

## 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 MWh<sup>12</sup> 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 Improvements<sup>13</sup>

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<sup>12</sup> The Applicant has decided to supply this information in MWh as opposed to KWh.

<sup>13</sup> 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.

<b>List of Eligible Improvements</b>		
<b>Year</b>	<b>Description of Improvement</b>	<b>Description of Benefits</b>
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.
<del>2008-5</del>	<del>Replaced couplings on G1 and G2 speed tachometer.</del>	<del>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.</del>
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	<b>Installed new 100 cfm Ingersoll Rand gas powered compressor. (See 2008-2 and 2009-3 for complementing expenditure).</b>	<b>Made trash rack cleaning safer and more efficient for operators, reduced head loss, increased production, cut down time for operators</b>
2008-10	<b>Refurbished dam left side of dam facing upstream. (See 2012-6 for complementing expenditure).</b>	<b>Reduce leakage, improved structural stability of dam, enable project to keep operating. Required and necessary to ensure longevity of dam structure.</b>
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	<b>Installed new Basler 3-P digital relay.</b>	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.
<del>2008-18</del>	<del>Installed new Watt hour meters on G1 and G2.</del>	<del>Watt hour meters had reached end of useful life and needed replacement with industry standard.</del>
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.
<b>2009-3</b>	<b>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).</b>	<b>Keeps air compressor running which is integral part of keeping trash racks clean and maintaining production.</b>
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.
<b>2009-5</b>	<b>Installed new gate limit switches (ordered 2 spare switches). (See 2009-8 and 2010-14 for complementing expenditures).</b>	<b>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.</b>
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.
<b>2009-8</b>	<b>Modified gates for single gate operation. (See 2009-5 and 2010-14 for complementing expenditures).</b>	<b>Reconfigured gate operation by installing new controls (see item 2009-5), increasing production particularly during low flows.</b>
<del>2009-9</del>	<del>Posted dam danger signs.</del>	<del>Brought facility into minimum compliance with FERC dam safety requirements.</del>
<b>2009-10</b>	<b>Installed new small center fan and set up thermostat for floor fans. (See 2008-1 for complementing expenditure).</b>	<b>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.</b>
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.	<del>Upgrade existing system to replace inefficient system, reducing labor costs and increasing safety. Upgraded to minimum conditions of FERC license.</del>
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. Sensor monitors critical flow of oil through the gearbox, preventing overheating and seizure of the gears. Sensor 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 G1 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. Failure to do so would result in complete facility shutdown.
2010-11	Replaced G1 glass flow meter.	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.
<b>2010-14</b>	<b>Replaced hydraulic lines to gates. (See 2009-5 and 2009-8 for complementing expenditures).</b>	<b>Enables gates to operate at higher head and colder temperatures.</b>
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.
<del>2011-3</del>	<del>Tested gearbox oil through Signum for synthetic oil.</del>	<del>Adopted new oil test program to reduce overhead costs and pre-mature oil replacement and to monitor the condition of gearbox and HPU.</del>
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.

<del>2012-2</del>	<del>Replaced G2 bearing cover.</del>	<del>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.</del>
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.
<b>2012-6</b>	<b>Refurbished dam. (See 2008-10 for complementing expenditure).</b>	<b>Refurbished undermined foundation of dam and by placing 28 yards of gunnite in dam.</b>

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:

<b>Year</b>	<b>Baseline Generation (MWh)</b>	<b>Annual Generation (MWh)</b>	<b>Total Aggregate Increase In Electricity production (MWh)</b>	<b>Total Qualified Aggregate Increase In Electricity production (MWh)</b>	<b>Total Qualified Aggregate Increase In Electricity production (Percentage)</b>
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
<b>2008-1</b>	<b>Installed new 24-inch exhaust fan with thermostat and floor fans.</b>	<b>12.50%</b>	<b>42.484</b>	
<b>2008-2</b>	<b>Installed new leaf boom.</b>	<b>12.50%</b>	<b>42.484</b>	
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
<del>2008-5</del>	<del>Replaced couplings on G1 and G2 speed tachometer.</del>	<del>0.00%</del>	<del>0.000</del>	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	
<b>2008-9</b>	<b>Installed new 100 cfm Ingersoll Rand gas powered compressor.</b>	<b>0.00%</b> <b>(See 2008-2 for combined percentage)</b>	<b>0.000</b>	
<b>2008-10</b>	<b>Refurbished dam left side of dam facing upstream.</b>	<b>20.00%</b>	<b>69.974</b>	
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	
<del>2008-18</del>	<del>Installed new Watt-hour meters on G1 and G2.</del>	<del>0.50%</del>	<del>1.699</del>	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	
<b>2009-3</b>	<b>Installed new air compressor starter solenoid (new starter motor in 11/09; new solenoid in 12/09).</b>	<b>0.00%</b> <b>(See 2008-2 for combined percentage)</b>	<b>0.000</b>	Definitely an Eligible Improvement
2009-4	Ordered new fan motors for G1 and G2 after G2 replacement motor burned out.	0.50%	1.699	
<b>2009-5</b>	<b>Installed new gate limit switches (ordered 2 spare switches).</b>	<b>20.00%</b>	<b>69.974</b>	
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 single gate operation.	0.00% (See 2009-5 for combined percentage)	0.000	
<del>2009-9</del>	<del>Posted dam danger signs.</del>	<del>0.00%</del>	<del>0.000</del>	Regulatory Requirement
2009-10	Installed new small center fan and set up thermostat for floor fans.	0.00% (See 2008-1 for combined percentage)	0.000	
2009-11	Installed fuses on transducers in cabinets.	0.50%	1.699	
2009-12	Refurbished G2 gearbox, redipped G2 generator windings and brake coil, installed new bearings and on generator shaft.	0.50%	1.699	
2009-13	Installed new smoke detector and hooked up to sensaphone.	0.25%	0.859	Definitely an Eligible Improvement
2009-14	Installed frazil timer.	0.50%	1.699	
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.	0.50%	1.699	
2009-16	Replaced rotten beams in forebay in front of G1 gates.	0.25%	0.850	Definitely an Eligible Improvement
<del>2009-17</del>	<del>Installed new floating bobble line for boat barrier at dam.</del>	<del>0.00%</del>	<del>0.000</del>	Probably not an Eligible Improvement
2009-18	Replaced turbine bearing bolts on G2.	0.50%	1.699	
2009-19	Replaced burned terminals on primary powerhouse panel.	0.50%	1.699	
2010-1	Installed new vacuum contactor bottles G1 and G2.	0.50%	1.699	
2010-2	Installed new overspeed protection.	0.50%	1.699	
2010-3	Installed new starter on HPU motor.	0.25%	0.850	Definitely an Eligible Improvement
2010-4	Installed new	0.50%	1.699	

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

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

**Hopkinton Hydro Project**  
**2008 Capital Expenditures Which Are Efficiency Improvements**

<u>No.</u>	<u>Description of Improvements</u>	<u>When Started/When Completed</u>	<u>Description of Improvement Benefit</u>	<u>Whether the Improvement Was An O&amp;M Item, An Efficiency Improvement Item, Or Another Item;</u>	<u>Why It Should Be In That Category?</u>	<u>Age at Time of Refurbishment</u>	<u>New Useful Life</u>	<u>Percent of Overall Increase in Production Attributed to this Improvement</u>
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 <sup>1</sup>	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%

<sup>1</sup> “New piece of equipment”-indicates that the plant did not have this vital piece of equipment installed for reliable operation in 2008.

