LIST OF ENCLOSURES

- I. A list of claimed eligible improvements that excludes:
 - (i) Items that are not capital investments;
 - (ii) Items that were installed, replaced, or implemented for a primary reason other than increasing electric generating output; and
 - (iii) Items that have little or no effect on increasing electric generation output from the Facility.
- II. For the listed improvements taken as a whole, *a good faith estimate* of the total aggregate increase in electricity production attributable to the improvements, expressed either in MWh¹² or on a percentage basis, above the historical generation baseline.
- III. For the listed improvements, if possible, *a good faith estimate* of the increase in electricity production attributable to such improvement, expressed either in MWh or on a percentage basis, above the historical generation baseline.
- IV. 2008 Through 2012 List of Capital Expenditures Which Are Efficiency Improvements¹³

¹² The Applicant has decided to supply this information in MWh as opposed to KWh.

¹³ These reports were prepared by combining confidential reports submitted to the Maine and Rhode Island Public Utility Commissions. Previously, these reports are have been submitted to the Commission.

Below is a list of claimed eligible improvements that excludes:

- (i) Items that are not capital investments;
- (ii) Items that were installed, replaced, or implemented for a primary reason other than increasing electric generating output; and
- (iii) Items that have little or no effect on increasing electric generation output from the Facility.

	List of Eligible Improvements			
Year	Description of Improvement	Description of Benefits		
2008-1	Installed new 24-inch exhaust fan with thermostat and floor fans. (See 2009-10 for complementing expenditure).	Keeps generators cool to prevent plant from shutting down due to overheating of powerhouse. Installed floor fans with thermostatic control. Turbine/generator units used to shut down when powerhouse temperature exceeded 130°F		
2008-2	Installed new leaf boom. (See 2008- 9 and 2009-3 for complementing expenditures).	Minimized debris on rack, increase production and reduce need for maintenance. Racks would clog and plant would shut down. Major improvement in production.		
2008-3	Replaced valve gaskets on G1 and G2 safety air valves.	Rebuilt safety air valves that are used to reduce torque on turbine. Valves were leaking causing substantial loss on production. Required piece of equipment to maintain safety of plant to reduce torque on turbine during shutdown and emergency shutdown. Now included on normal shutdown to protect equipment.		
2008-4	Rewound burned out coil on G2 air valve.	Safety air valve was not functional but is required equipment for plant operations. Rebuilt safety air valves are used to reduce torque on turbine. Required piece of equipment to maintain safety of plant to reduce torque on turbine during normal and emergency shutdown. Now included on normal shutdown to protect equipment.		
2008-5	Replaced couplings on G1 and G2 speed tachometer.	Continual failure of tachometer would shut plant down and reduce production. Replaced couplings and motor to keep plant on line and running. Dramatic increase in production, as this was a common failure.		
2008-6	Installed new tachometer-Servotek.	Continual failure of tachometer would shut plant down and reduce production. Replaced motor to keep plant on line and running. Dramatic increase in production, as this was a common failure. Plant used to stock broken spare parts on shelf. Production is increased by keeping stock of working critical spare parts on hand.		
2008-7	Installed new vacuum contactor bottles g1 and g2.	Thermal imager enabled us to locate main vacuum contactor bottle overheating. Replaced before imminent failure. Stocked spare vacuum contactor, with spare bottles.		
2008-8	Purchased thermal imager.	Purchase thermal imaging device for continual inspection		

		and monitoring of plant. Thermal imager has enabled problems to be discovered before they become critical. Has prevented shutdowns and increased production. Gives us time to locate and purchase replacement products for repair, while still being on line and operating. Major increases in production.
2008-9	Installed new 100 cfm Ingersoll Rand gas powered compressor. (See 2008-2 and 2009-3 for complementing expenditure).	Made trash rack cleaning safer and more efficient for operators, reduced head loss, increased production, cut down time for operators
2008-10	Refurbished dam left side of dam facing upstream. (See 2012-6 for complementing expenditure).	Reduce leakage, improved structural stability of dam, enable project to keep operating. Required and necessary to ensure longevity of dam structure.
2008-11	Refurbished trash racks.	Original trashracks were corroded and had reduced spacing due to thick rust and corrosion, thus reducing production and increasing headloss. Headloss was often over 1 foot through the racks, even when racks were cleaned. Major increase in production.
2008-12	Installed motion sensor light and handrail.	Improved safety for operators and safety of other personnel, reducing risk of fall injury.
2008-13	Built and installed new 12V dc backup power supply.	Enabled plant to be safely shut down when grid power was down. This is a required emergency backup system; there was no system in place before installation. Without DC UPS 12V system facility cannot experience a controlled shutdown of the turbines during a loss of power.
2008-14	Installed new Basler 3-P digital relay.	Required upgrade by PSNH to maintain plant on line. Old relay deemed obsolete by utility, extended life of facility by protecting plant during grid instability.
2008-15	Ordered new digital tachometer and proximity sensor for G2 I	Plant was blowing 250 amp fuses due to inaccurate signal from speed tachometer, causing instability in generation, and throwing plant off line. Old tachometer system was functionally obsolete. There was no feedback on cause of outage. New tachometer brought plant to industry standard using digital controls.
2008-16	Installed 1/3 hp 3-p fan motor with seized bearings on G2 with new motor.	Critical component for cooling of gearbox, increased useful life span of gearbox. Existing motor was industry standard, but not functioning. Cleaned cooling mechanism-which was clogged due to lack of maintenance. Increase overall efficiency of cooling of gearbox oil. Prevent overheating which can result in significant turbine efficiency loss
2008-17	Replaced level sensor pressure transducer, installed dessicant with low wattage light bulb.	Replaced level sensor which is main control component of plant for reliable operation. Upgraded cabinet with dessicant and heating device to keep moisture out of new transducer, increasing useful life span of transducer.
2008-18	Installed new Watt-hour meters on G1-and G2-	Watt-hour meters had reached end of useful life and needed replacement with industry standard.
2008-19	Replaced saturated meter per PSNH requirements.	Plant had increased production due to upgrades so that existing meter was not able to accurately read production. Utility required meter to be changed to accurately read production.
2008-20	Replaced transducer in G1 with new Crompton Paladin transducer- Spectrum Industries.	Transducer drives watt meter and is used to record production. Transducer had reached end of useful life span. Required replacement, New transducer meets industry standard and is part of shutdown mechanism to protect from overpower and underpower of generators.

2008-21	Installed new spooler on gate 3	Replaced hydraulic spooler, part of gate control system, required to keep plant safely operational.
2009-1	Ordered new TR5000 from electro- sensors for G2. Installed in April 2009.	Brought second unit up to industry standard with replacement of mechanical tachometer with digital tachometer with higher accuracy and safety settings to protect from underspeed and overspeed, required to put induction unit on line at right time. Longevity advantage for synching unit with grid.
2009-2	Installed new digital KW meter on G1.	Provides more accurate reading of output, and more reliable trip setting and shut down relay to determine when plant shut down during power production. Protects equipment from cavitation due to low flows. Bring up to industry standards with use of digital device.
2009-3	Installed new air compressor starter solenoid (new starter motor in 11/09; new solenoid in 12/09). (See 2008-2 and 2008-9 for complementing expenditures).	Keeps air compressor running which is integral part of keeping trash racks clean and maintaining production.
2009-4	Ordered new fan motors for G1 and G2 after G2 replacement motor burned out.	Critical component for cooling of gearbox, increased useful life span of gearbox. Existing motor was industry standard, but not functioning. Cleaned cooling mechanism, which was clogged due to lack of maintenance. Increased overall efficiency of cooling of gearbox oil. Prevents overheating which can result in significant loss of turbine efficiency.
2009-5	Installed new gate limit switches (ordered 2 spare switches). (See 2009-8 and 2010-14 for complementing expenditures).	Critical component for operation of plant. Without limit switch working, gates would not function and plant could not operate. Had reached end of previous useful life and was replaced with industry standard.
2009-6	Ordered new separator filter for IR compressor.	Keeps air compressor running which is integral part of keeping trash racks clean and maintaining production.
2009-7	Ordered spare time delay 250 amp fuses.	Keeps spare parts on shelf for immediate repair to enable plant to be on line quickly when fault occurs.
2009-8	Modified gates for single gate operation. (See 2009-5 and 2010-14 for complementing expenditures).	Reconfigured gate operation by installing new controls (see item 2009-5), increasing production particularly during low flows.
2009-9	Posted dam danger signs.	Brought facility into-minimum compliance with FERC dam safety requirements.
2009-10	Installed new small center fan and set up thermostat for floor fans. (See 2008-1 for complementing expenditure).	Keep generators cool to prevented plant from shutting down due to overheating of powerhouse. Install floor fans with thermostatic control. T/G units used to shut down for overheating when powerhouse temperature exceeded 130°F.
2009-11	Installed fuses on transducers in cabinets.	Fuses protect transducers during faults; thus, reducing catastrophic damage to control panel and reducing risk of system failure.
2009-12	Refurbished G2 gearbox, redipped G2 generator windings and brake coil, installed new bearings and on generator shaft.	Major overhaul of gearbox and generator winding required to extend previous useful life and reliability of unit. Anticipated to last for additional decade or more.
2009-13	Installed new smoke detector and hooked up to sensaphone.	Installation of new smoke detection system for early warning of any conditions that produce smoke in powerhouse. Attached to powerhouse alarm system that notifies operator of problem.
2009-14	Installed frazil timer.	Frazil timer relay circuitry installed to accommodate delayed start in winter when frazil ice is present to increase

