Peak Generation and Energy Resource Plan for Stehekin (DRAFT)

A Generation and Demand Response Plan for Meeting Future Load Growth

February 21, 2020

Executive Summary

This peak generation and energy resource plan outlines the demand-side measures and generating resource options that can be used to meet the projected shortfalls between the District's existing generating capacity and future load growth in Stehekin. This PLAN looks at resources to meet both the peak capacity and energy needs of the Stehekin community. The options include energy efficiency improvements, peak load shifting, fuel switching from electric appliances to propane, diesel and hydro generator enhancements, and a central battery storage system at the Stehekin power plant.

Loads are continuing to grow in Stehekin. Over the past three years, the District has received 2,000 amps of new service requests. In addition to physical enhancements to customer and District-owned equipment, rate and policy changes may be needed to keep future electrical consumption within the capacity of the power generating resource limitations that exist in Stehekin. There are limited technical solutions to support increased loads. Rate and policy actions may also be needed to keep loads from exceeding the capacity of the generators. At some point, if technical solutions are unavailable, and loads continue to grow without limitation, there could be periods of time when there is not enough generation to meet load. This can lead to temporarily shutting off power to sections of Stehekin when loads exceed the capacity of the generating plant.

This plan recommends the following measures be implemented in 2020 and 2021:

1. Pursue all cost-effective energy efficiency improvements.

2. Purchase and install a battery energy storage system that would operate in parallel with the existing hydro/diesel plant. The battery system would store excess hydro generation and then use that extra power to meet the peak power needs of the community. To help pay for the battery, the District is eligible to receive a $125,000 grant from APPA's Demonstration in Energy Efficiency and Design (DEED) program.

3. Review electric service policies to address how to deal with new service requests.

4. Conduct a rate study and contemplate new rates that encourage energy efficiency and limit peak loads on the system.

5. Implement a communication plan that explains to customers the power generation limitations and what customers can do to stay within those limitations, while also minimizing their power costs.

6. Assess how an automatic meter reading system can help to clearly identify opportunities for reducing off-peak energy use.

Peak Capacity Needs

Due to restrictions on the District's existing water rights and the high cost to upgrade the existing hydro-generator, the maximum power output of the existing hydropower generator in Stehekin is limited to a net output of 180 kW. A 75-kW diesel generator (D-2), also known as the induction generator, is currently run whenever District loads exceed the output of the hydropower generator. Since the 300kW generators are limited to emergency usage only by permit, they are not available as a resource to meet peak load requirements. Figure 4 shows how projected peak growth is expected to require an increase in diesel usage from 14% of the time to 56% of the time.

This PLAN identified a list of options that can be implemented to reduce the peak loads or expand the capabilities of the power plant to meet the projected loads and to reduce the need to run the diesel generators.

The following options were identified for meeting additional capacity needs in Stehekin:

Incremental Peak kW Reduction	Cumulative Peak kW Reduction	Cost per kW-Month of Peak Capacity Supply
5	5	$13.73/kW-mo, Residential Lighting Replacement with LED
2	6	$20.56/kW-mo, Pre-1990 Refrig. w/ EnergyStar Replacement
91	97	$25.95/kW-mo, 500 kWh/250 kW Lithium Ion Battery Storage
1	99	$28.92/kW-mo, Pre-1993 Refr. w/ EnergyStar Replacement
3	102	$30.99/kW-mo, Commercial Lighting Replacement with LED
19	121	$31.57/kW-mo, Propane Dryer Replacement
51	172	$32.53/kW-mo, WH Demand Control
33	205	$37.40/kW-mo, Propane Water Heater Conversion
17	222	$40.86/kW-mo, Propane Stove/Oven Conversion
19	241	$41.95/kW-mo, New EnergyStar Rated Refr.
1	241	$50.84/kW-mo, Pre-2000 Refr. w/ EnergyStar Replacement
31	272	$53.43/kW-mo, Electric HP Water Heater
6	279	$57.72/kW-mo, Residential Ductless HP
14	293	$64.94/kW-mo, Commercial Ductless HP
5	298	$141.58/kW-mo, Upgrade D-2's 75 kW generator to 120 kW & replace 75 kVA transformer
31	329	$333.96/kW-mo, Multi-Jet Pelton Wheel

Energy Needs

Although a majority of the existing electricity generated in Stehekin comes from hydro, expected load growth has the potential to dramatically increase the amount of diesel consumed at the plant. Unless something is done to reduce projected electricity consumption, additional load growth will need to be met almost entirely with D2, with D1 and D4 to be used for emergencies when the hydro unit is offline. Many of the same demand side resources that will reduce the system peak capacity needs will also reduce electricity consumption.

The following options were identified for reducing electricity consumption in Stehekin:

Cumulative Avg. kW Savings	Levelized Cost per kWh	Description of Peak Capacity Reduction
1.58	$0.05	Residential Lighting Replacement with LED
3.09	$0.12	Pre-1990 Refrig. w/ EnergyStar Replacement
4.19	$0.12	Commercial Lighting Replacement with LED
10.38	$0.12	Electric HP Water Heater
17.12	$0.12	Propane Dryer Replacement
17.73	$0.16	Commercial Insulation & Weatherization
20.82	$0.16	Residential Insulation & Weatherization
21.14	$0.16	Pre-1993 Refr. w/ EnergyStar Replacement
39.33	$0.18	500 kWh/250 kW Lithium Ion Battery Storage System
61.02	$0.18	Distributed Solar PV Generation w/o Storage
66.71	$0.18	Commercial Ductless HP
78.30	$0.18	Propane Water Heater Conversion
84.21	$0.19	Propane Stove/Oven Conversion
86.98	$0.23	Residential Ductless HP
90.98	$0.24	New EnergyStar Rated Refr.
93.04	$0.24	Commercial Windows
99.20	$0.24	Residential Windows
100.42	$0.29	Pre-2000 Refr. w/ EnergyStar Replacement
106.59	$0.38	Upgrade D-2's 75 kW generator to 120 kW & replace 75 kVA
119.05	$1.14	Multi-Jet Pelton Wheel
119.05	N/A	WH Demand Control

Planning and Operating Environment

Water Rights

The Stehekin Project is authorized by the Department of Ecology to divert 17.86 cfs of water from Company Creek under two water rights (S4-CV3P1041C, 15 cfs, and S4-01197CWRIS, 2.86 cfs).

National Park Service Permit

The District has operated the Stehekin Hydro Project under special use permit originally issued by the Forest Service in 1966, and in subsequent years by the National Park Service (NPS). Recently, NPS policy has changed requiring special use permits be converted to right-of-way (ROW) permits. The District is currently working with the NPS to secure a renewed permit to operate the Stehekin Project and is evaluating the consequences, costs, and considerations in obtaining a ROW permit. The Districts goal is to secure a permit that allows the Project to remain economically viable.

Washington Department of Ecology - Air Quality Permit

The District's Stehekin power plant is built on National Park Service land. Operating terms and conditions of the generators are set out in the "Air Quality Permit" and the District.

The 75kW synchronous generator can be operated to meet supplemental loads on an ongoing basis. The larger 300+ kW diesel generators have operating restrictions. They are intended to only be operated during an emergency where the hydro unit becomes unavailable, or when a planned maintenance outage is scheduled that requires the hydro unit to be offline.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

IN THE MATTER OF APPROVING A NEW CONTAMINANT SOURCE FOR PUBLIC UTILITY DISTRICT NO. 1 OF CHELAN COUNTY- STEHEKIN POWERHOUSE)	))))	**ORDER NO. 06AQ-C029**

To: **Public Utility District No. 1 of Chelan County**
PO Box 1231
Wenatchee, Washington 98807

2.0 PROJECT SUMMARY

The project consists of installation and operation by Public Utility District No. 1 of Chelan County (hereinafter called "Chelan PUD") of one 170-horsepower (a.k.a. engine no. D2B), diesel-fired internal combustion engine to drive an existing 75-kilowatt generator to provide peaking electrical power production at a hydroelectric generation facility near Stehekin, Washington. Peaking power is needed when the hydroelectric generation facility does not produce sufficient power to satisfy the demand from the settlement of Stehekin, which is not connected to the outside power distribution grid. The hydroelectric generation facility is located on National Park Service land on Company Creek near the north end of Lake Chelan, within Section 22, Township 33 North, Range 17 East, W.M., Chelan County.

The new 170-horsepower engine will replace an existing 1950's 100-horsepower diesel internal combustion engine in driving the existing 75-kilowatt generator.

Two other diesel internal combustion engines, one 425-horsepower engine and one 360-horsepower engine (a.k.a. engines nos. D4 & D1, respectively), also exist at the hydroelectric generation facility and are each connected to an emergency generator. These two emergency generators produce power during power outages or primary generator malfunctions.

Historic & Projected Energy Use

Historical and projected energy use in Stehekin.

