

**Appendix K:  
Regional Haze Control  
Measures Selected for  
August 12, 2022 RH-SIP Submittal  
and  
2024 RH-SIP Submittal**

Regional Haze Control  
Measures Selected for  
August 12, 2022 RH-SIP Submittal

**Kaoelehua-Hill Power Plant**

Highest Emission Reduction with Control Measure Below \$5,800/Ton Threshold in Green							
Unit	Control Measure	Cost per Ton	Emission Reduction (Tons)			Total Reduction	Notes
			NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>		
Boiler Hill 5	Fuel Switch from Fuel Oil No. 6 to ULSD	\$4,319	113.2	819.9	21.0	954	Boilers Hill 5 and Hill 6 shall be fired only on ULSD with a maximum fuel sulfur content not to exceed 0.0015% by weight.
Boiler Hill 6	Fuel Switch from Fuel Oil No. 6 to ULSD	\$4,684	70.7	1,345.5	27.5	1,444	
Total Combined Reduction for Switching Fuel---->						2,398	
Boiler Hill 5	LNB w/OFA and/or FGR for fuel oil No. 6	\$1,051	119.7			120	
Boiler Hill 6	LNB w/OFA and/or FGR for fuel oil No. 6	\$598	209.4			209	
Total Combined Reduction for Combustion Controls---->						329	
Boiler Hill 5	Fuel Switch to ULSD + Combustion Controls	\$4,147	183.2	819.9	21.0	1,024	Combustion controls are economically feasible after fuel switch from fuel oil No. 6 to ULSD since control cost is below \$5,800/ton threshold. See Notes a, b, d, e, f, and g.
Boiler Hill 6	Fuel Switch to ULSD + Combustion Controls	\$4,345	212.2	1,345.5	27.5	1,585	
Total Combined Reduction for Fuel Switch and Combustion Controls---->						2,609	
Boiler Hill 5	SCR for Fuel Oil No. 6	\$1,733	207.6			208	
Boiler Hill 6	SCR for Fuel Oil No. 6	\$1,858	281.5			282	
Total Combined Reduction for SCR---->						489	
Boiler Hill 5	Fuel Switch to ULSD + SCR	\$4,152	238.2	819.9	21.0	1,079	SCR is economically feasible after fuel switch from fuel oil No. 6 to ULSD since control cost is below \$5,800/ton threshold. See Notes a, c, d, e, h, and i.
Boiler Hill 6	Fuel Switch to ULSD + SCR	\$4,290	325.4	1,345.5	27.5	1,698	
Total Combined Reduction for Fuel Switch + SCR---->						2,778	
Boiler Hill 5	SCR + Combustion Controls for Fuel Oil No. 6	\$2,116	229.5			230	
Boiler Hill 6	SCR + Combustion Controls for Fuel Oil No. 6	\$2,041	317.6			318	
Total Combined Reduction for SCR + Combustion Controls---->						547	
Boiler Hill 5	SCR + Combustion Controls + ULSD	\$4,242	245.3	819.9	21.0	1,086	SCR and combustion controls are economically feasible after fuel switch to ULSD since control cost is below \$5,800/ton threshold. See Notes a, b, c, d, e, f, h, k, l, and m.
Boiler Hill 6	SCR + Combustion Controls + ULSD	\$4,326	339.6	1,345.5	27.5	1,713	
Total Combined Reduction for SCR +Combustion Controls + ULSD----->						2,799	
Boiler Hill 5	SNCR for Fuel Oil No. 6	\$1,884	119.7			120	SNCR was not evaluated after fuel switch since SCR provides greater control for NO <sub>x</sub> than SNCR. See Note d.
Boiler Hill 6	SNCR for Fuel Oil No. 6	\$1,522	209.4			209	
Total Combined Reduction for SNCR---->						329	
Boiler Hill 5	SNCR + Combustion Controls for Fuel Oil No. 6	\$2,147	163.7			164	SNCR + combustion controls was not evaluated after fuel switch since SCR provides greater control for NO <sub>x</sub> than SNCR. See Note d.
Boiler Hill 6	SNCR + Combustion Controls for Fuel Oil No. 6	\$1,597	245.5			246	
Total Combined Reduction for SNCR plus Combustion Controls---->						409	