		production when normally plant would shut down.
2009-15	Repacked gate cylinders and new bushings on two cylinders, straightened one bent cylinder and replaced badly pitted cylinder with new chrome plated stainless steel cylinder.	Major overhaul of hydraulic gate cylinders required to extend useful life and reliability of gates. Anticipated to last for additional decade or more
2009-16	Replaced rotten beams in forebay in front of G1 gates.	Improved safety for operators and safety of other personnel, reducing risk of injury to personnel and equipment.
2009-17	Installed new floating bobble line for boat barrier at dam.	Upgrade existing system to replace inefficient system, reducing labor costs and increasing safety. Upgraded to minimum conditions of FERC license.
2009-18	Replaced turbine bearing bolts on G2.	Replacing broken bolts prevented major failure of bearing which would have caused catastrophic failure and taken plant off line for indeterminate period of time.
2009-19	Replaced burned terminals on primary powerhouse panel.	Drastically improved reliability of control system, facilitating increased production due to reduction of nuisance tripping of control equipment for both units.
2010-1	Installed new vacuum contactor bottles G1 and G2.	Thermal imager enabled locating main vacuum contactor bottle before overheating and replacement before failure. Stocked spare vacuum contactor with spare bottles.
2010-2	Installed new overspeed protection.	Installed overspeed protection. Previously, there was no overspeed protection on generators. Lack of overspeed protection could have caused a major failure that will cause a loss of production.
2010-3	Installed new starter on HPU motor.	Installed to prevent failure. Maintains operations of gates that are critical component to safe and productive operation of plant. Without replacement of main hydraulic unit failure could have limited future operation.
2010-4	Installed new Electrosensor 5000 on G1.	Brought first unit up to industry standard with replacement of digital tachometer with higher accuracy and safety settings to protect from underspeed and overspeed conditions, required to put induction unit on line at right time. Longevity advantage for synching unit with grid. Intermittent problem- resolved with replacement with same unit
2010-5	Replaced oil flow sensors.	Replaced with current industry standard solid state oil flow detection device. Senor monitors critical flow of oil through the gearbox, preventing overheating and seizure of the gears. Senor extends anticipated life of gearbox.
2010-6	Installed new thermostat on gearbox.	Upgraded old analog temperature sensing devices with new digital programmable thermostat relay. Thermostat gives more accurate and reliable feedback to the controls and provides critical protection of units.
2010-7	Installed lightning arrestors on GI and G2.	Installation of lightning surge arrestors on main switchgear. Adds protection to the main power source of the plant.
2010-8	Installed fuses in control cabinets.	Fuses protect potential transformers during faults, reducing risk of both catastrophic damage to control panel and system failure.
2010-9	Installed G2 safety air valve system operating on compressed air.	Coil had failed, been replaced and then failed again. New system designed to operate on compressed air. Increase longevity of valve assembly and operation. Critical component for reducing torque on turbine. Upgraded to industry standard using readily available components.
2010-10	Installed new flexible grease lines to G2 runner bearing.	Grease lines maintain grease to bearing. Without replacement, catastrophic failure could have occurred due to

		lack of grease to turbine, shortening operating life of bearing.		
2010-11	Replaced G1glass flow meter.	Failure to do so would result in complete facility shutdown.Replacement of glass required to ensure proper reading and		
		prevent damage to gearbox.		
2010-12	Rebuilt grease pump.	Grease flow to main bearing was insufficient; refurbishment of grease pump enabled proper operation and increased operating life of lower bearing.		
2010-13	Rebuilt dipsticks.	With upgraded dipsticks, improved maintenance and operating life of gearboxes.		
2010-14	Replaced hydraulic lines to gates. (See 2009-5 and 2009-8 for complementing expenditures).	Enables gates to operate at higher head and colder temperatures.		
2011-1	Refurbished gates with UHMW adhesive on downstream side of gates.	Required refurbishment. The lifespan and functionality of gates had decreased almost to point of limited usability. Refurbishment averted over \$50,000 for new gates, thus avoiding down time and increasing production and reliability.		
2011-2	Installed new oil pump on G1 gearbox.	Replaced with new oil pump which moves oil through the gearbox, preventing overheating and seizure of the gears and extending anticipated life of gearbox.		
2011-3	Tested gearbox oil through Signum	Adopted new oil test program to reduce overhead costs and		
	for synthetic oil.	pre-mature oil replacement and to monitor the condition of gearbox and HPU.		
2011-4	Installed new metal roof.	Old roof had reached end of previous useful life; rain was leaking into powerhouse and on to control equipment.		
2011-5	Replaced seal on G2 at base of generator.	Replaced oil seal with industry standard. Replaced original factory seals with higher temperature seals to increase longevity and life expectancy of seals which are critical to containment of oil in the gearbox.		
2011-6	Replaced G1 bearings with SKF 6320-ZC3S1 bearings.	Due to thermal imaging scanning of plant, early failure of bearings was detected. Bearings were replaced before imminent failure, thus allowing increased production and reduced downtime. Investment extended facilities useful life span by reducing the risk of system failure.		
2011-7	Modified transformer on high side with tygon tubing, to test oil levels. Replaced blown high voltage bushing and binary transformer	Installation of new visual oil level sensor allows for additional monitoring of oil in transformer. Facility was shut down due to blown high voltage bushing in transformer, bushing was replaced and oil was renovated to enable plant operation. Refurbishment increased useful lifespan and avoided expensive replacement of transformer.		
2011-8	Replaced batteries and maintainer in DC HPU, spare inverter to keep backup of critical component available	Enabled plant to be safely shut down when grid power was down. This is a required emergency backup system. Without replacement of batteries and maintenance DC UPS 12V system facility cannot experience a controlled shutdown of the turbines during a loss of power.		
2011-9	Installed new check valves for HPU	Required refurbishment, original component had reached end of useful life expectancy.		
2011-10	Bought two-stage compressor.	Installed more reliable compressor to drive safety air valve for more reliable operation of critical system.		
2012-1	Refurbished G2 capacitors to avoid shorting.	Complete overhaul of G2 capacitor bank to facilitate more robust connections. Previous capacitors continued to fail. Required for reliability of safety system. Replaced capacitors to maintain system stability and protection of generator from surges caused by instability in grid. Previous system was obsolete and damaged.		

2012-2	Replaced G2 bearing cover.	During annual inspection G2 bearing cover was found to be loose and wearing shaft. Cover was rebuilt repaired and reinforced to avoid future failures. Fixed G1 bearing cover to avoid same.
2012-3	Installed dry transformer.	Upgraded and reconfigured powerhouse electrical system. Increases operating efficiency of electrical equipment.
2012-4	Replaced relay-G1 safety air valve.	Replaced relay and circuit control of critical component. Safety air valve was not functional but is required for safe plant operations. Required piece of equipment to maintain safety of plant by reducing torque on turbine during normal and emergency shutdown. Now included on normal shutdown to protect equipment.
2012-5	Refurbished shaft.	Shaft on G2 turbine was weakened by loose bearing cover. Refurbished shaft.
2012-6	Refurbished dam. (See 2008-10 for complementing expenditure).	Refurbished undermined foundation of dam and by placing. 28 yards of gunnite in dam.

For the listed improvements taken as a whole, below is *a good faith estimate* of the total aggregate increase in electricity production attributable to the improvements, expressed either in MWh or on a percentage basis, above the historical generation baseline.

The total aggregate increase in electricity production attributable to the improvements since 2009 through 2012, measured in MWh or on a percentage basis, above the historical baseline would be as follows:

Year	Baseline Generation (MWh)	Annual Generation (MWh)	Total Aggregate Increase In Electricity production (MWh)	Total Qualified Aggregate Increase In Electricity production (MWh)	Total Qualified Aggregate Increase In Electricity production (Percentage)
2009	780.13	1,388.00	607.88	600.282	76.95
2010	780.13	899.00	118.88	117.394	15.05
2011	780.13	1,124.00	343.88	339.582	43.53
2012	780.13	1,069.00	288.88	285.269	36.57
Average	780.13	1,120.00	339.87	335.622	43.02

For the listed improvements, below is *a good faith estimate* of the increase in electricity production attributable to each such improvement, expressed in MWh or on a percentage basis, above the historical generation baseline.