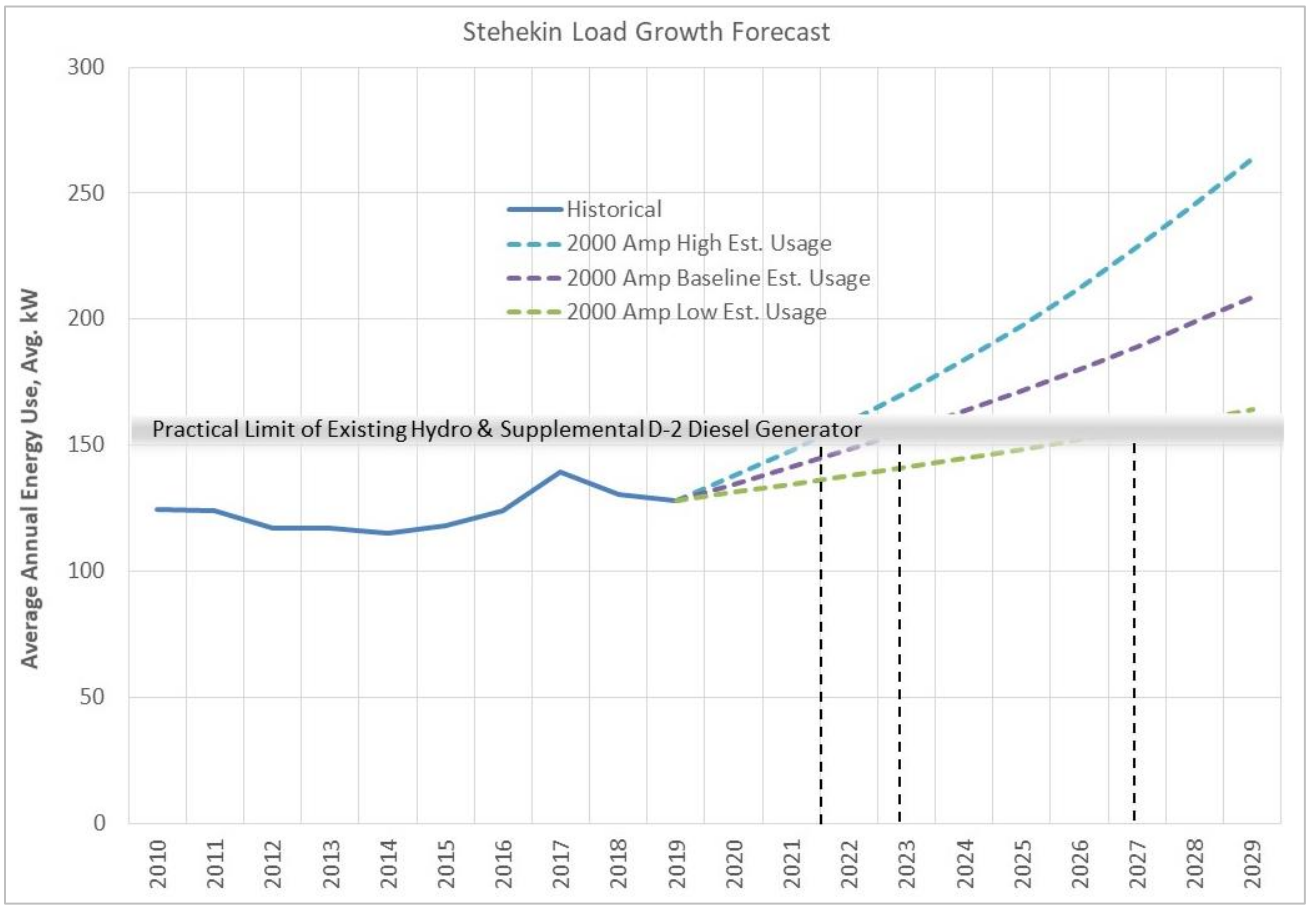


Figure 1 Historical Total Annual Energy Consumption

Detailed load profile information has only been available at the Stehekin Power plant since September of 2019. For this reason, average annual energy use has been used in Figure 1 to show historic load growth. Overall, load growth has historically been relatively flat, but new applications for approximately 2000 amps of new electrical service are expected to greatly increase the need for electricity in Stehekin. The existing hydroelectric plant and auxiliary D-2 diesel generator average are not capable of providing 100% of Stehekin's power needs if annual loads are greater than 160 average kW. It is not known exactly when this limit will be reached. Depending on when the actual loads are installed, the average 160 kW limit could be reached in 2021 or as far out as 2027.

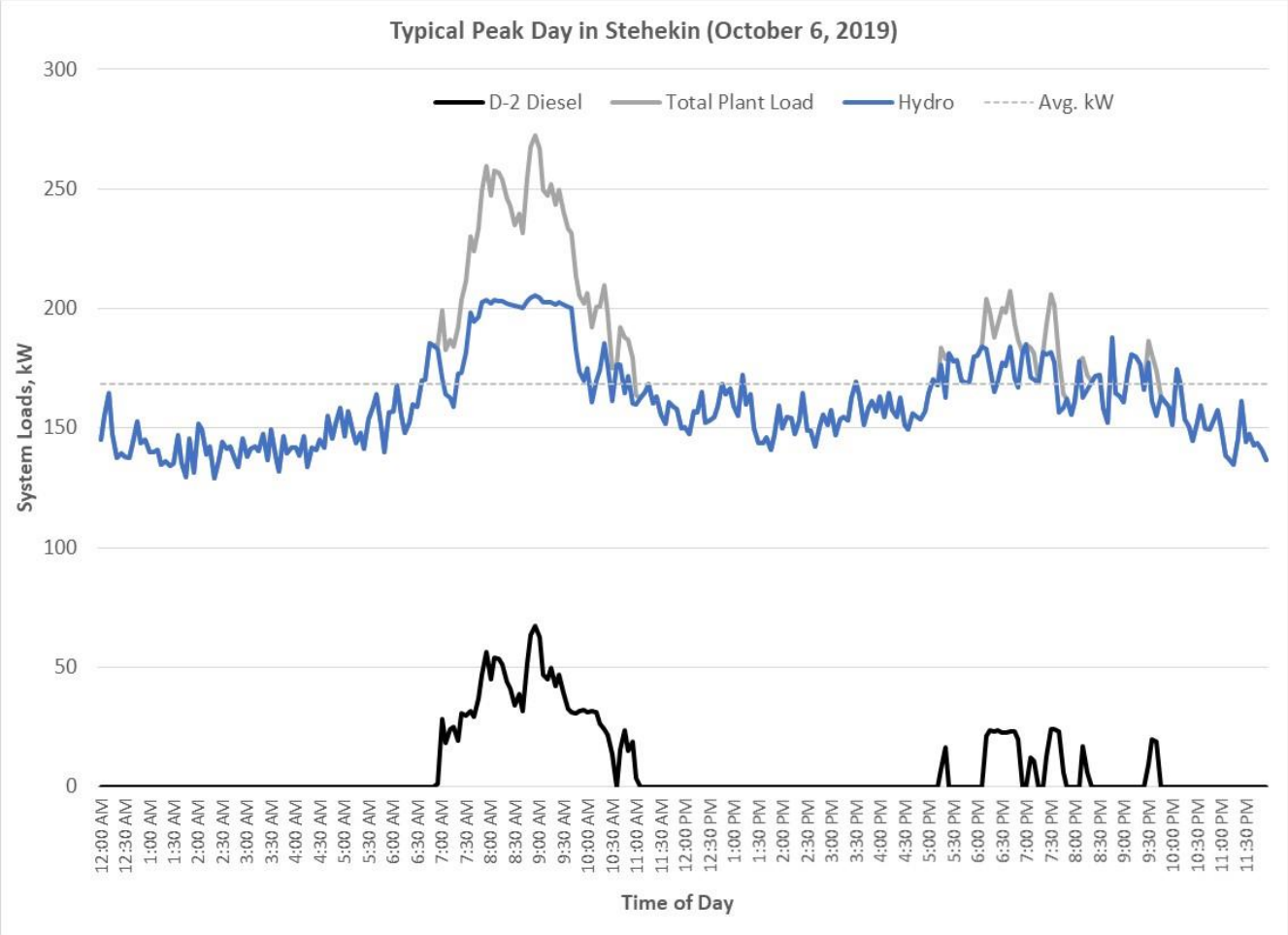


Figure 2 Peak load profile during cold day in October

This graph shows the amount of auxiliary diesel generation is needed as loads increase in Stehekin. Diesel generator D-2 comes on whenever loads reach a peak of about 180 kW and shut off when loads drop below 160 kW. If loads were 20 kW higher, D-2 would have run all day, and the peak loads likely would have exceeded the maximum capacity of the diesel generator.

