TO: SDC Board members

FROM: Bob Jenne

DATE: May 8, 2020

SUBJECT: How much will the Dharma Center save if we install solar power?

SUMMARY

Installing solar panels on the roof of the Dharma Center will probably save us an average of about $3266 per year on our electricity bill, or $272 per month, over the next 25 years. This translates to a total saving of about $81,643 over the next 25 years.

These numbers are a conservative estimate based on the best information we have now. Depending on how SMUD changes its rates in the future, we could save more than this amount (up to $95,242 over 25 years, or $3810 per year), or somewhat less ($77,658 over 25 years, or $3106 per year).

How did we arrive at these cost savings numbers?

A sophisticated analysis was generously prepared by Rick Codina, an engineer who worked for many years as an electricity rate analyst at SMUD before he retired. Rick is acquainted with a number of individuals who attend Dharma Center activities, is active in local environmental groups, and was a member of a SMUD Technical Working Group on solar rates.

Rick's analysis is set forth the attached Excel Spreadsheet. It contains an overwhelming amount of information, which I will try to summarize below. The very first page of the spreadsheet contains all of the key information, and there is really no need to look at the rest of the spreadsheet unless you want additional details. In fact, there is no need to read the rest of this memorandum unless you are interested in how the cost savings above were calculated.

Background Information that will help you understand the spreadsheet

Performing a solar analysis is complicated because SMUD has very recently promulgated a new rate schedule for commercial customers like the Dharma Center. SMUD is also in the process of revising its current "Net Energy Metering (NEM)" rules. Under the new rate schedule and new NEM rules, installing solar power won't save us as much money as it would have under the old rate schedule and NEM rules.

SMUD's new rate schedule for commercial customers has already been finalized for the years 2021 through 2028, and Rick's analysis takes these new rates into account. But

the new NEM rules are still under development and won't be adopted by SMUD until sometime in 2021.

The basic concept in all NEM rules (including both the existing NEM rules and the NEM revisions under development) is that customers sell excess solar power to SMUD at those times of the day when their solar system is generating more electricity than they are using, and buy electricity from SMUD at those times of the day when the customer's system is generating less electricity than they using (such as at night or in winter when there is less sun).

SMUD's electricity rates vary depending on the time of day and the season of the year. For example, the highest electricity rates are the "Summer Peak" rates that apply during summer days from 4pm to 7pm. One important feature of the current NEM rules—a feature that makes solar power a really good deal for customers—is that if a customer is charged a particular rate to buy electricity at a particular time of day, SMUD will pay the exact same rate for the excess solar power that SMUD buys from the customer at the same time of day.

This isn't a good deal for SMUD and they want to change it. When they revise the NEM rules in 2021, SMUD would like to restructure them so that customers will be compensated at a lower rate for their excess solar generation than SMUD currently pays. The new rate has not yet been finalized, but Rick's best estimate, based on his participation in SMUD's Technical Working Group, is that SMUD will probably pay about $5.86 cents/kWh to purchase a customer's excess solar power. This is substantially lower than SMUD pays now. The final rate could be higher or lower than that, but I think it is unlikely to be lower due to political pressure from the solar industry, environmental groups, and some legislators who want the rate to stay high to encourage widespread adoption of solar power.

The good news, however, is that there will almost certainly be a period of time during which customers who have already installed solar power will be "grandfathered" in under the old, more favorable rate schedule. In all previous revisions of the NEM rules, customers who had already installed solar power were grandfathered in under the old rate schedules for 25 years.

The same thing may happen again under the new still-to-be developed NEM revisions. But it is likely that SMUD will attempt to establish a shorter grandfathering period of 10 years, or perhaps even 5 years. Stakeholders would strenuously oppose both a 5 or 10 year grandfathering period, but if SMUD is successful a 10-year period is the most likely result.

Rick's analysis quantifies the cost savings that the Dharma Center would achieve under three grandfathering scenarios: 25 years, 10 years, and 5 years. The "conservative estimate" mentioned at the beginning of this memo assumes that SMUD will establish a 10-year grandfathering period.

What key information can be found in Rick's spreadsheet?

The most important information can be found on the very first page of the spreadsheet: the "Summary" tab, which is titled "Summary of Savings for Photovoltaic."

The chart on the left side of the spreadsheet's first page

On the left side of the spreadsheet's first page is a chart with a blue-shaded box labeled *"SMUD Billed Energy Savings (Export Price = Rate)."* This chart shows the savings that we would achieve under a **best-case scenario** in which there would be a 25-year grandfather period in which the SMUD continues to pay the favorable old rate for excess solar power from the customer that is "exported" to SMUD.

Under this **best-case scenario**, the "Total" column in the chart shows how much the Dharma Center would save each year (i.e., $4028 in 2021; $3973 in 2022, etc.) Adding up all the numbers in the "Total" column gives one **the total savings over 25 years: $95,000, or an average of $3810 per year, or $317 per month.**

The chart on the right side of the spreadsheet's first page

On the right side of the spreadsheet's first page is a chart with a salmon-colored box labeled *"SMUD Billed Energy Savings (New Export Pricing)."* This chart shows the savings that we would achieve under **two conservative scenarios** in which there would be either a 10-year grandfather period or a 5-year grandfather period.

The column labeled *"Total (5-year phase-in)"* shows how much the Dharma Center would save each year with a 5-year grandfather period. You can see that the savings drop significantly after the first 5 years. Adding up all the numbers in this column gives one **the total savings over 25 years: $77,658, or an average of $3106 per year ,or $259 per month. This is the worst-case scenario**.