Using the percentages shown below for the 64 Eligible Improvements, below is Percent of Overall Increase in Production Attributed to this Improvement and Total Aggregate Increase In Electricity Production (MWh) allocated over the Eligible Improvements:

Year	Improvements	Percent of Overall Increase in Production Attributed to this Improvement	Total Aggregate Increase In Electricity Production (MWh)	Notes
2008-1	Installed new 24- inch exhaust fan with thermostat	12.50%	42.484	
	and floor fans.			
2008-2	Installed new leaf boom.	12.50%	42.484	
2008-3	Replaced valve gaskets on G1 and G2 safety air valves.	0.50%	1.699	
2008-4	Rewound burned out coil on G2 air valve.	0.25%	0.850	Definitely an Eligible Improvement
2008-5	Replaced couplings on G1 and G2 speed tachometer.	0.00%	0.000	Not a Capital Expenditure
2008-6	Installed new tachometer-Servotek.	0.25%	0.850	Definitely an Eligible Improvement
2008-7	Installed new vacuum contactor bottles g1 and g2.	0.50%	1.699	
2008-8	Purchased thermal imager.	0.50%	1.699	
2008-9	Installed new 100 cfm Ingersoll Rand gas powered compressor.	0.00% (See 2008-2 for combined percentage)	0.000	
2008-10	Refurbished dam left side of dam facing upstream.	20.00%	69.974	
2008-11	Refurbished trash racks.	10.00%	33.987	
2008-12	Installed motion sensor light and handrail.	0.50%	1.699	
2008-13	Built and installed new 12V dc backup	0.50%	1.699	

	power supply.			
2008-14	Installed new Basler 3-P digital relay.	0.25%	0.850	Definitely an Eligible Improvement
2008-15	Ordered new digital tachometer and proximity sensor for G2 I	0.50%	1.699	
2008-16	Installed 1/3 hp 3-p fan motor with seized bearings on G2 with new motor.	0.50%	1.699	
2008-17	Replaced level sensor pressure transducer, installed dessicant with low wattage light bulb.	0.50%	1.699	
2008-18	Installed new Watt- hour meters on G1 and G2.	0.50%	1.699	Monitoring Requirement
2008-19	Replaced saturated meter per PSNH requirements.	0.50%	1.699	
2008-20	Replaced transducer in G1 with new Crompton Paladin transducer-Spectrum Industries.	0.50%	1.699	
2008-21	Installed new spooler on gate 3	0.50%	1.699	
2009-1	Ordered new TR5000 from electro-sensors for G2. Installed in April 2009.	0.50%	1.699	
2009-2	Installed new digital KW meter on G1.	0.00%	0.000	
2009-3	Installed new air compressor starter solenoid (new starter motor in 11/09; new solenoid in 12/09).	0.00% (See 2008-2 for combined percentage)	0.000	Definitely an Eligible Improvement
2009-4	Ordered new fan motors for G1 and G2 after G2 replacement motor burned out.	0.50%	1.699	
2009-5	Installed new gate limit switches (ordered 2 spare switches).	20.00%	69.974	
2009-6	Ordered new separator filter for IR compressor.	0.50%	1.699	
2009-7	Ordered spare time	0.25%	0.850	Definitely an Eligible

	delay 250 amp fuses.			Improvement
2009-8	Modified gates for	0.00%	0.000	
	single gate	(See 2009-5 for		
	operation.	combined		
		percentage)		
2009-9	Posted dam danger	0.00%	0.000	Regulatory
	signs.			Requirement
2009-10	Installed new small	0.00%	0.000	•
	center fan and set	(See 2008-1 for		
	up thermostat for	combined		
	floor fans.	percentage)		
2009-11	Installed fuses on	0.50%	1.699	
	transducers in		,	
	cabinets.			
2009-12	Refurbished G2	0.50%	1.699	
2007 12	gearbox, redipped	0.5070	1.077	
	G2 generator			
	windings and brake			
	coil, installed new			
	bearings and on			
	generator shaft.			
2009-13	Installed new smoke	0.25%	0.859	Definitely an Eligible
2009-13	detector and hooked	0.2370	0.839	Improvement
				Impiovement
2000 14	up to sensaphone.	0.500/	1 (00	
2009-14	Installed frazil timer.	0.50%	1.699	
2009-15	Repacked gate	0.50%	1.699	
	cylinders and new			
	bushings on two			
	cylinders,			
	straightened one bent			
	cylinder and replaced			
	badly pitted cylinder			
	with new chrome			
	plated stainless steel			
	cylinder.			
2009-16	Replaced rotten	0.25%	0.850	Definitely an Eligible
	<mark>beams in forebay in</mark>			Improvement
	front of G1 gates.			
2009-17	Installed new	0.00%	0.000	Probably not an
	floating bobble line			Eligible Improvement
	<mark>for boat barrier at</mark>			
	dam.			
2009-18	Replaced turbine	0.50%	1.699	
	bearing bolts on G2.			
2009-19	Replaced burned	0.50%	1.699	
	terminals on primary			
	powerhouse panel.			
2010-1	Installed new	0.50%	1.699	
	vacuum contactor			
	bottles G1 and G2.			
2010-2	Installed new	0.50%	1.699	
	overspeed protection.			
2010-3	Installed new starter	0.25%	0.850	Definitely an Eligible
2010 5	on HPU motor.	0.20 /0	0.000	Improvement

	Electrosensor 5000			
	on G1.			
2010-5	Replaced oil flow sensors.	0.50%	1.699	
2010-6	Installed new	0.50%	1.699	
2010 0	thermostat on	0.5070	1.077	
	gearbox.			
2010-7		0.25%	0.850	Definitely on Elisible
2010-7	Installed lightning	0.23%	0.830	Definitely an Eligible
	arrestors on GI and G2.			Improvement
2010.0	U2. Installed fuses in	0.500/	1 (00	
2010-8		0.50%	1.699	
	control cabinets.			
2010-9	Installed G2 safety	0.50%	1.699	
	air valve system			
	operating on			
	compressed air.			
2010-10	Installed new	0.50%	1.699	
	flexible grease lines			
	to G2 runner bearing.			
2010-11	Replaced G1glass	0.50%	1.699	
2010 11	flow meter.	0.0070	11077	
2010-12	Rebuilt grease pump.	0.50%	1.699	
2010-12	Rebuilt dipsticks.	0.50%	1.699	
2010-13 2010-14	*	0.00%		
2010-14	Replaced hydraulic		0.000	
	lines to gates.	(see 2009-5 for		
		combined		
		percentage)		
2011-1	Refurbished gates	0.50%	1.699	
	with UHMW			
	adhesive on			
	downstream side of			
	gates.			
2011-2	Installed new oil	0.50%	1.699	
		0.50%	1.099	
	pump on G1	0.50%	1.099	
	pump on G1 gearbox.	0.50%	1.099	
2011-3	gearbox.			Probably not an
2011-3	gearbox. Tested gearbox oil	0.30%	0.850	Probably not an Eligible Improvement
2011-3	gearbox. Tested gearbox oil through Signum for			
	gearbox. Tested gearbox oil through Signum for synthetic oil.	0.25%	0.850	Eligible Improvemer
2011-3 2011-4	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal			Eligible Improvemer
2011-4	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof.	0.25% 0.25%	0.850 0.850	Eligible Improvemer
	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2	0.25%	0.850	Eligible Improvemer
2011-4	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator.	0.25% 0.25% 0.50%	0.850 0.850 1.699	Eligible Improvemen
2011-4	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator. Replaced G1	0.25% 0.25%	0.850 0.850	Eligible Improvemen
2011-4	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF	0.25% 0.25% 0.50%	0.850 0.850 1.699	Eligible Improvemen
2011-4	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF 6320-ZC3S1	0.25% 0.25% 0.50%	0.850 0.850 1.699	Eligible Improvemer
2011-4 2011-5 2011-6	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF 6320-ZC3S1 bearings.	0.25% 0.25% 0.50% 0.50%	0.850 0.850 1.699 1.699	Eligible Improvemer
2011-4	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF 6320-ZC3S1 bearings. Modified transformer	0.25% 0.25% 0.50%	0.850 0.850 1.699	Eligible Improvemen
2011-4 2011-5 2011-6	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF 6320-ZC3S1 bearings.	0.25% 0.25% 0.50% 0.50%	0.850 0.850 1.699 1.699	Eligible Improvemen
2011-4 2011-5 2011-6	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF 6320-ZC3S1 bearings. Modified transformer on high side with	0.25% 0.25% 0.50% 0.50%	0.850 0.850 1.699 1.699	Eligible Improvemer
2011-4 2011-5 2011-6	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF 6320-ZC3S1 bearings. Modified transformer on high side with tygon tubing, to test	0.25% 0.25% 0.50% 0.50%	0.850 0.850 1.699 1.699	Eligible Improvemer
2011-4 2011-5 2011-6	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF 6320-ZC3S1 bearings. Modified transformer on high side with tygon tubing, to test oil levels. Replaced	0.25% 0.25% 0.50% 0.50%	0.850 0.850 1.699 1.699	Eligible Improvemer
2011-4 2011-5 2011-6	gearbox. Tested gearbox oil through Signum for synthetic-oil. Installed new metal roof, Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF 6320-ZC3S1 bearings. Modified transformer on high side with tygon tubing, to test oil levels. Replaced blown high voltage	0.25% 0.25% 0.50% 0.50%	0.850 0.850 1.699 1.699	Eligible Improvemer
2011-4 2011-5 2011-6	gearbox. Tested gearbox oil through Signum for synthetic oil. Installed new metal roof. Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF 6320-ZC3S1 bearings. Modified transformer on high side with tygon tubing, to test oil levels. Replaced blown high voltage bushing and binary	0.25% 0.25% 0.50% 0.50%	0.850 0.850 1.699 1.699	Eligible Improvemen
2011-4 2011-5 2011-6	gearbox. Tested gearbox oil through Signum for synthetic-oil. Installed new metal roof, Replaced seal on G2 at base of generator. Replaced G1 bearings with SKF 6320-ZC3S1 bearings. Modified transformer on high side with tygon tubing, to test oil levels. Replaced blown high voltage	0.25% 0.25% 0.50% 0.50%	0.850 0.850 1.699 1.699	Eligible Improvemen