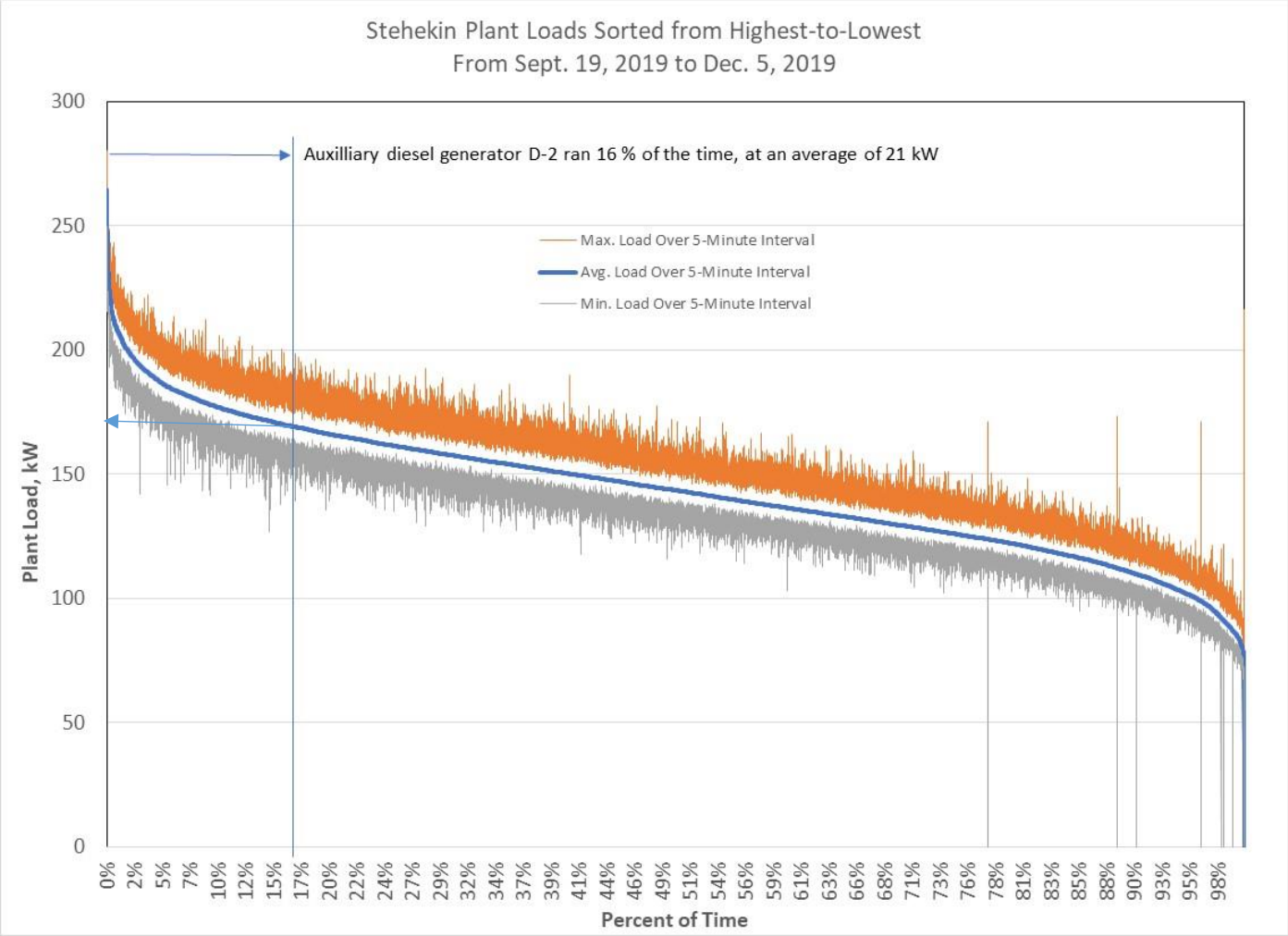


Figure 3 Stehekin Power Plant Loads Sorted from Highest to Lowest

This graph shows that D-2 is needed whenever 5-minute average loads exceed 170 kW. The graph also shows that because of the relatively flat slope of the line, shifting the line up 10% higher will have an even greater impact on the amount of time that D-2 is required to run. The expected increase in the amount of time that D-2 will run is shown in the following Figure 4.

Projected generation needs in Stehekin

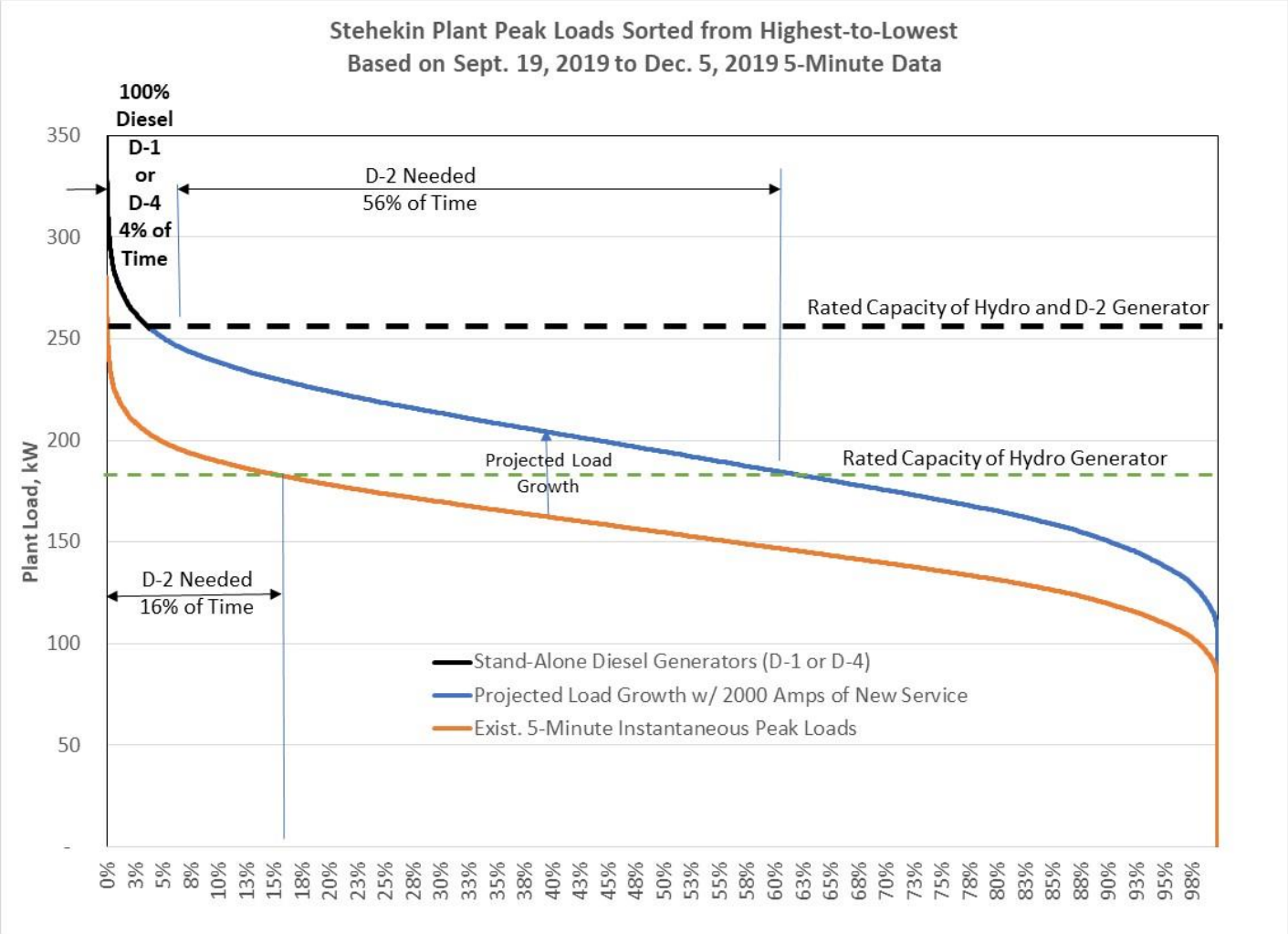


Figure 4 Projected Generator % Run Time per Year

Figure 4 shows the impact of adding 2,000 amps of new service to the loads in Stehekin. With the new loads D-2 generator run times would increase from 16% of the time, to having to run 56% of the time, and during 4% of the time the hydro would go offline because of excessive loads, which would then require running the big diesel generators to provide for Stehekin's power needs. The existing hydropower turbine and synchronous generators D4 and D1 cannot run at the same time because of limitations with the existing generator switchgear. If Stehekin loads exceed the capacity of the hydro and D-2 diesel generator, these two generators will shut off, and D1 or D4 diesel generators are then manually started to provide 100% of the generation.