NHPUC Filing

2008-3	Replaced valve gaskets on G1 and G2 safety air valves.	2008/ Jul. 2008	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.	Efficiency Improvement	Improved plant availability; 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.	24 years <sup>2</sup>	5 years	0.50%
2008-4	Rewound burned out coil on G2 air valve.	2008/ Jul. 2008	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.	Efficiency Improvement	Improved plant availability; 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	24 years	4 years	0.25%
2008-5	Replaced couplings on G1 and G2 speed tachometer.	2008/ Sep. 2008	Continual failure of tachometer would shut plant down and reduce production. Replaced	Efficiency Improvement	Improved plant availability; Continual failure of tachometer would shut plant down	<1 year	<1 year	0.00%

<sup>2</sup> 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

NHPUC Filing

			couplings and motor to keep plant on line and running. Dramatic increase in production, as this was a common failure.		and reduce production.			
2008-6	Installed new tachometer-Servotek.	2008/Sep. 2008	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.	Efficiency Improvement	Improved plant availability; Continual failure of tachometer would shut plant down and reduce production.	New piece of equipment	1 year	0.25%
2008-7	Installed new vacuum contactor bottles g1 and g2.	2009/2010	Thermal imager enabled us to locate main vacuum contactor bottle overheating. Replaced before imminent failure. Stocked spare vacuum contactor, with spare bottles.	Efficiency Improvement	Improved plant availability; Thermal imager enabled us to locate main vacuum contactor bottle overheating.	24 years	20 years	0.50%
2008-8	Purchased thermal imager.	Sept. 2009/2012	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	Efficiency Improvement	Improved plant availability; Thermal imager has enabled problems to be discovered before they become critical. Has prevented shutdowns and increased production.	New piece of equipment	15 years	0.50%



NHPUC Filing

			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	<b>Installed new 100 cfm Ingersoll Rand gas powered compressor.</b>	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% <b>(See 2008-2 for combined percentage)</b>
2008-10	<b>Refurbished dam left side of dam facing upstream.</b>	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%

NHPUC Filing

					cleaned.			
2008-12	Installed motion sensor light and handrail.	2008/Oct. 2008	Improved safety for operators and safety of other personnel, reducing risk of fall injury.	Efficiency Improvement	Improved plant availability; personnel able to work faster in safer work place	New piece of equipment	20 years	0.50%
2008-13	Built and installed new 12V dc backup power supply.	2008/Nov. 2008	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.	Efficiency Improvement	Improved plant availability; 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.	New system	20 years	0.50%
2008-14	Installed new Basler 3-P digital relay.	2008/Sept. 2008	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.	Efficiency Improvement	Improved plant availability; Old relay deemed obsolete by utility, extended life of facility by protecting plant during grid instability.	New piece of equipment	30 years	0.25%
2008-15	Ordered new digital tachometer and proximity sensor for G2 I	2008/Dec. 2008	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.	Efficiency Improvement	Improved plant availability; Plant was blowing 250 amp fuses due to inaccurate signal from speed tachometer, causing instability in generation, and throwing plant off line. Brought plant to	New piece of equipment	20 years	0.50%

NHPUC Filing

			There was no feedback on cause of outage. New tachometer brought plant to industry standard using digital controls.		industry standard using digital controls.			
2008-16	Installed 1/3 hp 3-p fan motor with seized bearings on G2 with new motor.	2008/Nov. 2008	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	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. Increase overall efficiency of cooling of gearbox oil. Prevent overheating which can result in significant turbine efficiency loss	24 years	15 years	0.50%
2008-17	Replaced level sensor pressure transducer, installed dessicant with low wattage light bulb.	2008/Nov. 2008	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.	Efficiency Improvement	Improved plant availability; Upgraded cabinet with <input type="checkbox"/> essiccant and heating device to keep moisture out of new transducer, increasing useful life span of transducer.	3 years	10 years	0.50%
2008-18	Installed new Watt-hour meters on G1	2008/Nov. 2008	Watt-hour meters had reached end of useful life and needed	Monitoring Requirement	Needed for Accurate Operation; particularly helpful when trouble	24 years	20 years	0.50%

NHPUC Filing

	and G2.		replacement with industry standard.		shooting causes of outages			
2008-19	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%
2008-20	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%
2008-21	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%