	HPU, spare inverter			
	to keep backup of			
	critical component			
	available			
2011-9	Installed new check	0.50%	1.699	
2011-9	valves for HPU	0.30%	1.099	
2011-10	Bought two-stage	0.50%	1.699	
2011-10		0.30%	1.099	
2012-1	compressor. Refurbished G2	0.50%	1.699	
2012-1	capacitors to avoid	0.50%	1.099	
	shorting.			
2012-2	Replaced G2 bearing	0.00%	0.000	Probably not an
2012-2	Replaced G2 bearing	0.00%	0.000	
2012-3	Installed dry	0.50%	1.699	Eligible Improvement
2012-3	transformer.	0.50%	1.099	
2012-4		0.50%	1.699	
2012-4	Replaced relay-G1	0.50%	1.099	
2012.5	safety air valve.	0.500/	1 (00	
2012-5	Refurbished shaft.	0.50%	1.699	
2012-6	Refurbished dam.	0.00%	0.000	
		(See 2008-10 for		
		combined		
		percentage)-	220.07	
	Gross Totals	100.00%	339.87	
2000 5	Less:	0.500/	1 (00)	
2008-5	Replaced couplings	0.50%	1.699	Not a Capital
	on G1 and G2 speed			Expenditure
2000.10	tachometer.	0.500/	1 (00)	
2008-18	Installed new Watt	0.50%	1.699	Monitoring
	hour meters on G1			Requirement
	and G2.			
2009-9	Posted dam danger	0.00%	0.000	Regulatory
	signs.			Requirement
2009-17	Installed new	0.00%	0.000	Probably not an
	<mark>floating bobble line</mark>			Eligible Improvement
	f or boat barrier at			
	dam.			
2011-3	Tested gearbox oil	0.25%	0.850	Probably not an
	through Signum for			Eligible Improvement
	synthetic oil.			
2012-2	Replaced G2 bearing	0.00%	0.000	Probably not an
	<mark>cover.</mark>			Eligible Improvement
	Net Totals	98.75%	335.640	

Hopkinton Hydro Project	
2008 Capital Expenditures Which Are Efficiency Improvements	

			•				•	
<u>No.</u>	Description of Improvements	<u>When</u> <u>Started/</u> <u>When</u> <u>Complet</u> <u>ed</u>	<u>Description of</u> <u>Improvement Benefit</u>	Whether the Improvement Was An O&M Item, An Efficiency Improvement Item, Or Another Item;	Why It Should Be In That Category?	<u>Age at Time of</u> <u>Refurbishment</u>	<u>New</u> <u>Useful</u> <u>Life</u>	Percent of Overall Increase in Production Attributed to this Improvement
2008-1	Installed new 24-inch exhaust fan with thermostat and floor fans.	2008/ May 2008	Keeps generators cool to prevent plant from shutting down due to overheating of powerhouse. Installed floor fans with thermostatic control. Turbine/generator units used to shut down when powerhouse temperature exceeded 130°F	Efficiency Improvement	Improved plant availability; Turbine/generator units used to shut down when powerhouse temperature exceeded 130°F	New piece of equipment ¹	15 years	12.00%
2008-2	Installed new leaf boom.	2008/ May 2008	Minimized debris on rack, increase production and reduce need for maintenance. Racks would clog and plant would shut down. Major improvement in production.	Efficiency Improvement	Improved water flow; Minimized debris on rack into turbines; increase production and reduced need for maintenance. Racks would clog and plant would shut down. Major improvement in production.	New piece of equipment	15 years	12.00%

¹ "New piece of equipment"-indicates that the plant did not have this vital piece of equipment installed for reliable operation in 2008.

2008-	Replaced valve	2008/	Rebuilt safety air	Efficiency	Improved plant	24 years^2	5	0.50%
3	gaskets on G1		valves that are used to	Improvement	availability; Valves	27 years	years	0.5070
5	and G2 safety air	5 uli 2000	reduce torque on	improvement	were leaking causing		years	
	valves.		turbine. Valves were		substantial loss on			
	var veb.		leaking causing		production. Required			
			substantial loss on		piece of equipment to			
			production. Required		maintain safety of			
			piece of equipment to		plant to reduce torque			
			maintain safety of		on turbine during			
			plant to reduce torque		shutdown and			
			on turbine during		emergency shutdown.			
			shutdown and		6 7			
			emergency shutdown.					
			Now included on					
			normal shutdown to					
			protect equipment.					
	Rewound burned		Safety air valve was	Efficiency	Improved plant	24 years	4	0.25%
	out coil on G2	Jul. 2008	not functional but is	Improvement	availability; Valves		years	
	<mark>air valve.</mark>		required equipment		were leaking causing			
			for plant operations.		substantial loss on			
			Rebuilt safety air		production. Required			
			valves are used to		piece of equipment to			
			reduce torque on		maintain safety of			
			turbine. Required		plant to reduce torque			
			piece of equipment to		on turbine during			
			maintain safety of		shutdown and			
			plant to reduce torque		emergency shutdown			
			on turbine during					
			normal and					
			emergency shutdown.					
			Now included on					
			normal shutdown to					
2000	Denlaged	2008/	protect equipment.		Turn normal in large (<1	1	0.000/
	Replaced	2008/	Continual failure of	Efficiency	Improved plant	<1 year	<1	0.00%
5	couplings on G1	Sep.	tachometer would shut	Improvement	availability; Continual		year	
	and G2 speed	2008	plant down and reduce		failure of tachometer			
	tachometer.		production. Replaced		would shut plant down			

 $^{^{2}}$ Plant was purchased in 2008 by Petitioner a 24-year period indicates that the equipment was past its useful life, and that refurbishment replaced original equipment

							1 1	
			couplings and motor		and reduce			
			to keep plant on line		production.			
			and running. Dramatic					
			increase in production,					
			as this was a common					
			failure.					
2008-	Installed new	2008/	Continual failure of	Efficiency	Improved plant	New piece of	1 year	0.25%
6	tachometer-	Sep.	tachometer would shut	Improvement	availability; Continual	equipment		
	Servotek.	2008	plant down and reduce	-	failure of tachometer			
			production. Replaced		would shut plant down			
			motor to keep plant on		and reduce			
			line and running.		production.			
			Dramatic increase in		1			
			production, as this					
			was a common failure.					
			Plant used to stock					
			broken spare parts on					
			shelf. Production is					
			increased by keeping					
			stock of working					
			critical spare parts on					
			hand.					
2008	Installed new	2009/	Thermal imager	Efficiency	Immuored plant	24 110000	20	0.50%
		2009/ 2010	enabled us to locate	•	Improved plant	24 years		0.30%
	vacuum	2010		Improvement	availability; Thermal		years	
	contactor bottles		main vacuum		imager enabled us to			
	g1 and g2.		contactor bottle		locate main vacuum			
			overheating. Replaced		contactor bottle			
			before imminent		overheating.			
			failure. Stocked spare					
			vacuum contactor,					
			with spare bottles.					
	Purchased	Sept.	Purchase thermal	Efficiency	Improved plant	New piece of	15	0.50%
8	thermal imager.	2009/	imaging device for	Improvement	availability; Thermal	equipment	years	
		2012	continual inspection		imager has enabled			
			and monitoring of		problems to be			
			plant. Thermal imager		discovered before they			
			has enabled problems		become critical. Has			
			to be discovered		prevented shutdowns			
			before they become		and increased			
1			critical. Has prevented		production.			