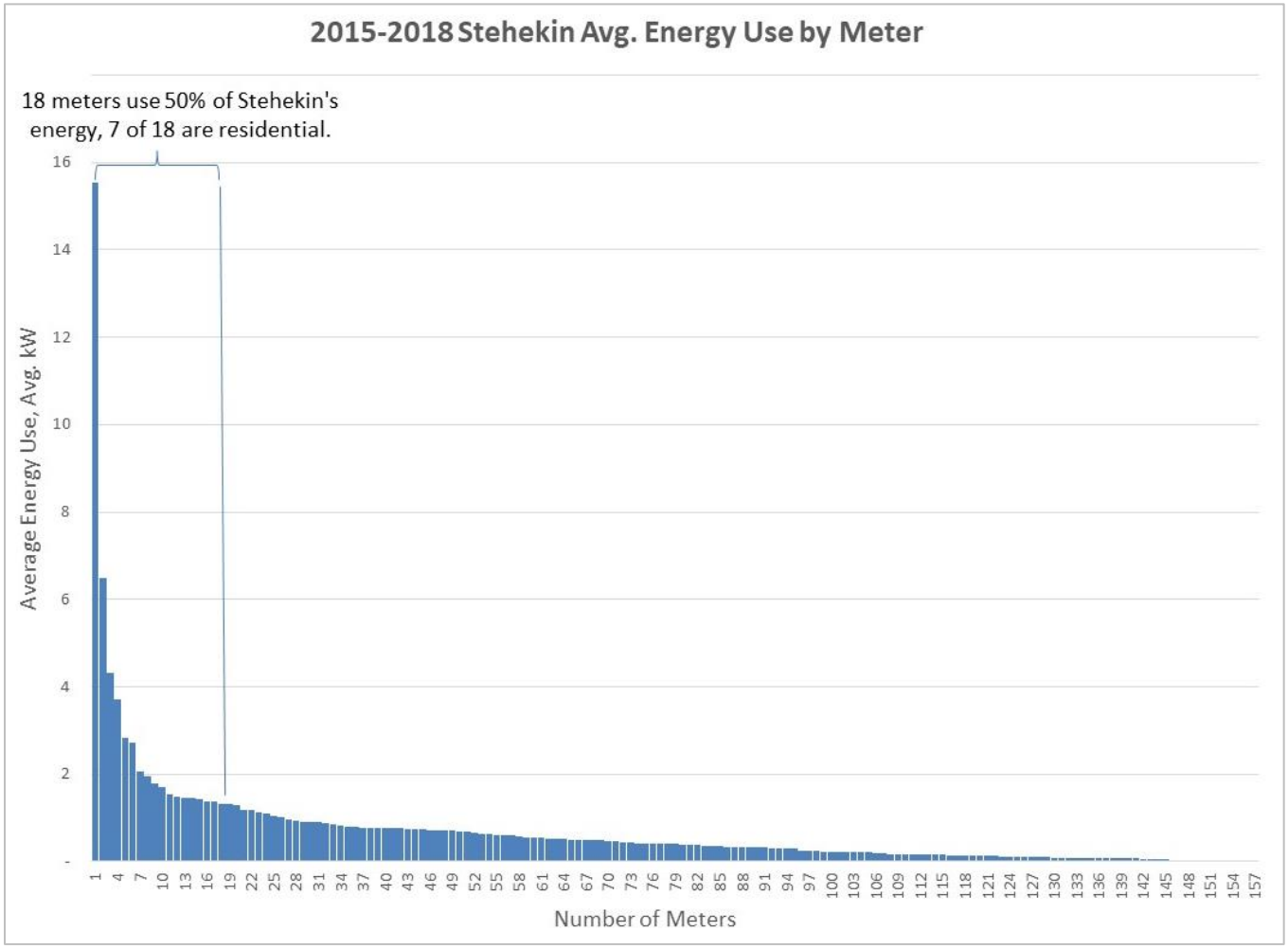


Figure 5 - Average Annual Energy Use by Meter

Figure 5 shows that a few residential and commercial customers can have a significant impact on the total energy use in Stehekin.

Over the past three years, there have been 10 applications for a total of 2000 amps of additional service in Stehekin. Using conservative estimates, this represents a potential average load increase of 15 to 25 akW, or roughly 10% of Stehekin's total load. Using a peak load factor of 30%, these new service requests would add up to 72 kW of additional peak load in Stehehkin.

Historically, annual energy use at Stehekin has not grown significantly but loads are predicted to increase significantly in the future. Large load increases are expected to come from the new church camp that is being built in Stehekin and from a fire fighting camp that is planned to be built at the Stehekin airport.

Auxiliary Diesel Generator

The electric generator attached to the Pelton wheel is rated to deliver up to 255 kW of electricity. Due to water right restrictions and turbine efficiencies, the actual electrical output of the hydro generator and the Pelton wheel is approximately 180 kW. A 75-kW auxiliary diesel generator (D-2) will run whenever the instantaneous loads on the plant exceed 200 kW capacity of the hydro generator.

As plant loads increase, the need to run the auxiliary diesel generator also increases. As Figure 4 shows, a 25% increase in plant loads would increase the auxiliary generator runtime by 400%.

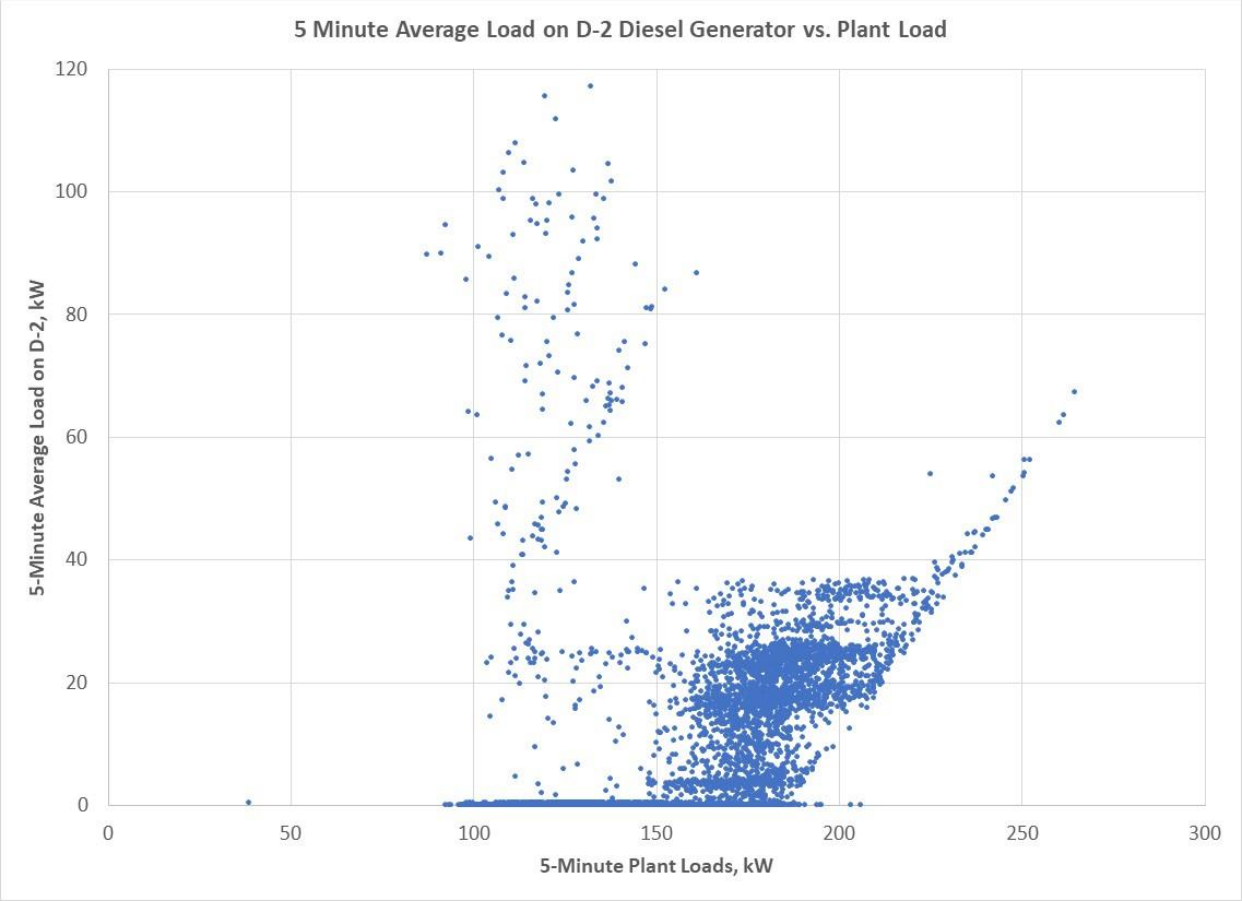
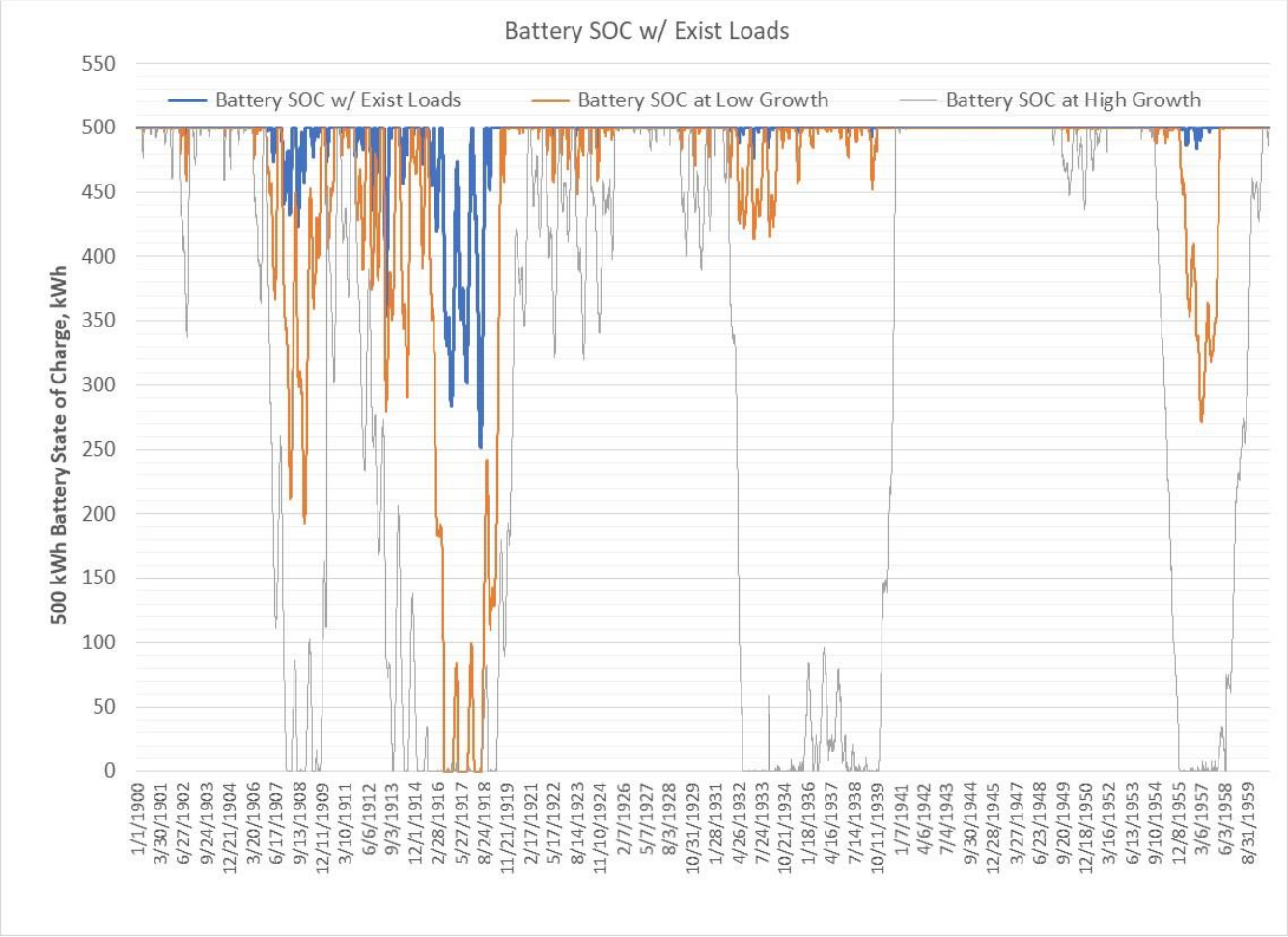