**Hopkinton Hydro Project**  
**2009 Capital Expenditures Which Are Efficiency Improvements**

<u>No.</u>	<u>Description of Improvements</u>	<u>When Started/When Completed</u>	<u>Description of Improvement Benefit</u>	<u>Whether the Improvement Was An O&amp;M Item, An Efficiency Improvement Item, Or Another Item;</u>	<u>Why It Should Be In That Category?</u>	<u>Age at Time of Refurbishment</u>	<u>New Useful Life</u>	<u>Percent of Overall Increase in Production Attributed to this Improvement</u>
2009-1	Ordered new TR5000 from electro-sensors for G2. Installed in April 2009.	2009/ 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.	Efficiency Improvement	Improved plant availability; 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.	New piece of equipment <sup>1</sup>	20 years	0.50%
2009-2	Installed new digital KW meter on G1.	2009/ Jan. 2009	Provides more accurate reading of output, and more reliable trip setting and shut down relay to determine when plant	Efficiency Improvement	Improved plant availability; Provides more accurate reading of output, and more reliable trip setting and shut down relay to	1 year (Replacement made in 2008 failed)	10 years	0.50%

<sup>1</sup> “New piece of equipment”-indicates that the plant did not have this vital piece of equipment installed for reliable operation in 2009.

NHPUC Filing

			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% <b>(See 2008-2 for combined percentage)</b>
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 <sup>2</sup>	20 years	0.50%

<sup>2</sup> 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

NHPUC Filing

2009-5	<b>Installed new gate limit switches (ordered 2 spare switches).</b>	2009/Nov. 2009	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.	Efficiency Improvement	Improved plant availability; Critical component for operation of plant. Without limit switch working, gates would not function and plant could not operate.	25 years	10 years	<b>20.00%</b>
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	<b>Ordered spare time delay 250 amp fuses.</b>	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	<b>Modified gates for single gate operation.</b>	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% <b>(See 2009-5 for combined percentage)</b>
2009-9	<b>Posted dam danger signs.</b>	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	<b>Installed new small center fan and set up thermostat for floor fans.</b>	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% <b>(See 2008-1 for combined percentage)</b>

NHPUC Filing

			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 voltage 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%
2009-13	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%



NHPUC Filing

			frazil ice is present to increase production when normally plant would shut down.		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.	Oct. 2009/ Dec. 2009	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	Improved plant availability; Major overhaul of hydraulic gate cylinders required to extend useful life and reliability of gates.	25 years	15 years	0.50%
2009-16	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%
2009-17	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%
2009-18	Replaced turbine bearing bolts on G2.	Jul. 2009/ Jul. 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%

NHPUC Filing

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

25.75%

**Hopkinton Hydro Project**  
**2010 Capital Expenditures Which Are Efficiency Improvements**

<b><u>No.</u></b>	<b><u>Description of Improvements</u></b>	<b><u>When Started/When Completed</u></b>	<b><u>Description of Improvement Benefit</u></b>	<b><u>Whether the Improvement Was An O&amp;M Item, An Efficiency Improvement Item, Or Another Item;</u></b>	<b><u>Why It Should Be In That Category?</u></b>	<b><u>Age at Time of Refurbishment</u></b>	<b><u>New Useful Life</u></b>	<b><u>Percent of Overall Increase in Production Attributed to this Improvement</u></b>
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 <sup>1</sup>	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 <sup>2</sup>	15 years	0.50%

<sup>1</sup> 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

<sup>2</sup> “New piece of equipment”-indicates that the plant did not have this vital piece of equipment installed for reliable operation in 2010.

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2010-3	Installed new starter on HPU motor.	2010/Jan-10	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.	Efficiency Improvement	Improved plant availability; 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.	26 years	15 years	0.50%
2010-4	Installed new Electrosensor 5000 on G1.	2010/Apr-10	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	Efficiency Improvement	Improved plant availability; 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	New piece of equipment	15 years	0.50%
2010-5	Replaced oil flow sensors.	2010/May-10	Replaced with current industry standard solid state oil flow detection device. Senor monitors critical flow of oil through the gearbox, preventing	Efficiency Improvement	Improved plant availability; Replaced with current industry standard solid state oil flow detection device. Senor monitors critical flow of oil	26 years.	20 years	0.50%