			shutdowns and increased production. Gives us time to locate and purchase replacement products for repair, while still being on line and operating. Major increases in production.					
2008- 9	Installed new 100 cfm Ingersoll Rand gas powered compressor.	2008/ Aug. 2008	Made trash rack cleaning safer and more efficient for operators, reduced head loss, increased production, cut down time for operators	Efficiency Improvement	Improved plant availability; Made trash rack cleaning safer and more efficient for operators, reduced head loss, increased production, cut down time for operators	New piece of equipment	10 years	0.00% (See 2008-2 for combined percentage)
2008-10	Refurbished dam left side of dam facing upstream.	2008/ Sep. 2008	Reduce leakage, improved structural stability of dam, enable project to keep operating. Required and necessary to ensure longevity of dam structure.	Efficiency Improvement	Improved plant availability; Reduced leakage, improved structural stability of dam, enabled project to keep operating.	200 years	100 years	20.00%
2008-11	Refurbished trash racks.	2008/ Oct. 2008	Original trashracks were corroded and had reduced spacing due to thick rust and corrosion, thus reducing production and increasing headloss. Headloss was often over 1 foot through the racks, even when racks were cleaned. Major increase in production.	Efficiency Improvement	Improved plant availability; Original trashracks were corroded and had reduced spacing due to thick rust and corrosion, thus reducing production and increasing headloss. Headloss was often over 1 foot through the racks, even when racks were	20 years	20 years	10.00%

					cleaned.			
2008-	Installed motion	2008/	Improved safety for	Efficiency	Improved plant	New piece of	20	0.50%
12	sensor light and	Oct.	operators and safety of		availability; personnel	equipment	years	
	handrail.	2008	other personnel,	1	able to work faster in	1 1	5	
			reducing risk of fall		safer work place			
			injury.		1			
2008-	Built and	2008/	Enabled plant to be	Efficiency	Improved plant	New system	20	0.50%
13	installed new	Nov.	safely shut down	Improvement	availability; Enabled	J.	years	
	12V dc backup	2008	when grid power was	1	plant to be safely shut		5	
	power supply.		down. This is a		down when grid			
	1 11 2		required emergency		power was down. This			
			backup system; there		is a required			
			was no system in		emergency backup			
			place before		system; there was no			
			installation. Without		system in place before			
			DC UPS 12V system		installation. Without			
			facility cannot		DC UPS 12V system			
			experience a		facility cannot			
			controlled shutdown		experience a			
			of the turbines during		controlled shutdown			
			a loss of power.		of the turbines during			
					a loss of power.			
	Installed new	2008/	Required upgrade by	Efficiency	Improved plant	New piece of	30	0.25%
14	Basler 3-P	Sept.	PSNH to maintain	Improvement	availability; Old relay	equipment	years	
	digital relay.	2008	plant on line. Old		deemed obsolete by			
			relay deemed obsolete		utility, extended life			
			by utility, extended		of facility by			
			life of facility by		protecting plant			
			protecting plant		during grid instability.			
			during grid instability.					
	Ordered new	2008/	Plant was blowing 250	Efficiency	Improved plant	New piece of	20	0.50%
15	digital	Dec.	amp fuses due to	Improvement	availability; Plant was	equipment	years	
	tachometer and	2008	inaccurate signal from		blowing 250 amp			
	proximity sensor		speed tachometer,		fuses due to inaccurate			
	for G2 I		causing instability in		signal from speed			
			generation, and		tachometer, causing			
			throwing plant off		instability in			
			line. Old tachometer		generation, and			
			system was		throwing plant off			
			functionally obsolete.		line. Brought plant to			

	· · · · · · · · · · · · · · · · · · ·		1					
			There was no		industry standard			
			feedback on cause of		using digital controls.			
			outage. New					
			tachometer brought					
			plant to industry					
			standard using digital					
			controls.					
2008-	Installed 1/3 hp	2008/	Critical component for	Efficiency	Improved plant	24 years	15	0.50%
	3-p fan motor	Nov.	cooling of gearbox,	Improvement	availability; Critical	5	years	
	with seized	2008	increased useful life	1	component for cooling		5	
	bearings on G2		span of gearbox.		of gearbox, increased			
	with new motor.		Existing motor was		useful life span of			
	when new motor.		industry standard, but		gearbox. Existing			
			not functioning.		motor was industry			
			Cleaned cooling		standard, but not			
			mechanism-which was		functioning. Cleaned			
			clogged due to lack of		cooling mechanism-			
			maintenance. Increase		which was clogged			
					22			
			overall efficiency of		due to lack of			
			cooling of gearbox oil.		maintenance. Increase			
			Prevent overheating		overall efficiency of			
			which can result in		cooling of gearbox oil.			
			significant turbine		Prevent overheating			
			efficiency loss		which can result in			
					significant turbine			
					efficiency loss			
2008-	Replaced level	2008/	Replaced level sensor	Efficiency	Improved plant	3 years	10	0.50%
17	sensor pressure	Nov.	which is main control	Improvement	availability; Upgraded		years	
	transducer,	2008	component of plant		cabinet with			
	installed		for reliable operation.		□esiccant and heating			
	dessicant with		Upgraded cabinet with		device to keep			
	low wattage		dessicant and heating		moisture out of new			
	light bulb.		device to keep		transducer, increasing			
	0		moisture out of new		useful life span of			
			transducer, increasing		transducer.			
			useful life span of					
			transducer.					
2008-	Installed new	2008/	Watt-hour meters had	Monitoring	Needed for Accurate	24 years	20	0.50%
18	Watt-hour	2000/ Nov.	reached end of useful		Operation; particularly	27 years	years	0.5070
10	meters on G1	2008	life and needed	requirement	helpful when trouble		Jeans	
		2000	ine and needed		nerprur when nouble			

	and G2.		replacement with industry standard.		shooting causes of outages			
19	Replaced saturated meter per PSNH requirements.	2008/ Sep. 2008	Plant had increased production due to upgrades so that existing meter was not able to accurately read production. Utility required meter to be changed to accurately read production.	Efficiency Improvement	Improved plant availability; Utility required meter to be changed to accurately read production.	24 years	10 years	0.50%
20	Replaced transducer in G1 with new Crompton Paladin transducer- Spectrum Industries.	2008/ Dec. 2008	Transducer drives watt meter and is used to record production. Transducer had reached end of useful life span. Required replacement, New transducer meets industry standard and is part of shutdown mechanism to protect from overpower and underpower of generators.	Efficiency Improvement	Improved plant availability; New transducer is part of shutdown mechanism to protect from overpower and underpower of generators	24 years	15 years	0.50%
	Installed new spooler on gate 3	2008/ Dec. 2008	Replaced hydraulic spooler, part of gate control system, required to keep plant safely operational.	Efficiency Improvement	Improved plant availability; spooler was no longer operable; new one was needed for any operation.	24 years	15 years	0.50%

61.75%

<u>Hopkinton Hydro Project</u>
2009 Capital Expenditures Which Are Efficiency Improvements

	1	1					1	
<u>No.</u>	Description of	When	Description of	Whether the	Why It Should Be In	<u>Age at Time of</u>	New	Percent of Overall
	Improvements	Started/	Improvement Benefit		That Category?	<u>Refurbishment</u>	<u>Useful</u>	<u>Increase in</u>
		When		Was An			Life	Production
		Complet		<u>O&M Item,</u>				Attributed to this
		<u>ed</u>		An Efficiency				Improvement
				Improvement				
				<u>Item, Or</u>				
				<u>Another</u>				
				<u>Item;</u>				
2009-	Ordered new	2009/	Brought second unit	Efficiency	Improved plant	New piece of	20	0.50%
1	TR5000 from	April	up to industry	Improvement	availability; Brought	equipment ¹	years	
	electro-sensors	2009	standard with		second unit up to			
	for G2. Installed		replacement of		industry standard with			
	in April 2009.		mechanical		replacement of			
			tachometer with		mechanical			
			digital tachometer		tachometer with			
			with higher accuracy		digital tachometer			
			and safety settings to		with higher accuracy			
			protect from		and safety settings to			
			underspeed and		protect from			
			overspeed, required to		underspeed and			
			put induction unit on		overspeed, required to			
			line at right time.		put induction unit on			
			Longevity advantage		line at right time.			
			for synching unit with		Longevity advantage			
			grid.		for synching unit with			
					grid.			
2009-	Installed new	2009/	Provides more	Efficiency	Improved plant	1 year	10	0.50%
2	digital KW	Jan.	accurate reading of	Improvement	availability; Provides	(Replacement	years	
	meter on G1.	2009	output, and more		more accurate reading	made in 2008		
			reliable trip setting		of output, and more	failed)		
			and shut down relay to		reliable trip setting			
			determine when plant		and shut down relay to			