**Footnotes:**

- a. Annual cost of fuel switch from fuel oil No. 6 to ULSD for Hill 5 and Hill 6 is \$4,120,758 and \$6,762,141, respectively.
- b. Annual cost of combustion controls for Hill 5 and Hill 6 is \$125,823 and \$125,184, respectively.
- c. Annual cost of SCR for Hill 5 and Hill 6 is \$359,776 and \$522,986, respectively.
- d. Control efficiency for control equipment is based on AP-42 Chapter 1.3 Fuel Oil Combustion, Table 1.3-14 Control Options for Oil-Fired Boilers, 2010.
- e. Total 2017 NO<sub>x</sub> after fuel switch is 252 tpy - 113 tpy = 139 tpy for Hill 5 and 354 tpy - 71 tpy = 283 tpy for Hill 6.
- f. Assuming 50% control efficiency for combustion controls, after fuel switch an additional 70 tpy of NO<sub>x</sub> reduced for Hill 5 and 142 tpy of NO<sub>x</sub> reduced for Hill 6.
- g. Cost of combustion controls after fuel switch is \$4,246,581/1,024 tons = \$4,147/ton for Hill 5 and \$6,887,325/1,585 = \$4,345/ton of pollutant removed for Hill 6.
- h. Assuming 90% control efficiency for SCR, after fuel switch an additional 125 tpy of NO<sub>x</sub> reduced for Hill 5 and a 254.7 tpy of NO<sub>x</sub> reduced for Hill 6.
- i. Total cost of fuel switch + SCR is \$4,480,534/1,079 tons = \$4,152/ton for Hill 5 and \$7,285,127/1,698 tons = \$4,290/ton for Hill 6.
- j. Total NO<sub>x</sub> after fuel switch and combustion controls is 252 tpy - 113 tpy - 70 tpy = 69 tpy for Hill 5 and 354 tpy - 71 tpy - 142 tpy= 141 tpy for Hill 6.
- k. Assuming 90% control efficiency for SCR after fuel switch and combustion controls, an additional 62.1 tpy of NO<sub>x</sub> is reduced for Hill 5 and 126.9 tpy of NO<sub>x</sub> reduced for Hill 6.
- l. Cost of fuel switch + combustion controls + SCR is \$4,606,357/1,086 tons of pollutant removed = \$4,242/ton of pollutant removed for Hill 5.
- m. Cost of fuel switch + combustion controls + SCR is \$7,410,311/1,713 tons of pollutant removed = \$4,326/ton of pollutant removed for Hill 6.

