



City of Chubbuck Drinking Water Upgrade Project

SRF Loan #DW1602 (pop. 14,125)

\$8,500,000

Final Green Project Reserve Justification

Categorical GPR Documentation

1. NEW BOOSTER PUMP STATION WITH PREMIUM ENERGY-EFFICIENT PUMPS AND VFDs (Energy Efficiency). Categorical per GPR 3.2-2: *projects that achieve a 20% reduction in energy consumption; if a project achieves less than a 20% reduction in energy efficiency, then it may be justified using a business case*; also, per 3.5-9: *VFDs can be justified based upon substantial energy savings (\$220,000)*.

Business Case Documentation

2. INSTALLS NEW WATER TRANSMISSION PIPING (Water Efficiency). Business Case GPR per 2.4-3: *Efficient water use...reducing the amount of energy required by a drinking water system...therefore, there are also energy and financial savings*; also (Energy Efficiency) Business Case GPR per 3.5-1: *Energy efficient...upgrades*; and, per 3.5-5: *Projects that achieve the remaining increments of energy efficiency*. (\$261,032).

1. PREMIUM PUMPS AND VFDs

Summary

- As part of the upgrade project, the City of Chubbuck constructed a new booster pump station with pumps equipped with premium energy-efficient motors and VFDs.
- Total Loan amount = \$8,500,000
- Estimated energy efficient (green) portion of loan = 2.5% (\$220,000) (design cost estimate)



Background

- The City of Chubbuck water system had four active water supply wells, three storage tanks, one booster pump station, and over 70 miles of distribution system piping ranging in size from 4 inch to 24 inch in diameter.
- The Water System required increased water production capacity and increased storage capacity to address immediate and future projected deficiencies.
- As part of the project, a new booster pump station was constructed equipped with three (3) vertical turbine pumps with premium energy-efficient 125 hp motors with VFDs.

GPR Justification

Motors/VFDs:

The Baseline Standard Practice for comparison is a standard Epact motor that is not controlled by a VFD². Published operating curves by the pump manufacturer provided VFD efficiency data:

- **Proposed Pumps - no VFD, standard Epact efficiency motor**

Type: Vertical Turbine Hollow Shaft
Efficiency 82%; Flow 1,400 gpm; 2.02 mgd; Head 265 ft.

Motor rating = 125 hp; Motor type = standard efficiency (93.0% assumed at 75% of full load³)
BHP, existing avg. flow = 115 hp
% operation = 33% (average day flow/pump output)
% Annual Usage = 50% (average daily operation throughout the year)
Energy usage = 125,078 kW-hr

- **Proposed Pumps - no VFD, with premium efficiency motor**

(95.4% assumed at 75% of full load)
BHP, existing avg. flow = 112.24 hp
% operation = 33% (average day flow/pump output)
% Annual Usage = 50% (avg daily operation throughout the yr) ∴ Energy usage = 122,076 kW-hr

- **Proposed Pumps - VFD operation with premium efficiency motor**

Type Hollow Shaft Vertical Turbine
Efficiency 82%; Head 230 ft;
Motor rating = 125 hp; Motor type = standard efficiency (95.4% assumed at 75% of full load)
BHP, existing avg flow = 90.75 hp; % operation = 33% (average day flow/pump output) %
Annual Usage = 50% (avg daily operation throughout the yr) ∴ Energy usage 98,703 kW-hr



¹ City of Chubbuck Final GPR Justification, Keller Associates, September 2019

² NYS Energy Research and Development Authority, Energy Evaluation Memorandum, Village of Greenport WWTP Upgrade 8-2009.

³ http://www.copper.org/environment/sustainable-energy/electric-motors/education/motor_text.html

- **Energy Reduction - comparing with VFD to without VFD**
Energy usage, w/o VFD 122,076 kW-hr
Energy usage, w/ VFD 98,703 kW-hr
- The premium motors with VFDs result in a 21.1% energy reduction compared to non-VFD, standard efficiency motors.

Conclusion

- The combined annual energy savings for utilizing premium pumps and VFDs is estimated to be 26,375 kWh/year per motor/VFD system - corresponding to an energy reduction of 21.1% when compared to the Baseline Standard Practice.
- The premium energy-efficient pumps/VFDs are categorically GPR eligible as they achieve greater than 20% reduction in energy consumption.
- **GRP Costs Identified:**
Booster Station VFDs (3 @ \$18,000 ea. = \$54,000) + Pumps & Motors (3 @ \$55,000 = \$165,000) = **Total = \$220,000**
- **GPR Justification:**
The Pump/VFD system is Categorically GPR eligible (Energy Efficiency) per Section 3.2-2 page 9⁴: *Projects that achieve a 20% reduction in energy consumption are categorically eligible for GPR; also, per 3.5-9: VFDs can be justified based upon substantial energy savings.*

⁴ Attachment 2. April 21, 2010 EPA Guidance for Determining Project Eligibility

2. New Water Transmission Line

Summary

- New 18-inch and 16-inch diameter transmission line consisting of 6,800 feet of PVC pipe was installed to increase system reliability, and to reduce energy requirements.
- Loan amount = \$8,500,000
- Energy saving (green) portion of loan = 3.1% (\$261,032) (design cost estimate)

Background

- The water system was experiencing fluctuating high pressure events due to a lack of transmission capacity.
- As part of a water loss management plan, various distribution alternatives were evaluated to identify potential pipeline rehabilitation/replacement projects. A priority alternative selected was the provision of new transmission lines. The work funded under DW1602 resulted in the installation of 6,800 feet of new 18-inch and 16-inch pipe.

Energy Savings

- With 6,800 feet of new transmission line, the City will use less energy.
- The WaterCAD model was used to calculate the cost per MG for a well based on discharge pressures, suction pressures, and flow. Because modified pump curves (to reflect both the drawdown and pump curve) are used, only the difference in cost per MG for the booster station is compared. Costs were calculated assuming \$0.08/kWh.
- Due to the new transmission line, an average estimated energy savings of approximately 16.7% is anticipated (150 to 125 hp booster pumps).
- For the period an estimated annual combined cost savings of at least \$6,526 would be realized by the 3 booster pumps. Over a 40-year period, this savings would amount to approximately \$261,032.



Conclusion

- Energy cost savings of at least \$261,032 will be realized over the 40-year life of the new transmission line.
- Additional benefits include reductions in unnecessary pumping and operation and maintenance expenditures.
- **GPR Costs:** 6,800-foot transmission line = \$1,200,000; GPR-eligible costs = **\$261,032**
- **GPR Justification:** The project is Business Case GPR-eligible (Water Efficient) per 2.4-3: *Efficient water use...reducing the amount of energy required by a drinking water system...therefore, there are also energy and financial savings*; also (Energy Efficiency) Business Case GPR per 3.5-1: *Energy efficient...upgrades*; and, per 3.5-5: *Projects that achieve the remaining increments of energy efficiency*.