¹ "New piece of equipment"-indicates that the plant did not have this vital piece of equipment installed for reliable operation in 2009.

			shut down during power production. Protects equipment from cavitation due to low flows. Bring up to industry standards with use of digital device.		determine when plant shut down during power production. Protects equipment from cavitation due to low flows.			
2009-3	Installed new air compressor starter solenoid (new starter motor in 11/09; new solenoid in 12/09).	2009/ Dec. 2009	Keeps air compressor running which is integral part of keeping trash racks clean and maintaining production.	Efficiency Improvement	Improved plant availability; Keeps air compressor running which is integral part of keeping trash racks clean and maintaining production.	New piece of equipment	10 years	0.00% (See 2008-2 for combined percentage)
2009-4	Ordered new fan motors for G1 and G2 after G2 replacement motor burned out.	2009/ Dec. 2009	Critical component for cooling of gearbox, increased useful life span of gearbox. Existing motor was industry standard, but not functioning. Cleaned cooling mechanism, which was clogged due to lack of maintenance. Increased overall efficiency of cooling of gearbox oil. Prevents overheating which can result in significant loss of turbine efficiency.	Efficiency Improvement	Improved plant availability; Critical component for cooling of gearbox, increased useful life span of gearbox. Existing motor was industry standard, but not functioning. Cleaned cooling mechanism, which was clogged due to lack of maintenance. Increased overall efficiency of cooling of gearbox oil. Prevents overheating which can result in significant loss of turbine efficiency.	25 year ²	20 years	0.50%

 $^{^{2}}$ Plant was purchased in 2008 by Petitioner a 25-year period indicates that the equipment was past its useful life, and that refurbishment replaced original equipment

2009-	Installed new	2009/	Critical component for	Efficiency	Improved plant	25 years	10	20.00%
5	gate limit switches (ordered 2 spare switches).	Nov. 2009	operation of plant. Without limit switch working, gates would not function and plant could not operate. Had reached end of previous useful life and was replaced with industry standard.	Improvement	availability; Critical component for operation of plant. Without limit switch working, gates would not function and plant could not operate.		years	
2009- 6	Ordered new separator filter for IR compressor.	2009/ Jan. 2009	Keeps air compressor running which is integral part of keeping trash racks clean and maintaining production.	Efficiency Improvement	Improved plant availability; Keeps air compressor running which is integral part of keeping trash racks clean and maintaining production	New piece of equipment	5 years	0.50%
2009- 7	Ordered spare time delay 250 amp fuses.	2009/ Mar. 2009	Keeps spare parts on shelf for immediate repair to enable plant to be on line quickly when fault occurs.	Efficiency Improvement	Improved plant availability;	New piece of equipment	10 years	0.25%
2009- 8	Modified gates for single gate operation.	2009/ Jan. 2009	Reconfigured gate operation by installing new controls (see item 2009-5), increasing production particularly during low flows.	Efficiency Improvement	Improved plant availability; Reconfigured gate operation by installing new controls (see item 2009-5), increasing production particularly during low flows.	New piece of equipment	20 years	0.00% (See 2009-5 for combined percentage)
2009- 9	Posted dam danger signs.	2009/ May 2009	Brought facility into minimum compliance with FERC dam safety requirements.	Regulatory requirement	FERC mandated safety item.	New piece of Equipment	15 years	0.00%
2009- 10	Installed new small center fan and set up thermostat for floor fans.	2009/ Apr. 2009	Keep generators cool to prevented plant from shutting down due to overheating of powerhouse. Install	Efficiency Improvement	Improved plant availability; Keep generators cool to prevented plant from shutting down due to	New piece of equipment	20 years	0.00% (See 2008-1 for combined percentage)

			floor fans with thermostatic control. T/G units used to shut down for overheating when powerhouse temperature exceeded 130°F.		overheating of powerhouse. Install floor fans with thermostatic control. T/G units used to shut down for overheating when powerhouse temperature exceeded 130°F.			
2009- 11	Installed fuses on transducers in cabinets.	2009/ Dec. 2009	Fuses protect transducers during faults; thus, reducing catastrophic damage to control panel and reducing risk of system failure.	Efficiency Improvement	Improved plant availability; Fuses protect transducers during faults; thus, reducing catastrophic damage to control panel and reducing risk of system failure.	New piece of equipment	10 years (or until voltag e surge)	0.50%
2009- 12	Refurbished G2 gearbox, redipped G2 generator windings and brake coil, installed new bearings and on generator shaft.	Jul. 2009/ Sep. 2009	Major overhaul of gearbox and generator winding required to extend previous useful life and reliability of unit. Anticipated to last for additional decade or more.	Efficiency Improvement	Improved plant availability; Major overhaul of gearbox and generator winding required to extend previous useful life and reliability of unit.	10-15 years	20 years	0.50%
	Installed new smoke detector and hooked up to sensaphone.	2009/ Sep. 2009	Installation of new smoke detection system for early warning of any conditions that produce smoke in powerhouse. Attached to powerhouse alarm system that notifies operator of problem.	Efficiency Improvement	Improved plant availability; Installation of new smoke detection system for early warning of any conditions that produce smoke in powerhouse.	New piece of equipment	10 years	0.25%
2009- 14	Installed frazil timer.	2009/ Dec. 2009	Frazil timer relay circuitry installed to accommodate delayed start in winter when	Efficiency Improvement	Improved plant availability; Frazil timer relay circuitry installed to	New piece of equipment	15 years	0.50%

15	Repacked gate cylinders and new bushings on two cylinders, straightened one bent cylinder and replaced badly pitted cylinder with new chrome plated stainless steel cylinder.	Oct. 2009/ Dec. 2009	frazil ice is present to increase production when normally plant would shut down. Major overhaul of hydraulic gate cylinders required to extend useful life and reliability of gates. Anticipated to last for additional decade or more	Efficiency Improvement	accommodate delayed start in winter when frazil ice is present to increase production when normally plant would shut down. Improved plant availability; Major overhaul of hydraulic gate cylinders required to extend useful life and reliability of gates.	25 years	15 years	0.50%
16	Replaced rotten beams in forebay in front of G1 gates.	2009/ 2009	Improved safety for operators and safety of other personnel, reducing risk of injury to personnel and equipment.	Efficiency Improvement	Improved plant availability; Improved safety for operators and safety of other personnel, reducing risk of injury to personnel and equipment.	25 years.	20 years	0.25%
	Installed new floating bobble line for boat barrier at dam.	2009/ 2009	Upgrade existing system to replace inefficient system, reducing labor costs and increasing safety. Upgraded to minimum conditions of FERC license.	Efficiency Improvement	Improved plant availability; Upgrade existing system to replace inefficient system, reducing labor costs and increasing safety.	New piece of equipment	15 years	0.00%
	Replaced turbine bearing bolts on G2.	2009/	Replacing broken bolts prevented major failure of bearing which would have caused catastrophic failure and taken plant	Efficiency Improvement	Improved plant availability; Replacing broken bolts prevented major failure of bearing which would have	25 years.	10 years	0.50%

			off line for		caused catastrophic			
			indeterminate period		failure and taken plant			
			of time.		off line for			
					indeterminate period			
					of time.			
2009-	Replaced burned	Jan.	Drastically improved	Efficiency	Improved plant	25 years	10	0.50%
19	terminals on	2009/	reliability of control	Improvement	availability;		years	
	primary	Dec.	system, facilitating		Drastically improved			
	powerhouse	2009	increased production		reliability of control			
	panel.		due to reduction of		system, facilitating			
			nuisance tripping of		increased production			
			control equipment for		due to reduction of			
			both units.		nuisance tripping of			
					control equipment for			
					both units.			