**Kahului Power Plant**

Kahului Power Plant and Highest Emission Reduction from Control Measures Below \$5,800/Ton Threshold in Green							
Unit	Control Measure	Cost per Ton	Emission Reduction (Tons)				Notes
			NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	Total Reduction	
K-1	Fuel switch to ULSD	\$4,935	40.1	292.9	12.4	345	Boilers K-1, K-2, K-3, and K-4 shall be fired only on ULSD with a maximum fuel sulfur content not to exceed 0.0015% by weight.
K-2	Fuel switch to ULSD	\$4,910	38	253.1	8.9	300	
K-3	Fuel switch to ULSD	\$4,920	131.7	897.8	32.6	1,062	
K-4	Fuel switch to ULSD	\$5,156	82.2	775.2	17.6	875	
Total Combined Reduction for Fuel Switch to ULSD---->						2,582	
K-1	LNB w/OFA and/or FGR for Fuel Oil No. 6	\$3,723	18.8			19	
K-2	LNB w/OFA and/or FGR for Fuel Oil No. 6	\$3,239	21.7			22	
K-3	LNB w/OFA and/or FGR for Fuel Oil No. 6	\$803	148.5			149	
K-4	LNB w/OFA and/or FGR for Fuel Oil No. 6	\$2,050	58.2			58	
Total Combined Reduction for Combustion Controls---->						247	
K-1	Fuel switch to ULSD + combustion controls	\$4,956	52.9	292.9	12.4	358	Combustion controls are economically feasible after fuel switch to ULSD since control cost is below \$5,800/ton threshold. See notes a through l.
K-2	Fuel switch to ULSD + combustion controls	\$4,946	69.5	253.1	8.9	332	
K-3	Fuel switch to ULSD + combustion controls	\$4,676	223.1	897.8	32.6	1,154	
K-4	Fuel switch to ULSD + combustion controls	\$5,006	132.5	775.2	17.6	925	
Total Combined Reduction for Fuel Switch to ULSD + Combustion Controls---->						2,769	
K-1	SCR for Fuel Oil No. 6	\$3,719	50.1			50	
K-2	SCR for Fuel Oil No. 6	\$3,795	48.8			49	
K-3	SCR for Fuel Oil No. 6	\$1,456	244.6			245	
K-4	SCR for Fuel Oil No. 6	\$2,381	141.2			141	
Total Combined Reduction for SCR---->						485	
K-1	Fuel Switch to ULSD + SCR	\$5,124	63.2	292.9	12.4	369	SCR is economically feasible after fuel switch to ULSD since control cost is below \$5,800/ton threshold. See notes a through l.
K-2	Fuel Switch to ULSD + SCR	\$5,149	59.9	253.1	8.9	322	
K-3	Fuel Switch to ULSD + SCR	\$4,624	276.5	897.8	32.6	1,207	
K-4	Fuel Switch to ULSD + SCR	\$5,018	172.7	775.2	17.6	966	
Total Combined Reduction for Fuel Switch + SCR---->						2,863	
K-1	SCR + Combustion Controls for Fuel Oil No. 6	\$4,422	58.0			58	
K-2	SCR + Combustion Controls for Fuel Oil No. 6	\$4,595	55.5			56	
K-3	SCR + Combustion Controls for Fuel Oil No. 6	\$1,769	268.6			269	
K-4	SCR + Combustion Controls for Fuel Oil No. 6	\$2,813	162.0			162	
Total Combined Reduction for SCR + Combustion Controls---->						544	
K-1	SCR + Combustion Controls + ULSD	\$5,300	64.5	292.9	12.4	370	SCR + combustion controls + ULSD is economically feasible since control cost is below \$5,800/ton threshold. See notes a through l
K-2	SCR + Combustion Controls + ULSD	\$5,350	61.1	353.1	8.9	423	
K-3	SCR + Combustion Controls + ULSD	\$4,692	284.6	897.8	32.6	1,215	
K-4	SCR + Combustion Controls + ULSD	\$5,120	177.7	775.2	17.6	970	
Total Combined Reduction for SCR + Combustion Controls---->						<b>2,978</b>	
K-1	SNCR	\$6,359	18.8			19	SNCR was not evaluated after fuel switch because SCR provides greater control for NO <sub>x</sub> than SNCR. See Note l.
K-2	SNCR	\$6,178	21.7			22	
K-3	SNCR	\$1,549	148.5			149	
K-4	SNCR	\$3,195	58.2			58	
Total Combined Reduction for SNCR---->						247	
K-1	SNCR + Combustion Controls	\$5,495	34.5			35	SNCR + combustion controls was not evaluated after fuel switch because SCR provides greater control for NO <sub>x</sub> than SNCR. See Note l.
K-2	SNCR + Combustion Controls	\$5,794	35.2			0	
K-3	SNCR + Combustion Controls	\$1,777	196.5			197	
K-4	SNCR + Combustion Controls	\$3,195	99.7			100	
Total Combined Reduction for SNCR + Combustion Controls---->						331	