Figure 6 Supplemental Diesel Generator D-2 Loads vs. Peak Plant Loads

Proposed Battery Storage System

It is proposed that the District install a battery energy storage system in Stehekin that would run in parallel with the plant's existing hydro and diesel generators. The proposed system would store 500 kWh of energy and would have the ability to provide up to 250 kW of additional capacity. The battery would be designed to provide additional power whenever the Stehekin loads exceeded the capacity of the hydro system, or if the hydro system is shut down for short periods for maintenance. It would be recharged whenever the loads dropped below the output of the hydropower generator output.

The chart below illustrates how the state of charge of the battery would be impacted by additional loads from the community. D2 would run when the battery state of charge (SOC) reaches zero.



The battery energy storage system (BESS) is estimated to cost approximately $350,000. The District is eligible to receive a $125,000 grant from APPA to help pay for the battery. If approved by the board, the battery system would be installed and operating by the end of 2020.

Peak Demand Resource Supply Curve

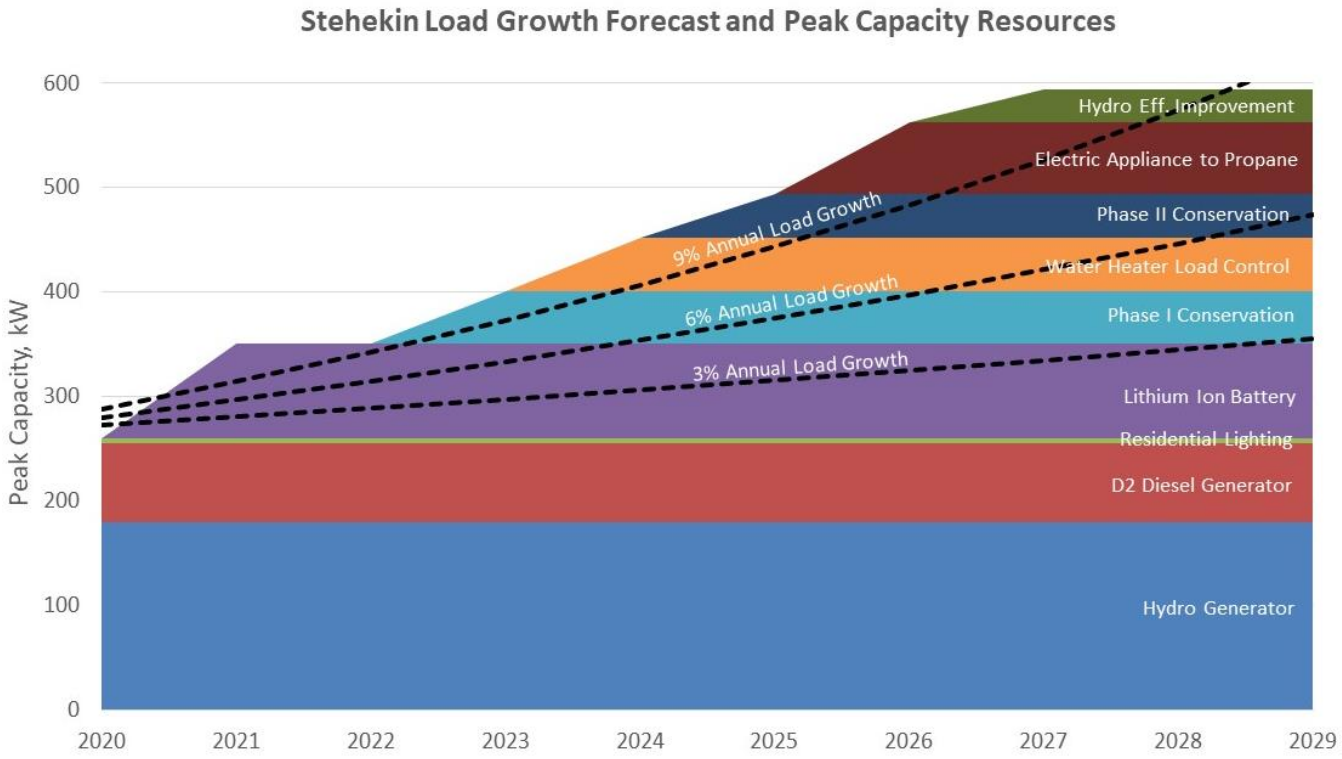


Figure 7 Peak Load Forecast & Capacity Resource Plan

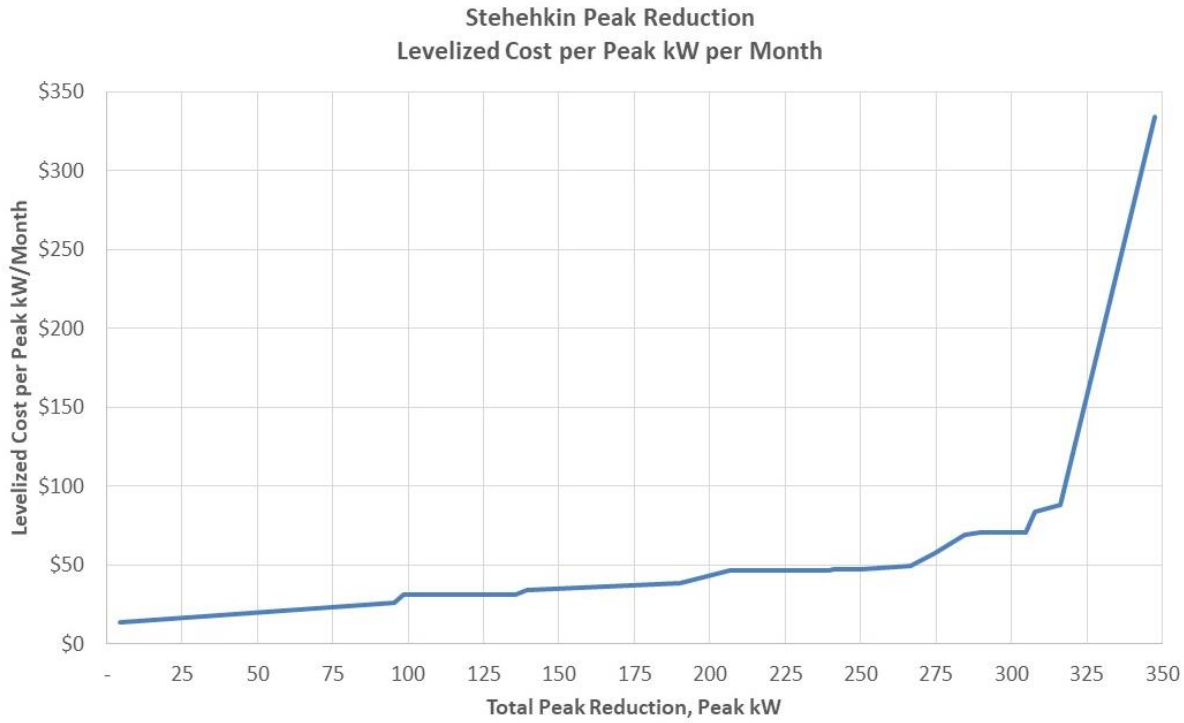


Figure 8 - Max. Peak kW Reduction of Various Generation & Supply Side Options

Peak demand reduction supply curve for various generation plant and demand-side options, ranked from most to least cost effective ($/kW-Month).