25.75%

<u>Hopkinton Hydro Project</u>
2010 Capital Expenditures Which Are Efficiency Improvements

<u>No.</u>	Description of Improvements	When Started/ When Complet <u>ed</u>	<u>Description of</u> Improvement Benefit	Whether the Improvement Was An O&M Item, An Efficiency Improvement Item, Or	Why It Should Be In That Category?	Age at Time of Refurbishment	<u>New</u> <u>Useful</u> <u>Life</u>	Percent of Overall <u>Increase in</u> <u>Production</u> <u>Attributed to this</u> <u>Improvement</u>
2010	T 11 . 1	2000/	TP1	Another Item;		26	20	0.50%
2010-1	Installed new vacuum contactor bottles G1 and G2.	2009/ 2010	Thermal imager enabled locating main vacuum contactor bottle before overheating and replacement before failure. Stocked spare vacuum contactor with spare bottles.	Efficiency Improvement	Improved plant availability; Thermal imager enabled locating main vacuum contactor bottle before overheating and replacement before failure.	26 years ¹	20 years	0.50%
2010-2	Installed new overspeed protection.	2010/ Nov-10	Installed overspeed protection. Previously, there was no overspeed protection on generators. Lack of overspeed protection could have caused a major failure that will cause a loss of production.	Efficiency Improvement	Improved plant availability; Installed overspeed protection. Previously, there was no overspeed protection on generators. Lack of overspeed protection could have caused a major failure that will cause a loss of production	New piece of equipment ²	15 years	0.50%

¹ Plant was purchased in 2008 by Petitioner a 26-year period indicates that the equipment was past its useful life, and that refurbishment replaced original equipment ² "New piece of equipment"-indicates that the plant did not have this vital piece of equipment installed for reliable operation in 2010.

2010	Installed new	2010/	Installed to prevent	Efficiency	Improved plant	26 years	15	0.50%
3	starter on HPU	Jan-10	failure. Maintains	Improvement	availability; Installed	20 years	years	0.5070
5	motor.	Jan-10	operations of gates	mprovement	to prevent failure.		years	
			that are critical		Maintains operations			
			component to safe and		of gates that are			
			productive operation		critical component to			
			of plant. Without		safe and productive			
			replacement of main		operation of plant.			
			hydraulic unit failure		Without replacement			
			could have limited		of main hydraulic unit			
			future operation.		failure could have			
			future operation.		limited future			
					operation.			
2010-	Installed new	2010/	Brought first unit up	Efficiency	Improved plant	New piece of	15	0.50%
4	Electrosensor	Apr-10	to industry standard	Improvement	availability; Brought	equipment	years	0.5070
-	5000 on G1.	Apr-10	with replacement of	mprovement	first unit up to	equipment	years	
	5000 01 01.		digital tachometer		industry standard with			
			with higher accuracy		replacement of digital			
			and safety settings to		tachometer with			
			protect from		higher accuracy and			
			underspeed and		safety settings to			
			overspeed conditions,		protect from			
			required to put		underspeed and			
			induction unit on line		overspeed conditions,			
			at right time.		required to put			
			Longevity advantage		induction unit on line			
			for synching unit with		at right time.			
			grid. Intermittent		Longevity advantage			
			problem-resolved with		for synching unit with			
			replacement with		grid. Intermittent			
			same unit		problem-resolved with			
					replacement with			
					same unit			
2010-	Replaced oil	2010/	Replaced with current	Efficiency	Improved plant	26 years.	20	0.50%
5	flow sensors.	May-10	industry standard solid	Improvement	availability; Replaced	-	years	
			state oil flow detection	-	with current industry			
			device. Senor		standard solid state oil			
			monitors critical flow		flow detection device.			
			of oil through the		Senor monitors			
			gearbox, preventing		critical flow of oil			

			1		1	Г		
			overheating and		through the gearbox,			
			seizure of the gears.		preventing			
			Senor extends		overheating and			
			anticipated life of		seizure of the gears.			
			gearbox.		Senor extends			
					anticipated life of			
					gearbox.			
2010-	Installed new	2010/	Upgraded old analog	Efficiency	Improved plant	26 years.	15	0.50%
6	thermostat on	May-10	temperature sensing	Improvement	availability; Upgraded		years	
	gearbox.		devices with new	-	old analog		-	
	-		digital programmable		temperature sensing			
			thermostat relay.		devices with new			
			Thermostat gives		digital programmable			
			more accurate and		thermostat relay.			
			reliable feedback to		Thermostat gives			
			the controls and		more accurate and			
			provides critical		reliable feedback to			
			protection of units.		the controls and			
			-		provides critical			
					protection of units			
2010-	Installed	2010/	Installation of	Efficiency	Improved plant	New piece of	15	0.25%
7	lightning	May-10	lightning surge	Improvement	availability; Installed	equipment	years	
	arrestors on GI		arrestors on main	-	of lightning surge		(or	
	and G.		switchgear. Adds		arrestors on main		until	
			protection to the main		switchgear. Adds		hit by	
			power source of the		protection to the		lightni	
			plant.		main power source		ng)	
			-		of the plant			
2010-	Installed fuses in	2010/	Fuses protect potential	Efficiency	Improved plant	New piece of	10	0.50%
8	control cabinets.	May-10	transformers during	Improvement	availability;. Fuses	equipment	years	
		-	faults, reducing risk of	-	protect potential		(or	
			both catastrophic		transformers during		until	
			damage to control		faults, reducing risk of		voltag	
			panel and system		both catastrophic		e	
			failure.		damage to control		surge)	
					panel and system			
					failure			
2010-	Installed G2	2010/	Coil had failed, been	Efficiency	Improved plant	2 years. (Rewound	20	0.50%
9	safety air valve	Aug-	replaced and then	Improvement	availability; New	coil had failed	years	
	system operating	2010	failed again. New	1.	system designed to	after 2 years, new	-	
			č		• •	. .		

	on compressed		system designed to		operate on	piece of		
	air.		operate on		compressed air.	equipment)		
			compressed air.		Increase longevity of			
			Increase longevity of		valve assembly and			
			valve assembly and		operation. Critical			
			operation. Critical		component for			
			component for		reducing torque on			
			reducing torque on		turbine. Upgraded to			
			turbine. Upgraded to		industry standard			
			industry standard		using readily available			
			using readily available		components			
			components.		-			
2010-	Installed new	2010/	Grease lines maintain	Efficiency	Improved plant	26 years.	20	0.50%
10	flexible grease	Jul-10	grease to bearing.	Improvement	availability; Without	-	years	
	lines to G2		Without replacement,	-	replacement,		÷	
	runner bearing.		catastrophic failure		catastrophic failure			
			could have occurred		could have occurred			
			due to lack of grease		due to lack of grease			
			to turbine, shortening		to turbine, shortening			
			operating life of		operating life of			
			bearing. Failure to do		bearing. Failure to do			
			so would result in		so would result in			
			complete facility		complete facility			
			shutdown.		shutdown.			
2010-	Replaced	2010/	Replacement of glass	Efficiency	Improved plant	26 years	20	0.50%
11	G1glass flow	May-10	required to ensure	Improvement	availability;		years	
	meter.		proper reading and		Replacement of glass			
			prevent damage to		required to ensure			
			gearbox.		proper reading and			
					prevent damage to			
					gearbox.			
	Rebuilt grease	2010/	Grease flow to main	Efficiency	Improved plant	26 years	20	0.50%
12	pump.	May-10	bearing was	Improvement	availability;		years	
			insufficient;		refurbishment of			
			refurbishment of		grease pump enabled			
			grease pump enabled		proper operation and			
			proper operation and		increased operating			
			increased operating		life of lower bearing.			
			life of lower bearing.					

2010-	Rebuilt	2010/	With upgraded	Efficiency	Improved plant	26 years	30	0.50%
13	dipsticks.	Dec-10	dipsticks, improved maintenance and operating life of gearboxes.	Improvement	availability; With upgraded dipsticks, improved maintenance and operating life of gearboxes.		years	
	Replaced hydraulic lines		Enables gates to operate at higher head	Efficiency Improvement	Improved plant availability; Enables	26 years	20 years	0.00% (see 2009-5 for
	to gates.		and colder temperatures.		gates to operate at higher head and colder temperatures.			combined percentage)

6.25%

<u>Hopkinton Hydro Project</u>
2011 Capital Expenditures Which Are Efficiency Improvements

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<u>No.</u>	Description of	When	Description of	Whether the	Why It Should Be In	<u>Age at Time of</u>	New	Percent of Overall
	Improvements	Started/	Improvement Benefit		That Category?	<u>Refurbishment</u>	<u>Useful</u>	<u>Increase in</u>
		When		<u>Was An</u>			Life	Production
		Complet		<u>O&M Item,</u>				Attributed to this
		ed		An Efficiency				Improvement
				Improvement				
				<u>Item, Or</u>				
				<u>Another</u>				
				<u>Item;</u>		1		
2011-		2011/	Required	Efficiency	Improved plant	27 years ¹	10	0.50%
1	gates with	Mar.	refurbishment. The	Improvement	availability; The		years	
	UHMW	2011	lifespan and		lifespan and			
	adhesive on		functionality of gates		functionality of gates			
	downstream side		had decreased almost		had decreased almost			
	of gates.		to point of limited		to point of limited			
			usability.		usability.			
			Refurbishment averted		Refurbishment averted			
			over \$50,000 for new		over \$50,000 for new			
			gates, thus avoiding		gates, thus avoiding			
			down time and		down time and			
			increasing production		increasing production			
			and reliability.		and reliability.			
2011-	Installed new oil	2011/	Replaced with new oil	Efficiency	Improved plant	27 years	20	0.50%
2	pump on G1	May	pump which moves oil	Improvement	availability; Replaced		years	
	gearbox.	2011	through the gearbox,		with new oil pump			
			preventing		which moves oil			
			overheating and		through the gearbox,			
			seizure of the gears		preventing			
			and extending		overheating and			
			anticipated life of		seizure of the gears			
			gearbox.		and extending			
					anticipated life of			