## Kahului Power Plant

### Footnotes:

a: Annual cost for fuel switch from fuel switch for fuel oil No. 6 to ULSD for K-1, K-2, K-3, and K-4 is \$1,704,479; 1,473,028; \$5,225,092; and \$4,511,548, respectively.

b: Annual cost for combustion controls is \$69,914; \$70,168; \$119,191; and \$119,394 for K-1, K-2, K-3, and K-4, respectively.

c: Annual cost for SCR is \$186,428; \$185,001; \$356,020; and \$336,163 for K-1, K-2, K-3, and K-4, respectively.

d. Control efficiency for control equipment is based on AP-42 Chapter 1.3 Fuel Oil Combustion, Table 1.3-14 Control Options for Oil-Fired Boilers, 2010.

e: Total NO<sub>x</sub> after fuel switch is 65.8 tpy - 40.1 tpy = 25.7 for K-1; 62.3 tpy - 38.0 = 24.3 tpy for K-2; 292.6 tpy - 131.7 tpy = 160.9 tpy for K-3; and 182.7 tpy - 82.2 tpy = 100.5 tpy for K-4.

f: Assuming 50% control efficiency for combustion controls after fuel switch, an additional 12.85 tpy, 12.15 tpy, 80.45 tpy, and 50.25 tpy of NO<sub>x</sub> is removed for K-1, K-2, K-3, and K-4, respectively.

g: Cost for combustion controls after fuel switch, is \$1,774,393/358 ton = \$4,956/ ton for K-1; \$1,543,196/312 ton = \$4,946/ton for K-2; \$5,344,283/1,143 ton = \$4,676/ton for K-3; \$4,630,942/925 ton = \$5,006/ton for K-4.

h: Assuming a 90% control efficiency for SCR after fuel switch, an additional 23.1 tpy, 21.9 tpy, 144.8 tpy, and 90.5 tpy of NO<sub>x</sub> is removed for K-1, K-2, K-3, and K-4, respectively.

i: Cost for SCR after fuel switch is \$1,890,907/369 ton = \$5,124/ ton for K-1; \$1,658,029/322 ton = \$5,149/ton for K-2; \$5,581,112/1,207 ton = \$4,624/ton for K-3; \$4,847,711/966 ton = \$5,018/ton for K-4.

j: Total NO<sub>x</sub> after fuel switch and combustion controls is 25.7 tpy - 12.85 tpy = 12.85 for K-1; 24.3 tpy - 12.15 tpy = 12.15 tpy for K-2; 160.9 tpy - 80.45 tpy for K-3; and 100.5 tpy - 50.25 tpy = 50.25 tpy for K-4.

k: Assuming a 90% control efficiency for SCR after fuel switch and combustion controls, an additional 11.57 tpy, 10.94 tpy, 72.41 tpy, and 45.23 tpy of NO<sub>x</sub> is removed from K-1, K-2, K-3, and K-4, respectively.

l: Cost for SCR + combustion controls after fuel switch is \$1,960,821/370 ton = \$5,300/ton for K-1; \$1,728,197/323 ton = \$5,350/ton for K-2; \$5,700,303/1,215 ton = \$4,692/ton for K-3; \$4,967,105/970 ton = \$5,120/ton for K-4.

**Puna Power Plant**

Highest Emission Reduction from Control Measure Below \$5,800/Ton Threshold in Green							
Unit	Control Measure	Cost per Ton	Emission Reduction (Tons)			Total Reduction	Emissions limit
			NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>		
Boiler	Fuel Switch to ULSD	\$4,697	18.2	183.9	8.3	<b>210</b>	The boilers shall be fired only on ULSD with a maximum fuel sulfur content not to exceed 0.0015% by weight.