Rank	Capacity Measures	Expected Measure Life (Years)	Number of Units in Survey	Est. Actual Number of Units	Total Avg kW	Per Unit Equip. Cost	Total Installed Cost	Cost per Peak kW per Month	Incremental Peak kW Reduction	Cumulative Peak kW Reduction
1	Residential Lighting Replacement with LED	8	N/A	1358	1.58	3	$4,444	$13.73	5	5
2	500 kWh/250 kW Lithium Ion Battery Storage	12	N/A	1	18.19	350,000	$225,000	$25.95	91	95
3	Commercial Lighting Replacement with LED	7	N/A	420	1.10	15	$6,300	$30.99	3	99
4	Electric HP Water Heater	15	43	25.8	6.18	1,300	$60,630	$31.39	18	116
5	Propane Dryer Replacement	15	33	57.75	6.74	550	$66,413	$31.57	19	136
6	Pre-1990 Refrig. w/ EnergyStar Replacement	15	79	10	1.51	1,400	$14,000	$33.86	4	139
7	WH Demand Control	15	43	75.25	-	1,300	$214,463	$38.63	51	190
8	Commercial Ductless HP	15	N/A	15	5.68	3,000	$82,500	$46.47	16	206
9	Propane Water Heater Conversion	15	43	75.25	11.60	700	$169,313	$46.75	33	240
10	Commercial Insulation & Weatherization	50	N/A	3	0.62	4,000	$12,000	$47.02	2	241
11	Residential Insulation & Weatherization	50	N/A	15	3.08	4,000	$60,000	$47.02	8	249
12	Pre-1993 Refr. w/ EnergyStar Replacement	15	79	3	0.32	1,400	$4,200	$47.63	1	250
13	Propane Stove/Oven Conversion	15	36	63	5.91	1,450	$91,350	$49.53	17	266
14	Residential Ductless HP	15	N/A	10	2.77	2,500	$50,000	$57.72	8	274
15	New EnergyStar Rated Refr.	15	79	54	4.00	1,400	$75,460	$69.09	10	284
16	Commercial Windows	50	N/A	5	2.05	12,000	$60,000	$70.53	5	289
17	Residential Windows	50	N/A	15	6.16	12,000	$180,000	$70.53	15	305
18	Pre-2000 Refr. w/ EnergyStar Replacement	15	79	20	1.22	1,400	$28,000	$83.74	3	308
19	Upgrade D-2's 75 kW generator to 120 kW & replace 75 kVA transformer	30	1	1	2.05	850	$35,000	$88.49	8	316
20	Multi-Jet Pelton Wheel	50	N/A	1	12.46	1,723,000	$1,723,000	$333.96	31	347
	Total				**93**		**$3,162,072**		**347**	

Figure 9 Peak Capacity Resource Calculations

Energy Supply Curve

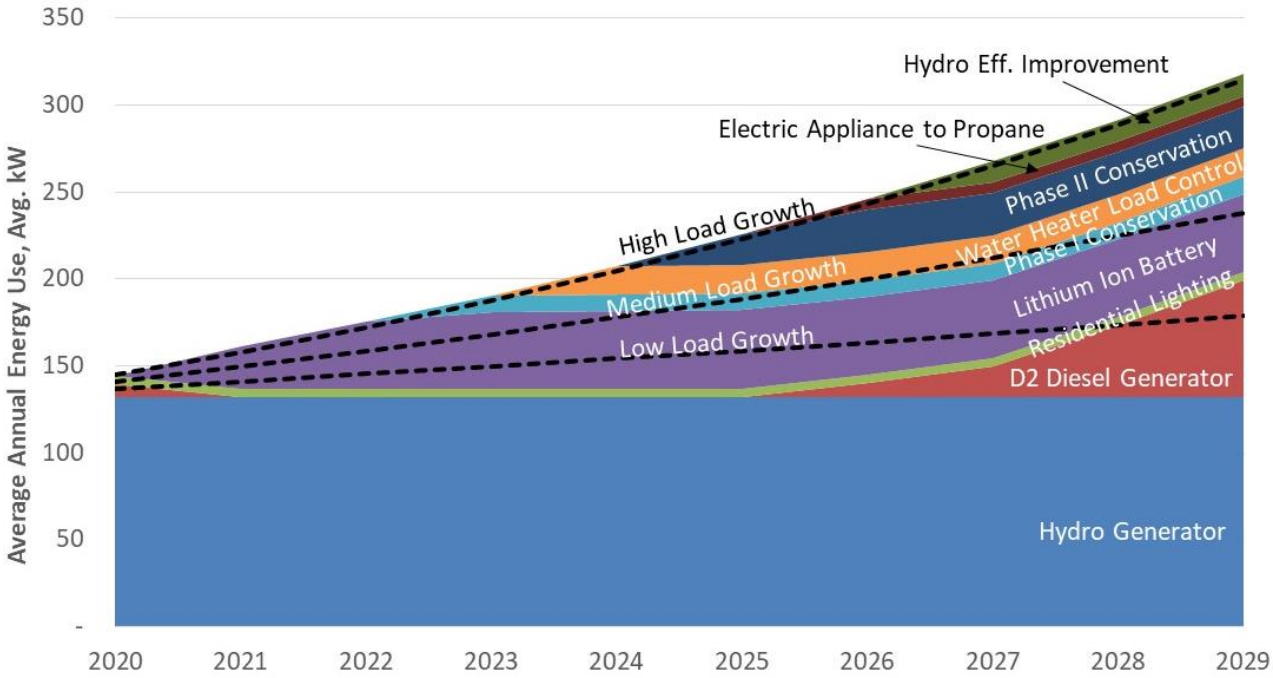


Figure 10 Stehekin Load Growth Forecast and Energy Resource Plans

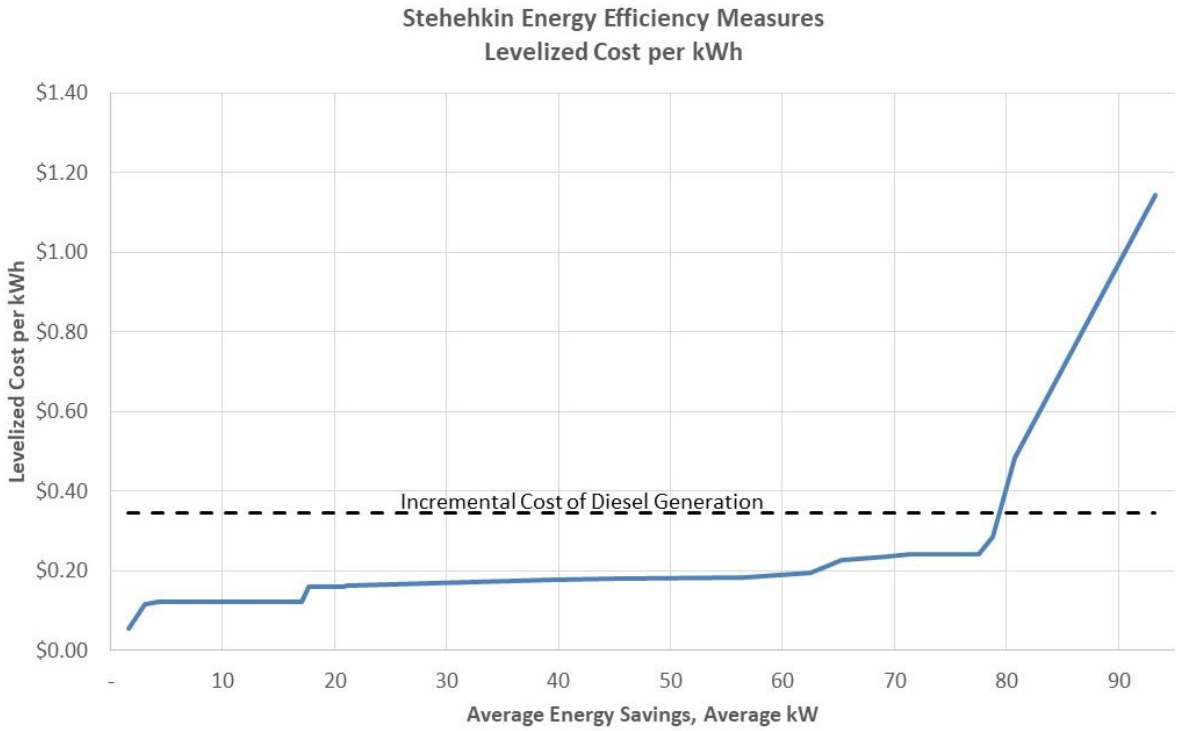


Figure 11 Levelized Cost of Energy Resources

Rank	Energy Measures	Expected Measure Life (Years)	Number of Units in Survey	Est. Actual Number of Units	Stehekin kWh/Year Saved	Total Avg kW	Total Cost per Unit	Total Installed Cost	Levelized Cost per kWh
1	Residential Lighting Replacement with LED	8	N/A	1358	13,852	1.58	3	4,444	$0.05
2	Pre-1990 Refrig. w/ EnergyStar Replacement	15	79	10	13,256	1.51	1,400	14,000	$0.12
3	Commercial Lighting Replacement with LED	7	N/A	420	9,639	1.10	15	6,300	$0.12
4	Electric HP Water Heater	15	43	25.8	54,180	6.18	2,350	60,630	$0.12
5	Propane Dryer Replacement	15	33	57.75	59,021	6.74	1,150	66,413	$0.12
6	Commercial Insulation & Weatherization	50	N/A	3	5,400	0.62	4,000	12,000	$0.16
7	Residential Insulation & Weatherization	50	N/A	15	27,000	3.08	4,000	60,000	$0.16
7	Pre-1993 Refr. w/ EnergyStar Replacement	15	79	3	2,827	0.32	1,400	4,200	$0.16
8	500 kWh/250 kW Lithium Ion Battery Storage	12	N/A	1	159,375	18.19	350,000	225,000	$0.18
9	Distributed Solar PV Generation w/o Storage	20	N/A	200	190,000	21.69	1,800	360,000	$0.18
10	Commercial Ductless HP	15	N/A	15	49,800	5.68	5,500	82,500	$0.18
11	Propane Water Heater Conversion	15	43	75.25	101,588	11.60	2,250	169,313	$0.18
12	Propane Stove/Oven Conversion	15	36	63	51,739	5.91	1,450	91,350	$0.19
13	Residential Ductless HP	15	N/A	10	24,300	2.77	5,000	50,000	$0.23
14	New EnergyStar Rated Refr.	15	79	54	35,013	4.00	1,400	75,460	$0.24
15	Commercial Windows	50	N/A	5	18,000	2.05	12,000	60,000	$0.24
16	Residential Windows	50	N/A	15	54,000	6.16	12,000	180,000	$0.24
17	Pre-2000 Refr. w/ EnergyStar Replacement	15	79	20	10,720	1.22	1,400	28,000	$0.29
18	Upgrade D-2's 75 kW generator to 120 kW &	30	1	1	54,000	6.16	35,000	35,000	$0.38
19	Multi-Jet Pelton Wheel	50	N/A	1	109,163	12.46	1,723,000	1,723,000	$1.14
20	WH Demand Control	15	43	75.25	-	-	2,850	214,463	N/A
	Total				**1,042,872**	**119**		**$3,522,072**	