¹ Plant was purchased in 2008 by Petitioner a 27-year period indicates that the equipment was past its useful life, and that refurbishment replaced original equipment

					gearbox.			
2011-	Tested gearbox	2011/	Adopted new oil test	Efficiency	Improved plant	New maintenance	Perpet	0.25%
3	oil through	Mar.	program to reduce	Improvement	availability; Adopted	protocol	ual	0.2070
U	Signum for	2011	overhead costs and	impro (emene	new oil test program	protocor	uur	
	synthetic oil.	_011	pre-mature oil		to reduce overhead			
			replacement and to		costs and pre-mature			
			monitor the condition		oil replacement and to			
			of gearbox and HPU.		monitor the condition			
					of gearbox and HPU.			
2011-	Installed new	2011/	Old roof had reached	Efficiency	Improved plant	27 years	20	0.25%
4	metal roof.	Aug.	end of previous useful	Improvement	availability; new roof	-	years	
		2011	life.	-	prevents leaks that			
					could short out			
					equipment and take			
					unit off-line.			
2011-	Replaced seal on	2011/	Replaced oil seal with	Efficiency	Improved plant	10 years	10	0.50%
5	G2 at base of	Mar.	industry standard.	Improvement	availability; Replaced		years	
	generator.	2011	Replaced original	1	original factory seals		5	
	-		factory seals with		with higher			
			higher temperature		temperature seals to			
			seals to increase		increase longevity and			
			longevity and life		life expectancy of			
			expectancy of seals		seals which are critical			
			which are critical to		to containment of oil			
			containment of oil in		in the gearbox.			
			the gearbox.					
	Replaced G1	2011/	Due to thermal	Efficiency	Improved plant	27 years	10	0.50%
6	bearings with	Nov.	imaging scanning of	Improvement	availability; Due to		years	
	SKF 6320-	2011	plant, early failure of		thermal imaging			
	ZC3S1 bearings.		bearings was detected.		scanning of plant,			
			Bearings were		early failure of			
			replaced before		bearings was detected.			
			imminent failure, thus		Bearings were			
			allowing increased production and		replaced before imminent failure, thus			
			reduced downtime.		allowing increased			
			Investment extended		production and			
			facilities useful life		reduced downtime.			
			span by reducing the		Investment extended			
L	l		span by reducing the		myestment extended		1	

			risk of system failure.		facilities useful life			
					span by reducing the			
					risk of system failure.			
2011-	Modified	2011/	Installation of new	Efficiency	Improved plant	Modification to 27	10	0.50%
7	transformer on	Nov.	visual oil level sensor	Improvement	availability;	year old equipment	years	
	high side with	2011	allows for additional	-	Installation of new		•	
	tygon tubing, to		monitoring of oil in		visual oil level sensor			
	test oil levels.		transformer. Facility		allows for additional			
	Replaced blown		was shut down due to		monitoring of oil in			
	high voltage		blown high voltage		transformer. Facility			
	bushing and		bushing in		was shut down due to			
	binary		transformer, bushing		blown high voltage			
	transformer		was replaced and oil		bushing in			
			was renovated to		transformer, bushing			
			enable plant operation.		was replaced and oil			
			Refurbishment		was renovated to			
			increased useful		enable plant operation.			
			lifespan and avoided					
			expensive replacement					
			of transformer.					
.011-	Replaced	2011/	Enabled plant to be	Efficiency	Improved plant	27 years	4	0.25%
8	batteries and	Dec.	safely shut down	Improvement	availability; This is a		years	
	maintainer in	2011	when grid power was		required emergency			
	DC HPU, spare		down. This is a		backup system.			
	inverter to keep		required emergency		Without replacement			
	<mark>backup of</mark>		backup system.		of batteries and			
	<mark>critical</mark>		Without replacement		maintenance DC UPS			
	<mark>component</mark>		of batteries and		12V system facility			
	<mark>available</mark>		maintenance DC UPS		cannot experience a			
			12V system facility		controlled shutdown			
			cannot experience a		of the turbines during			
			controlled shutdown		a loss of power.			
			of the turbines during					
			a loss of power.					
	Installed new	2011/	Required	Efficiency	Improved plant	27 years	20	0.50%
	check valves for	Dec.	refurbishment,	Improvement	availability; Required		years	
	HPU	2011	original component		refurbishment,			
			had reached end of		original component			
			useful life expectancy.		had reached end of			
					useful life expectancy.	1		

NHPUC Filing

2011-	Bought two-	2011/	Installed more reliable	Efficiency	Improved plant	New piece of	15	0.50%
10	stage	Dec.	compressor to drive	Improvement	availability; Installed	equipment ²	years	
	compressor.	2011	safety air valve for		more reliable			
			more reliable		compressor to drive			
			operation of critical		safety air valve for			
			system.		more reliable			
					operation of critical			
					system.			

4.25%

² "New piece of equipment"-indicates that the plant did not have this vital piece of equipment installed for reliable operation in 2011.

Hopkinton Hydro Project						
2012 Capital Expenditures Which Are Efficiency Improvements						

<u>No.</u>	Description of Improvements	When Complet ed	<u>Description of</u> Improvement Benefit	Was An O&M Item, An Efficiency Improvement Item, Or Another Item;	Why It Should Be In That Category?	Age at Time of Refurbishment	<u>New</u> <u>Useful</u> <u>Life</u>	Percent of Overall Increase in Production Attributed to this Improvement
1	Refurbished G2 capacitors to avoid shorting.	2012	Complete overhaul of G2 capacitor bank to facilitate more robust connections. Previous capacitors continued to fail. Required for reliability of safety system. Replaced capacitors to maintain system stability and protection of generator from surges caused by instability in grid. Previous system was obsolete and damaged.	Efficiency Improvement	Improved plant availability; Required for reliability of safety system. Replaced capacitors to maintain system stability and protection of generator from surges caused by instability in grid. Previous system was obsolete and damaged.	28 years ¹	10 years	0.50%
	Replaced G2 bearing cover.	2012/ June 2012	During annual inspection G2 bearing cover was found to be loose and wearing shaft. Cover was rebuilt repaired and reinforced to avoid	Efficiency Improvement	Improved plant availability; Cover was rebuilt repaired and reinforced to avoid future failures. Fixed G1 bearing cover to avoid same.	28 years	10 years	0.00%

¹ Plant was purchased in 2008 by Petitioner a 28-year period indicates that the equipment was past its useful life, and that refurbishment replaced original equipment

2012- 3	Installed dry transformer.	2012/ Jun. 2012	future failures. Fixed G1 bearing cover to avoid same. Upgraded and reconfigured powerhouse electrical system. Increases operating efficiency of electrical equipment.	Efficiency Improvement	Increases operating efficiency of electrical equipment. Improvement was made in conjunction with item 2012-1	New piece of equipment ²	20 years	0.50%
2012- 4	Replaced relay- G1 safety air valve.	2012/ Jun. 2012	Replaced relay and circuit control of critical component. Safety air valve was not functional but is required for safe plant operations. Required piece of equipment to maintain safety of plant by reducing torque on turbine during normal and emergency shutdown. Now included on normal shutdown to protect equipment.	Efficiency Improvement	Improved plant availability; Required piece of equipment to maintain safety of plant by reducing torque on turbine during normal and emergency shutdown. Now included on normal shutdown to protect equipment.	28 years	10 years	0.50%
2012-5	Refurbished shaft.	2012/ Sept. 2012	Shaft on G2 turbine was weakened by loose bearing cover. Refurbished shaft.	Efficiency Improvement	Improved plant availability; Shaft on G2 turbine was weakened by loose bearing cover. Refurbished shaft. Improvement was made after item 2012-2 was performed.	28 years	20 years	0.50%
	Refurbished dam.	2012/ July	Refurbished undermined	Efficiency Improvement	Improved plant availability; Reduce	>200 years	100 years	0.00% (See 2008-10 for

² "New piece of equipment"-indicates that the plant did not have this vital piece of equipment installed for reliable operation in 2012.

NHPUC Filing

2012	foundation of dam and	leakage, improved	combined
	by placing. 28 yards	structural stability of	percentage)
	of gunnite in dam.	dam, enable project to	
	-	keep operating.	

2.00%