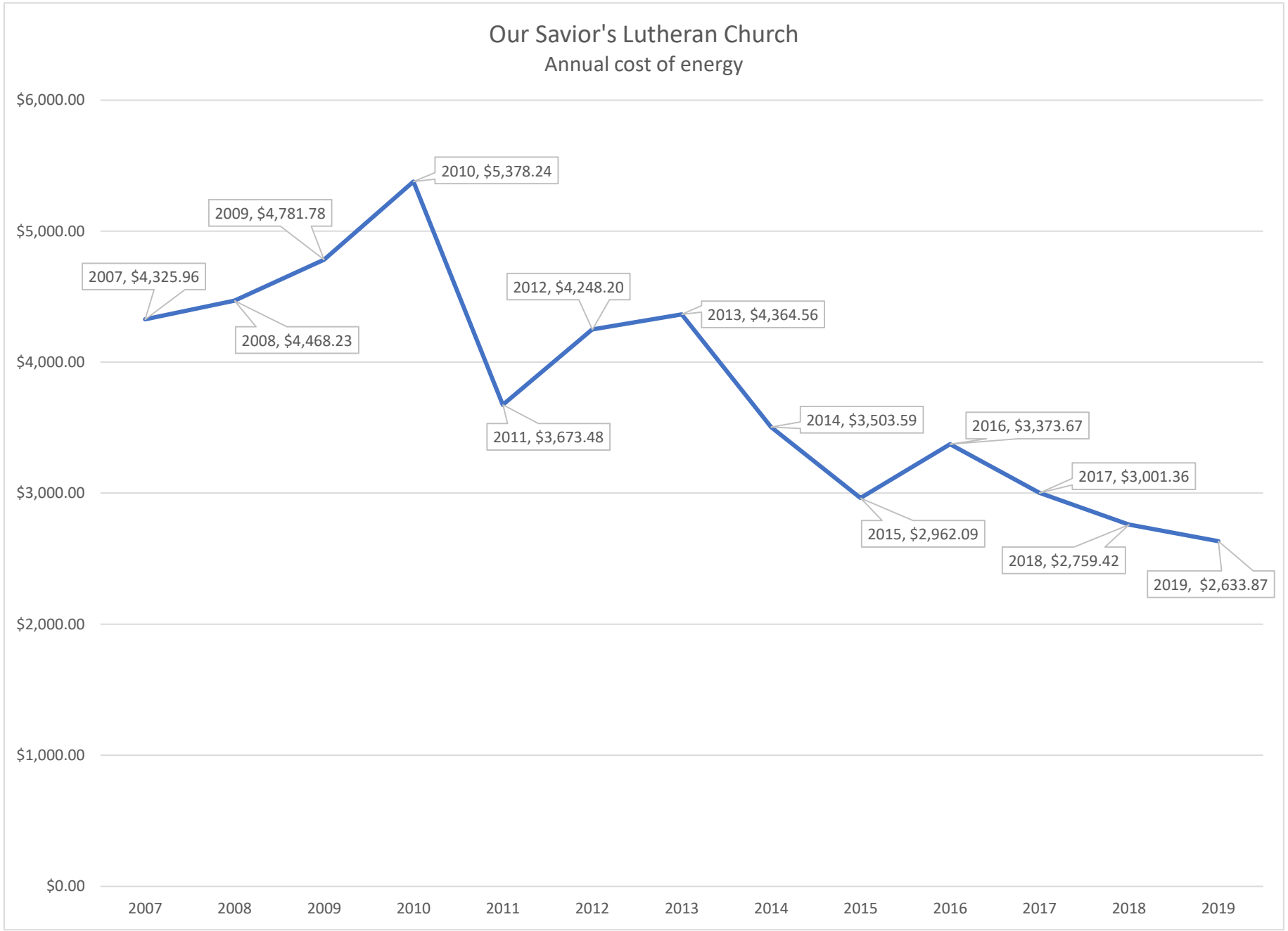
Ann Young



Monthly Average		
2009	3,023	kWh
2017	1,660	kWh
2018	1,480	kWh
2019	1,383	kWh


Our Savior's Lutheran Church
Annual kWh Usage by Year
Annual kWh Usage
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Solar array commissioned on 10/7/2010
4kW solar array - estimated annual output = 5,000 kWh


Our Savior's Lutheran Church
Monthly Usage - Comparison
2009 kWh usage
2017 kWh usage
2018 kWh usage
2019 kWh usage
Linear (2009 kWh usage)
Linear (2019 kWh usage)
kWh Usage
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
This orange line is the church's energy usage in 2009.
2009 trendline
2019 trendline
january
february
march
april
may
june
july
august
september
october
november
december
Monthly Average
2009 3,023 kWh
2017 1,660 kWh
2018 1,480 kWh
2019 1,383 kWh


Our Savior's Lutheran Church
Annual cost of energy
$6,000.00
$5,000.00
$4,000.00
$3,000.00
$2,000.00
$1,000.00
$0.00
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2007, $4,325.96
2008, $4,468.23
2009, $4,781.78
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