Figure 12 Energy Resource Economic Calculations

Appendix

Peak Demand Supply Curve Description: Various demand response, energy efficiency, fuel switching, and generator options were ranked from lowest cost on the left to highest cost on the right by calculating the amount of peak demand reduction each option would obtain, and then dividing it by the number of months that each option could be expected to last.

A discount rate of 7% was used for determining the levelized cost of the various options.

$$\text{Peak kW Savings} = \frac{[\text{Regional kWh/Yr Savings}] \times [\text{Stehekin Adj. Factor}]}{([\text{Stehekin Load Factor}] \times 8760\ \text{Hr/Yr})}$$

$$\text{Cost per kW Month} = [\text{Levelized Capital Cost per Year}] / ([\text{Peak kW Savings}] \times [12\ \text{Mo/Yr}])$$

Demand and Supply Side Options

Residential Lighting Replacement

In a survey done in Fall of 2018; it was reported that 60% of all light bulbs in homes in Stehekin were incandescent lamps. These bulbs use up to 90% more energy than an LED bulb. Over two trips, we have already replaced over 3,000 incandescent bulbs. As we continue to have access to more customers and more homes, it will be important to bring different styles and temperatures of LED lights. This is a very cost-effective way to save energy in homes in Stehekin.

Commercial Lighting Replacement

Rather than simply replacing individual bulbs, this measure would replace the entire fixture with a more efficient LED light fixtures.

500 kWh, 250 kW Lithium Ion Battery Storage

This measure would install a lithium ion battery storage system that would run in parallel with the District's existing hydro/diesel generating plant.

Refrigerator Replacement

In order to remove refrigerators and freezers that are older than 1993, the PUD would have to: pay full replacement cost, haul in new energy star refrigerators and haul out and properly decommission the old appliances. This would allow for large energy savings from the baseload in Stehekin. Customers would need to self-select if they have an older fridge and want to have it replaced by a new EnergyStar model. The PUD would work with a contractor to haul up and replace the older appliance and haul it away.

Energy consumption for typical refrigerator/freezers based on age can be found at https://www.energystar.gov/index.cfm?fuseaction=refrig.calculator

Electric Water Heater Demand Response Controls

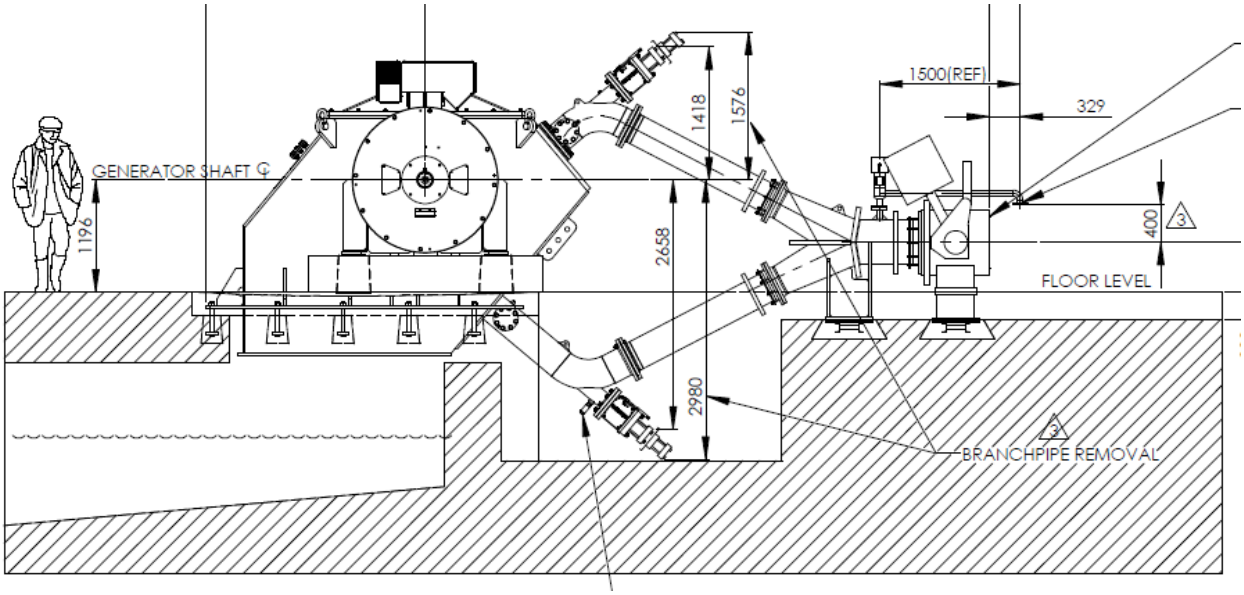
This measure would use radio frequency-controlled relay switches to remotely disconnect electric water heaters temperately until system peak loads drop.

Water heater controls that would utilize the proposed automatic metering system were considered, but the high cost of each controller and the annual software maintenance costs were found to be too expensive for the relatively small number of water heaters in Stehekin (~120 each).

This measure is not recommended until a less expensive water heater controller can be located.

Multi-jet Pelton Wheel

The existing hydro generator has a single nozzle Pelton wheel. The existing system runs at relatively low efficiency because the diameter of the water jet (d) is relatively large compared to the diameter (D) of the Pelton wheel. Increasing the number of jets will result in smaller jet diameters, which will increase the amount of energy that can be generated from the same flow of water. The additional jet has been calculated to increase the hydro generator's nominal output from 180 kW to 220 kW.



New Induction Generator and Transformer

The existing D-2 diesel engine has a maximum rated capacity of 175 HP, which means that it could deliver up to 130 kW. The diesel generator is connected to a 75-kW transformer. This measure would replace the existing 75 kVA transformer with a larger 150 kVA transformer that would allow the induction generator to carry more of the load during periods when the hydro power system cannot meet the system load.

Heat Pump Water Heater

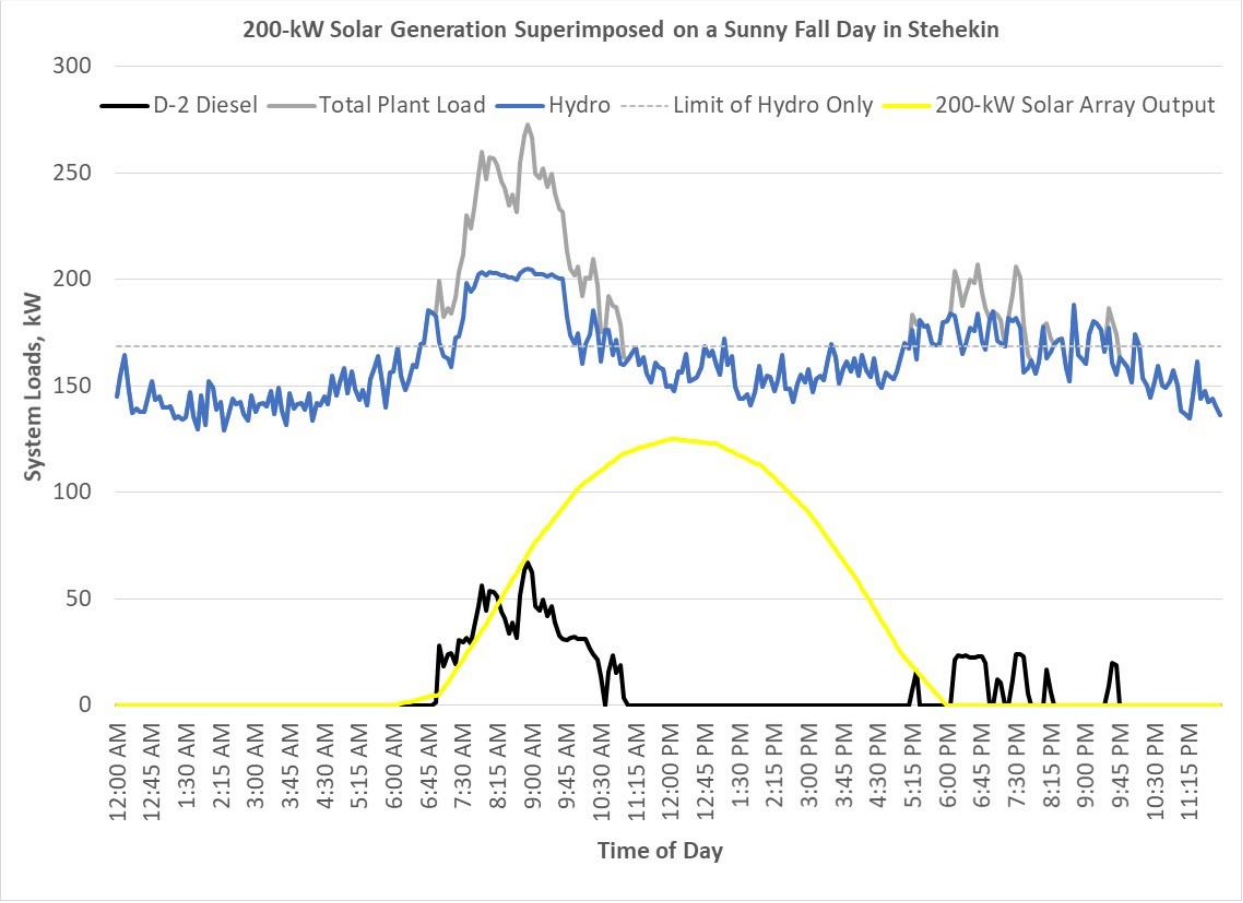
This product uses heat pump technology to heat water and is 50% more efficient than electric resistant water heaters. Approximately 40% of water heaters in Stehekin use electric resistance. Not all homes have water heaters in locations that will work for a heat pump water heater as they need plenty of space around them. We would likely need to bulk ship these water heaters and pre-select homes that would be good candidates for replacement of a water heater. There are people who do installation of water heaters in Stehekin that could be hired to install this product.