**Maalaea Power Plant**

Highest Emission Reduction from Control Measures Below \$5,800/Ton Threshold in Green							
Unit	Control Measure	Cost per Ton	Emission Reduction (Tons)			Total Reduction	Notes
			NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>		
M1	FITR	\$3,030	5.0			5	
M2	FITR	\$5,225	2.9			3	
M3	FITR	\$3,030	5.0			5	
Total Combined Reduction for FITR---->						<b>13</b>	
M7	SCR	\$5,530	110.6			111	
Total Reduction for SCR---->						<b>111</b>	
Total Combined Reduction for FITR and SCR---->						<b>124</b>	

The Effect of Emission Controls on Q/d Metric - Haleakala NP Big Island

Facility: Before Controls	d (Km)	2014				2017				
		Q (tpy)			Q/d	Q (tpy)			Q/d	
		NOx	SO2	PM10		NOx	SO2	PM10		
HELCO - Kanoelehua-Hill	147.01	611	1852	56	17	609	2167	57	19	
MECO - Kahului	26.49	483	1634	60	82	603	2221	84	110	
MECO - Maalaea	25.52	2114	549	148	110	2786	235	144	124	

Facility: After Single Control Method Applied	d (Km)	Fuel-Switch to ULSD				SCR				SNCR				Combustion Controls				FITR				
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d	
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10		
HELCO - Kanoelehua-Hill	147.01	421	1.73	8.6	3	116	2167	57	16	276	2167	57	17	333	2167	57	17	N/A	N/A	N/A	NA	
MECO - Kahului	26.49	314	1.78	12.7	12	119	2221	84	92	356	2221	84	100	247	2221	84	96	N/A	N/A	N/A	NA	
MECO - Maalaea	25.52	N/A	N/A	N/A	N/A	456	235	144	33	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2773	235	144	124

Facility: After All Control Methods within Control Cost Threshold Are Applied	d (Km)	Control Methods within Cost Threshold					Q (tpy)			Final Q/d
		ULSD	SCR	SNCR	Comb. Cntrls.	FITR	NOx	SO2	PM10	
		HELCO - Kanoelehua-Hill: Hill 5 and Hill 6	147.01	✓	✓		✓		24	2
MECO - Kahului: K-1, K-2, K-3, K-4	26.49	✓	✓		✓		15	2	12	1.1
MECO - Maalaea: FITR for M1, M2, M3; SCR for M7	25.52		✓			✓	2662	N/A	N/A	104.3

The Effect of Emission Controls on Q/d Metric - Haleakala NP Small Island

Facility: Before Controls	d (Km)	2014				2017			
		Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	147.66	611	1852	56	17	609	2167	57	19
MECO - Kahului	50.16	483	1634	60	43	603	2221	84	58
MECO - Maalaea	48.49	2114	549	148	58	2786	235	144	65

Facility: After Single Control Method Applied	d (Km)	Fuel-Switch to ULSD				SCR				SNCR				Combustion Controls				FITR			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	147.66	421	1.73	8.6	3	116	2167	57	16	276	2167	57	17	333	2167	57	17	N/A	N/A	N/A	NA
MECO - Kahului	50.16	314	1.78	12.7	7	119	2221	84	48	356	2221	84	53	247	2221	84	51	N/A	N/A	N/A	NA
MECO - Maalaea	48.49	N/A	N/A	N/A	N/A	456	235	144	17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2773	235	144	65

Facility: After All Control Methods within Control Cost Threshold Are Applied	d (Km)	Control Methods within Cost Threshold					Q (tpy)			Final Q/d
		ULSD	SCR	SNCR	Comb. Cntrls.	FITR	NOx	SO2	PM10	
		HELCO - Kanoelehua-Hill: Hill 5 and Hill 6	147.66	✓	✓		✓		24	2
MECO - Kahului: K-1, K-2, K-3, K-4	50.16	✓	✓		✓		15	2	12	0.6
MECO - Maalaea: FITR for M1, M2, M3; SCR for M7	48.49		✓			✓	2662	N/A	N/A	54.9