NHPUC Filing

			overheating and seizure of the gears. Senor extends anticipated life of gearbox.		through the gearbox, preventing overheating and seizure of the gears. Senor extends anticipated life of gearbox.			
2010-6	Installed new thermostat on gearbox.	2010/ May-10	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.	Efficiency Improvement	Improved plant availability; 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	26 years.	15 years	0.50%
2010-7	Installed lightning arrestors on GI and G.	2010/ May-10	Installation of lightning surge arrestors on main switchgear. Adds protection to the main power source of the plant.	Efficiency Improvement	Improved plant availability; <b>Installed of lightning surge arrestors on main switchgear. Adds protection to the main power source of the plant..</b>	New piece of equipment	15 years (or until hit by lightning)	0.25%
2010-8	Installed fuses in control cabinets.	2010/ May-10	Fuses protect potential transformers during faults, reducing risk of both catastrophic damage to control panel and system failure.	Efficiency Improvement	Improved plant availability;. Fuses protect potential transformers during faults, reducing risk of both catastrophic damage to control panel and system failure	New piece of equipment	10 years (or until voltage surge)	0.50%
2010-9	Installed G2 safety air valve system operating	2010/ Aug-2010	Coil had failed, been replaced and then failed again. New	Efficiency Improvement	Improved plant availability; New system designed to	2 years. (Rewound coil had failed after 2 years, new	20 years	0.50%

NHPUC Filing

	on compressed air.		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.		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	piece of equipment)		
2010-10	Installed new flexible grease lines to G2 runner bearing.	2010/ Jul-10	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. Failure to do so would result in complete facility shutdown.	Efficiency Improvement	Improved plant availability; Without replacement, catastrophic failure could have occurred due to lack of grease to turbine, shortening operating life of bearing. Failure to do so would result in complete facility shutdown.	26 years.	20 years	0.50%
2010-11	Replaced G1 glass flow meter.	2010/ May-10	Replacement of glass required to ensure proper reading and prevent damage to gearbox.	Efficiency Improvement	Improved plant availability; Replacement of glass required to ensure proper reading and prevent damage to gearbox.	26 years	20 years	0.50%
2010-12	Rebuilt grease pump.	2010/ May-10	Grease flow to main bearing was insufficient; refurbishment of grease pump enabled proper operation and increased operating life of lower bearing.	Efficiency Improvement	Improved plant availability; refurbishment of grease pump enabled proper operation and increased operating life of lower bearing.	26 years	20 years	0.50%

NHPUC Filing

2010-13	Rebuilt dipsticks.	2010/Dec-10	With upgraded dipsticks, improved maintenance and operating life of gearboxes.	Efficiency Improvement	Improved plant availability; With upgraded dipsticks, improved maintenance and operating life of gearboxes.	26 years	30 years	0.50%
2010-14	Replaced hydraulic lines to gates.	2010/Aug-10	Enables gates to operate at higher head and colder temperatures.	Efficiency Improvement	Improved plant availability; Enables gates to operate at higher head and colder temperatures.	26 years	20 years	<b>0.00%</b> (see 2009-5 for combined percentage)

6.25%

**Hopkinton Hydro Project**  
**2011 Capital Expenditures Which Are Efficiency Improvements**

<b><u>No.</u></b>	<b><u>Description of Improvements</u></b>	<b><u>When Started/ When Completed</u></b>	<b><u>Description of Improvement Benefit</u></b>	<b><u>Whether the Improvement Was An O&amp;M Item, An Efficiency Improvement Item, Or Another Item;</u></b>	<b><u>Why It Should Be In That Category?</u></b>	<b><u>Age at Time of Refurbishment</u></b>	<b><u>New Useful Life</u></b>	<b><u>Percent of Overall Increase in Production Attributed to this Improvement</u></b>
2011-1	Refurbished gates with UHMW adhesive on downstream side of gates.	2011/ Mar. 2011	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.	Efficiency Improvement	Improved plant availability; 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.	27 years <sup>1</sup>	10 years	0.50%
2011-2	Installed new oil pump on G1 gearbox.	2011/ May 2011	Replaced with new oil pump which moves oil through the gearbox, preventing overheating and seizure of the gears and extending anticipated life of gearbox.	Efficiency Improvement	Improved plant availability; Replaced with new oil pump which moves oil through the gearbox, preventing overheating and seizure of the gears and extending anticipated life of	27 years	20 years	0.50%