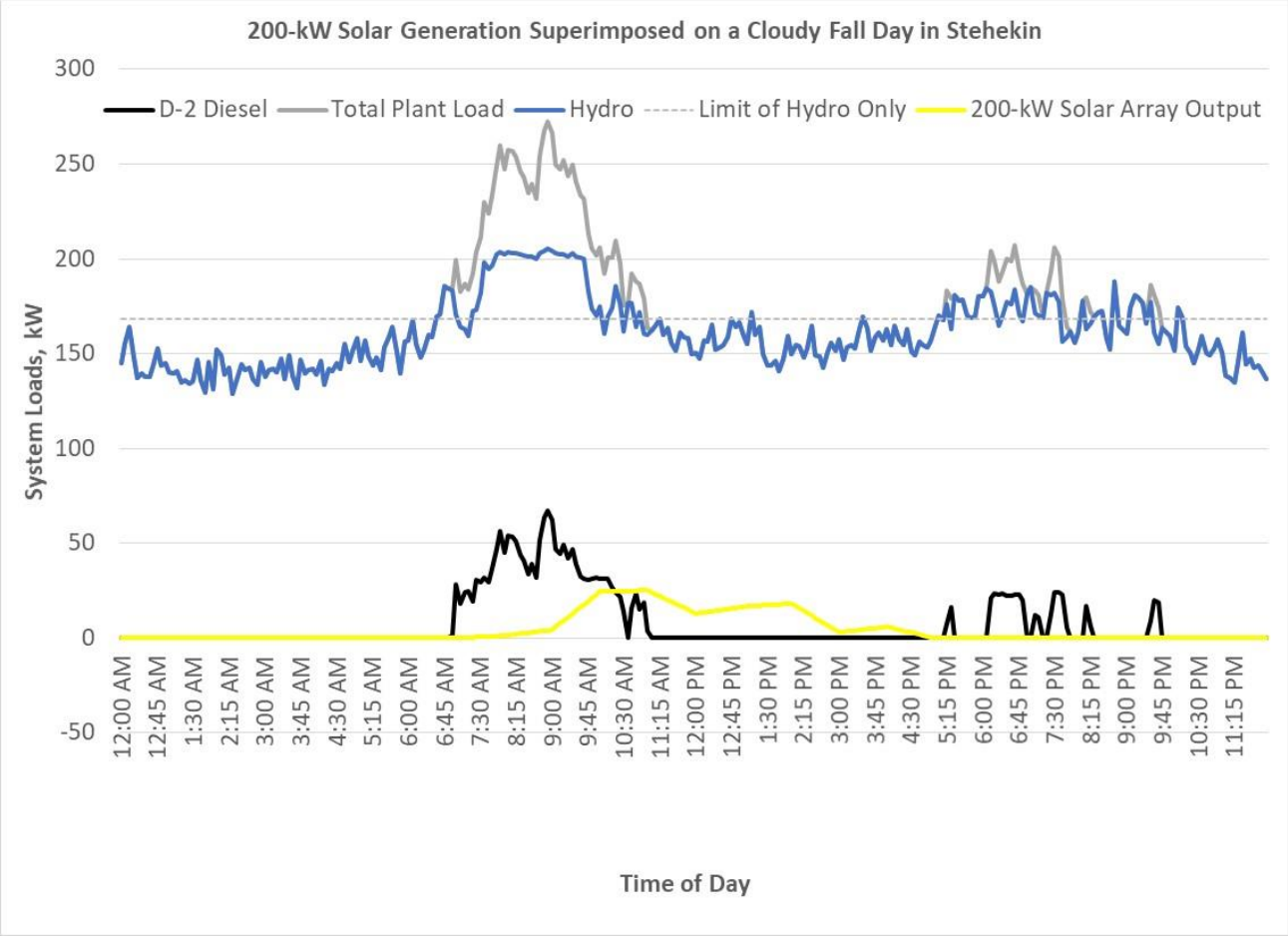
Ductless Heat Pump

This measure could save energy in homes that have electric resistance heat in the winter. In order to consider this as an option, homes would need to be pre-selected by these filters: live in home year-round and do not currently heat with wood as primary source. The flip side to installing these would be there may be an increase of electricity in the summer as it can be used for cooling in a home as well. Once homes are pre-selected and customers have agreed to install these, a HVAC contractor would need to be selected to install these in Stehekin.

Distributed Solar PV System without Batteries

This measure would install solar PV on the Stehekin electrical grid. The solar PV systems could consist of smaller PV systems installed in individual homes or businesses in Stehekin, or a single large solar array for instance at the Stehekin Airport. While the solar PV systems could reduce the need to run the diesel generators during certain times of the day or year, especially during sunny spring and summer days, solar would not help Stehekin meet its peak generating needs on the late afternoon or dark cloudy mornings in the winter and fall.





Note that diesel generation would not be needed during the times that the solar generation exceed the output of the diesel generator. The two graphs show that while solar can reduce the need to run the diesel generator during certain times of the day or year, solar could not be counted on to provide for the power plant's peak generating needs on a cloudy day.

Distributed Solar PV System with Batteries

Excess energy generated by solar arrays in the Stehekin could be stored in a stationary battery at the Stehekin power plant to supplement the existing hydro generating system and provide additional energy to meet peak power demands of the community. In this case, it would be the battery that is meeting the peak power demand, not the solar power system.

Fuel Switching - Replace Electric Dryers with Propane

Under this proposal, the District would provide propane clothes dryers to customers to replace their existing electric resistance dryers. In addition to replacing the dryers, for those customers that do not have propane, additional costs would be needed to provide propane tanks and propane piping for the new dryers. The cost effectiveness of this measure does not include the

additional cost of propane for the customer. At $2.50 per gallon, using propane to dry clothes cost the equivalent of $0.10 per kWh.

Note that economically, it will cost customers about the same amount to heat with propane instead of electricity, but switching to propane may simply shift the carbon emissions of the diesel over to increased carbon emissions from the propane appliances.

Fuel Switching – Replace Electric Stoves/Ovens with Propane

Under this proposal, the District would provide propane stoves and ovens to customers to replace their existing electric resistance stoves. In addition to replacing the stoves, for those customers that do not have propane, additional costs would be needed to provide propane tanks and propane piping for the new stoves. The cost effectiveness of this measure does not include the additional cost of propane for the customer. At $2.50 per gallon, using propane to cook with would cost the equivalent of $0.10 per kWh.

Fuel Switching – Replace Electric Water Heaters with Instantaneous Propane Water Heaters

Under this proposal, the District would provide propane fired instantaneous water heaters to customers to replace their existing electric resistance water heaters. In addition to replacing the water heaters, for those customers that do not have propane, additional costs would be needed to provide propane tanks and propane piping for the new water heaters. The cost effectiveness of this measure does not include the additional cost of propane for the customer. At $2.50 per gallon, using propane to heat water would cost the equivalent of $0.10 per kWh.

Annual Power Plant Operating Costs

	2014	2015	2016	2017	2018	2019
Annual Stehekin Power Plant Operating Costs*	$192,253	$240,966	$170,447	$305,982	$294,964	$211,851
Total Annual Revenue	$100,068	$102,328	$106,441	$115,499	$107,378	$111,767
Total Annual kWh	849,093	863,972	919,320	1,023,800	942,551	992,168
Cost per kWh	$0.23	$0.28	$0.19	$0.30	$0.31	$0.21
Revenue per kWh	$0.12	$0.12	$0.12	$0.11	$0.11	$0.11
* Note: Does not include tree trimming or distribution system costs.						