### The Effect of Emission Controls on Q/d Metric - Volcanoes NP

Facility: Before Controls	d (Km)	2014				2017			
		Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	34.53	611	1852	56	<b>73</b>	609	2167	57	<b>82</b>
HELCO - Puna	27.46	70	524	29	<b>23</b>	23	187	11	<b>8</b>
MECO - Kahului	176.82	483	1634	60	<b>12</b>	603	2221	84	<b>16</b>
MECO - Maalaea	169.61	2114	549	148	<b>17</b>	2786	235	144	<b>19</b>

Facility: After Single Control Method Applied	d (Km)	After Fuel-Switch to ULSD				After SCR				After SNCR				Combustion Controls				FITR			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	34.53	421	1.73	8.6	<b>12</b>	116	2167	57	<b>68</b>	276	2167	57	<b>72</b>	333	2167	57	<b>74</b>	N/A	N/A	N/A	<b>N/A</b>
HELCO - Puna	27.46	4.8	0.15	1.65	<b>0.2</b>	9.8	187	11	<b>8</b>	15	187	11	<b>8</b>	15	187	11	<b>8</b>	N/A	N/A	N/A	<b>N/A</b>
MECO - Kahului	176.82	314	1.78	12.7	<b>2</b>	119	2221	84	<b>14</b>	356	2221	84	<b>15</b>	247	2221	84	<b>14</b>	N/A	N/A	N/A	<b>N/A</b>
MECO - Maalaea	169.61	N/A	N/A	N/A	<b>N/A</b>	456	235	144	<b>5</b>	N/A	N/A	N/A	<b>N/A</b>	N/A	N/A	N/A	<b>N/A</b>	2773	235	144	<b>19</b>

Facility: After All Control Methods within Control Cost Threshold Are Applied	d (Km)	Control Methods within Cost Threshold					Q (tpy)			Final Q/d
		ULSD	SCR	SNCR	Comb. Cntrls.	FITR	NOx	SO2	PM10	
		HELCO - Kanoelehua-Hill: Hill 5 and Hill 6	34.53	✓	✓		✓		24	2
HELCO - Puna	27.46	✓					4.8	0.15	1.65	<b>0.2</b>
MECO - Kahului: K-1, K-2, K-3, K-4	176.82	✓	✓		✓		15	2	12	<b>0.2</b>
MECO - Maalaea: FITR for M1, M2, M3; SCR for M7	169.61		✓			✓	2662	N/A	N/A	<b>15.7</b>

### The Effect of Emission Controls on Q/d Metric - Volcanoes NP Olaa Tract

Facility: Before Controls	d (Km)	2014				2017			
		Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	25.69	611	1852	56	<b>98</b>	609	2167	57	<b>110</b>
HELCO - Puna	23.01	70	524	29	<b>27</b>	23	187	11	<b>10</b>
MECO - Kahului	197.82	483	1634	60	<b>11</b>	603	2221	84	<b>15</b>
MECO - Maalaea	191.85	2114	549	148	<b>15</b>	2786	235	144	<b>16</b>

Facility: After Single Control Method Applied	d (Km)	After Fuel-Switch to ULSD				After SCR				After SNCR				Combustion Controls				FITR			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	25.69	421	1.73	8.6	<b>17</b>	116	2167	57	<b>91</b>	276	2167	57	<b>97</b>	333	2167	57	<b>100</b>	N/A	N/A	N/A	<b>N/A</b>
HELCO - Puna	23.01	4.8	0.15	1.65	<b>0.3</b>	9.8	187	11	<b>9</b>	15	187	11	<b>9</b>	15	187	11	<b>9</b>	N/A	N/A	N/A	<b>N/A</b>
MECO - Kahului	197.82	314	1.78	12.7	<b>2</b>	119	2221	84	<b>12</b>	356	2221	84	<b>13</b>	247	2221	84	<b>13</b>	N/A	N/A	N/A	<b>N/A</b>
MECO - Maalaea	191.85	N/A	N/A	N/A	<b>N/A</b>	456	235	144	<b>4</b>	N/A	N/A	N/A	<b>N/A</b>	N/A	N/A	N/A	<b>N/A</b>	2773	235	144	<b>16</b>