The column labeled *"Total (10-year phase-in)"* shows how much the Dharma Center would save each year with a 10-year grandfather period. You can see that the savings drop significantly after the first 10 years. Adding up all the numbers in this column gives one **the total savings over 25 years: $77,658, or an average of $3106 per year ,or $259 per month. This is a conservative scenario that falls between the best and worst case scenarios.**

The "Cashflow" columns in both charts

Both charts have "Cashflow" columns that show how long it would take for the Dharma Center to achieve enough savings to recoup the cost of installing solar panels, which would be $45,000. This "payback period" is 12 years under a 25-year grandfather period, 14 years under a 10-year grandfather period, and 16 years under a 5-year grandfather period.

Power exported to SMUD vs. power consumed on-site at the Dharma Center

The chart on the left side of the spreadsheet's first page has a column with this blue-shaded title: PV kWh On-Site. This column beneath this title shows the savings we would achieve each year from electricity generated by our solar panels and consumed on-site (i.e., solar power used at the Dharma Center at the time it is generated, and not sold to SMUD as excess power). There is also a column with this blue-shaded title: PV export to SMUD. This chart shows the savings we would save each year from excess solar power that would be generated by us and sold to SMUD.

You will notice that the most of our savings would come from excess power sold to SMUD. In fact, Rick has calculated that over 70% of the solar electricity we would generate would be sold to SMUD as excess power. That's why it is important to consider the rates that SMUD will pay to purchase our excess solar power.

The main reason that we would generate a lot of excess solar power is that our HVAC units are electric heat pumps that both heat and cool our building, and our highest energy use is in the winter when solar power generation is low because of fewer hours of daylight. Since our winter electricity use is high, we would be relying on the sale of excess solar power in the summer to offset the cost of our winter electricity use. Most commercial buildings are not in this situation because they use more electricity in the summer than in the winter, since they use a lot of electricity for air conditioning in the summer, and in the winter they typically rely on burning natural gas for heat. Natural gas pipes don't run to our building, so we rely entirely on electricity.

Did we get other cost analyses in addition to the one prepared by Rick?

Yes. Each contractor who bid on our solar project prepared their own analysis, which is standard practice in the solar industry. The two contractors who offered the most attractive bids are Solar Revolution and Energy Saving Pros. Solar Revolution's analysis concluded that we would save about **$146,000** over 25 years, and Energy Saving Pros' analysis concluded that we would save about **$184,000**.

(Note: These total savings numbers, as well as the numbers from Rick's analysis mentioned above in the first sentence of this memorandum, are estimates of the savings that would be achieved by paying less to SMUD on our monthly electricity bills. These savings numbers do not factor in the cost of installing the solar system at the

Dharma Center, which would be about $45,000. The cost of installing the solar system is taken into account when calculating the "payback period" discussed in the previous section.)

Why are the savings calculated by the solar contractors so much greater than the savings calculated by Rick Codina in his analysis?

Rick's analysis is much more sophisticated than the simpler solar calculation programs used by the solar contractors. When we initially received the contractor's calculations, it was apparent that they were based on some overly optimistic assumptions. That is why I asked Rick to prepare his own analysis.

Rick's analysis takes into account the following factors that were not taken into account in the contractors' calculations.

- New rate schedule for commercial customers. Rick's analysis takes into account the new rate schedule. The contractors used the old, superseded rate schedule. (In fairness to the contractors, the new rate schedule had not yet been adopted when they prepared their estimates.)

- Grandfathering period. The contractors assumed that SMUD will continue their past practice of allowing a grandfathering period of 25 years for existing solar customers. As explained above, Rick's analysis calculates the cost savings that the Dharma Center would achieve under three grandfathering scenarios: 25 years, 10 years, and 5 years.

- Future SMUD rate increases. The contractors assumed that future SMUD rates would increase by an average 4% per year (Solar Revolution) or 5% per year (Energy Saving Pros). Rick's analysis assumed a more conservative average increase of 3% per year after the current commercial rate schedule expires in 2028. This is a reasonable assumption, because SMUD electricity rates increased an average of about 3% per year from 2008 through 2017.

  However, Rick also said that it is quite possible that future rates could increase by an average of up to 5% per year. Electric utilities are under cost pressure because they are mandated by California law to use an ever-increasing share of renewable energy, and transitioning to renewables will be costly. Utilities are also under cost pressure to upgrade their infrastructure to reduce the risk of catastrophic wildfires.

With all of the uncertainty related to the pandemic, does it make sense to install solar power this year? Would it make more sense to wait until next year or later?

We will save a lot more money if we act this year instead of waiting. If we wait too long we won't be grandfathered in under the old, more favorable rates. In addition, the federal tax credit for commercial solar installations is 26% in 2020, but it goes down to 22% in 2021 and 10% in 2022. So if we wait too long to install solar, our total savings would likely be less than the worst case scenario described above.

Rick's analysis describes the savings we would realize over the next 25 years. What happens after 25 years—will our solar panels still work?

Yes. Our solar panels should still work, but they will be less efficient at generating solar power. All solar panels gradually become less efficient over time. The solar panels that we would most likely install (Hanwha Q cells) are high quality panels that come with a warranty that they will achieve at least 93% of their original power output for up to 10 years (an average loss of about .28% each year), and at least 85% for up to 25 years (an average loss of about .6% each year). This is the guaranteed minimum output under the manufacturer's warranty. In actual practice, high quality solar panels often perform better than their minimum guaranteed output. Rick's analysis assumes an average efficiency loss of .51% per year.

Please let me know if you have any questions. Bob Jenne