<sup>1</sup> 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



NHPUC Filing

					gearbox.			
2011-3	Tested gearbox oil through Signum for synthetic oil.	2011/Mar. 2011	Adopted new oil test program to reduce overhead costs and pre-mature oil replacement and to monitor the condition of gearbox and HPU.	Efficiency Improvement	Improved plant availability; Adopted new oil test program to reduce overhead costs and pre-mature oil replacement and to monitor the condition of gearbox and HPU.	New maintenance protocol	Perpetual	0.25%
2011-4	Installed new metal roof.	2011/Aug. 2011	Old roof had reached end of previous useful life.	Efficiency Improvement	Improved plant availability; new roof prevents leaks that could short out equipment and take unit off-line.	27 years	20 years	0.25%
2011-5	Replaced seal on G2 at base of generator.	2011/Mar. 2011	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.	Efficiency Improvement	Improved plant availability; 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.	10 years	10 years	0.50%
2011-6	Replaced G1 bearings with SKF 6320-ZC3S1 bearings.	2011/Nov. 2011	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	Efficiency Improvement	Improved plant availability; 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	27 years	10 years	0.50%

NHPUC Filing

			risk of system failure.		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	2011/Nov. 2011	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.	Efficiency Improvement	Improved plant availability; 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.	Modification to 27 year old equipment	10 years	0.50%
2011-8	Replaced batteries and maintainer in DC HPU, spare inverter to keep backup of critical component available	2011/Dec. 2011	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.	Efficiency Improvement	Improved plant availability; 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.	27 years	4 years	0.25%
2011-9	Installed new check valves for HPU	2011/Dec. 2011	Required refurbishment, original component had reached end of useful life expectancy.	Efficiency Improvement	Improved plant availability; Required refurbishment, original component had reached end of useful life expectancy.	27 years	20 years	0.50%

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2011-10	Bought two-stage compressor.	2011/Dec. 2011	Installed more reliable compressor to drive safety air valve for more reliable operation of critical system.	Efficiency Improvement	Improved plant availability; Installed more reliable compressor to drive safety air valve for more reliable operation of critical system.	New piece of equipment <sup>2</sup>	15 years	0.50%
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4.25%

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<sup>2</sup> “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>	<u>Description of Improvements</u>	<u>When Started/ When Completed</u>	<u>Description of Improvement Benefit</u>	<u>Whether the Improvement Was An O&amp;M Item, An Efficiency Improvement Item, Or Another Item;</u>	<u>Why It Should Be In That Category?</u>	<u>Age at Time of Refurbishment</u>	<u>New Useful Life</u>	<u>Percent of Overall Increase in Production Attributed to this Improvement</u>
2012-1	Refurbished G2 capacitors to avoid shorting.	2012/ Apr. 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 <sup>1</sup>	10 years	0.50%
2012-2	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%

<sup>1</sup> 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

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			future failures. Fixed G1 bearing cover to avoid same.					
2012-3	Installed dry transformer.	2012/ Jun. 2012	Upgraded and reconfigured powerhouse electrical system. Increases operating efficiency of electrical equipment.	Efficiency Improvement	Increases operating efficiency of electrical equipment. <b>Improvement was made in conjunction with item 2012-1</b>	New piece of equipment <sup>2</sup>	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. <b>Improvement was made after item 2012-2 was performed.</b>	28 years	20 years	0.50%
2012-6	<b>Refurbished dam.</b>	2012/ July	Refurbished undermined	Efficiency Improvement	Improved plant availability; Reduce	>200 years	100 years	0.00% <b>(See 2008-10 for</b>

<sup>2</sup> “New piece of equipment”-indicates that the plant did not have this vital piece of equipment installed for reliable operation in 2012.

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		2012	foundation of dam and by placing. 28 yards of gunnite in dam.		leakage, improved structural stability of dam, enable project to keep operating.			<b>combined percentage)</b>
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2.00%