Facility: After All Control Methods within Control Cost Threshold Are Applied	d (Km)	Control Methods within Cost Threshold					Q (tpy)			Final Q/d
		ULSD	SCR	SNCR	Comb. Cntrls.	FITR	NOx	SO2	PM10	
		HELCO - Kanoelehua-Hill: Hill 5 and Hill 6	25.69	✓	✓		✓		24	2
HELCO - Puna	23.01	✓					4.8	0.15	1.65	<b>0.3</b>
MECO - Kahului: K-1, K-2, K-3, K-4	197.82	✓	✓		✓		15	2	12	<b>0.1</b>
MECO - Maalaea: FITR for M1, M2, M3; SCR for M7	191.85		✓			✓	2662	N/A	N/A	<b>13.9</b>

# Regional Haze Control Measures Selected for 2024 RH-SIP Submittal

Kaoelehua-Hill Power Plant							
Emission Reduction with Control Measure in Green							
Unit	Control Measure	Cost per Ton	Emission Reduction (Tons)			Notes	
			NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>		Total Reduction
Boiler Hill 5	Shut Down by December 31, 2028	N/A	251.5	820.6	24.7	1,097	See Note a and b.
Boiler Hill 6	Shut Down by December 31, 2028	N/A	353.6	1,346.6	32.4	1,733	
Total Combined Reduction for Switching Fuel---->						2,829	
a.Hawaiian Electric committed to an enforceable shutdown of Boilers Hill 5 and Hill 6 by December 31, 2028. Therefore, the four factor analysis does not apply.							
b: The combustion turbine generator and diesel engine generators were considered limited use units.							

Kahului Power Plant							
Kahului Power Plant and Highest Emission Reduction from Control Measures Below \$5,800/Ton Threshold in Green							
Unit	Control Measure	Cost per Ton	Emission Reduction (Tons)				Notes
			NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	Total Reduction	
K-1	Shut Down by December 31, 2028	N/A	65.8	293.1	14.6	374	See Note a.
K-2	Shut Down by December 31, 2028	N/A	62.3	253.3	10.5	326	
K-3	Shut Down by December 31, 2028	N/A	292.6	898.5	38.4	1,230	
K-4	Shut Down by December 31, 2028	N/A	182.7	775.8	20.7	979	
Total Combined Reduction for Switching Fuel---->						2,908	

a: Maui Electric committed to an enforceable shut down of Boilers K-1, K-2, K-3, and K-4 by December 31, 2028. Therefore, the four factor analysis does not apply.

Puna Power Plant and Highest Emission Reduction from Control Measure Below \$6,800/Ton Threshold in Green							
Unit	Control Measure	Cost per Ton	Emission Reduction (Tons)				Emissions limit
			NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	Total Reduction	
Boiler	Fuel Switch to ULSD	\$5,804	4.5	183.9	8.3	197	The Puna Boiler shall be fired only on ULSD with a maximum fuel sulfur content not to exceed 0.0015% by weight.

Maalaea Power Plant Emission Reduction from Control Measures in Green (\$6,800 Cost Threshold)							
Unit	Control Measure	Cost per Ton	Emission Reduction (Tons)				Notes
			NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	Total Reduction	
M1	FITR	\$5,328	5.0			5	
M3	FITR	\$5,328	5.0			5	
Total Combined Reduction for FITR---->						<b>10</b>	
M7	SCR or (shut down)	\$7,753	110.6(122.9)	(1.2)	(1.2)	110.6(125.3)	Control cost based on remaining useful life of 10 years (time from when SCR could be installed by end of 2027 and unit shut down date by end of 2037). <sup>a</sup>
M10	SCR or (shut down)	\$7,864	522.3(580.3)	(11.6)	(10.9)	522.3(602.8)	Control cost based on remaining useful life of 3 years (time from when SCR could be installed by end of 2027 and unit shut down date by end of 2030).
M11	SCR or (shut down)	\$7,174	455.6(506.2)	(10.1)	(9.5)	455.6(525.8)	Control cost based on remaining useful life of 3 years (time from when SCR could be installed by end of 2027 and unit shut down date by end of 2032). <sup>a</sup>
M12	SCR or (shut down)	\$7,256	365.3(405.9)	(11.4)	(19.0)	365.3(436.3)	Control cost based on remaining useful life of 10 years (time from when SCR could be installed by end of 2027 and unit shut down date by end of 2037). <sup>a</sup>
M13	SCR or (shut down)	\$7,020	377.6(419.5)	(11.0)	(19.1)	377.6(449.6)	Control cost based on remaining useful life of 10 years (time from when SCR could be installed by end of 2027 and unit shut down date by end of 2037). <sup>a</sup>
Total Reduction for SCR or (shut down)---->						<b>1831.4(2139.8)</b>	
Total Combined Reduction for FITR and SCR or (shut down)---->						<b>1841.4(2149.8)</b>	

a. Provided option to either install SCR or shut down unit.

The Effect of Emission Controls on Q/d Metric - Haleakala NP Big Island

Facility: Before Controls	d (Km)	2014				2017			
		Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	147.01	611	1852	56	17	609	2167	57	19
MECO - Kahului	26.49	483	1634	60	82	603	2221	84	110
MECO - Maalaea	25.52	2114	549	148	110	2786	235	144	124

Facility: After Single Control Method Applied	d (Km)	Fuel-Switch to ULSD				SNCR				Combustion Controls			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	147.01	421	1.73	8.6	3	276	2167	57	17	333	2167	57	17
MECO - Kahului	26.49	314	1.78	12.7	12	356	2221	84	100	247	2221	84	96
MECO - Maalaea	25.52	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Facility: After Single Control Method Applied	d (Km)	FITR				SCR				Shut Down			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	147.01	N/A	N/A	N/A	N/A	116	2167	57	16	609	2167	57	19
MECO - Kahului	26.49	N/A	N/A	N/A	N/A	119	2221	84	92	603	2221	84	110
MECO - Maalaea	25.52	2776	235	144	124	955	235	144	52	2786	235	144	124

Facility: After All Control Methods within Control Cost Threshold Are Applied	d (Km)	Control Methods within Cost Threshold					Q (tpy)			Final Q/d	
		ULSD	SNCR	Comb. Cntrls.	FITR	SCR	Shut Down	NOx	SO2		PM10
		HELCO - Kanoelehua-Hill: Shut Down Hill 5 and Hill 6	147.01						✓	4.2	0.0
MECO - Kahului: Shut Down K-1, K-2, K-3, K-4	26.49						✓	0.0	0.0	0.0	N/A
MECO - Maalaea: FITR for M1 and M3; SCR for M7, and M10 - M13	25.52				✓	✓		944.6	N/A	N/A	37.01
MECO - Maalaea: FITR for M1 and M3; Shut Down M7, and M10 - M13	25.52				✓		✓	636.2	N/A	N/A	24.93

The Effect of Emission Controls on Q/d Metric - Haleakala NP Small Island

Facility: Before Controls	d (Km)	2014				2017			
		Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	147.66	611	1852	56	17	609	2167	57	19
MECO - Kahului	50.16	483	1634	60	43	603	2221	84	58
MECO - Maalaea	48.49	2114	549	148	58	2786	235	144	65

Facility: After Single Control Method Applied	d (Km)	Fuel-Switch to ULSD				SNCR				Combustion Controls			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	147.66	421	1.73	8.6	3	276	2167	57	17	333	2167	57	17
MECO - Kahului	50.16	314	1.78	12.7	7	356	2221	84	53	247	2221	84	51
MECO - Maalaea	48.49	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Facility: After Single Control Method Applied	d (Km)	FITR				SCR				Shut Down			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	147.66	N/A	N/A	N/A	N/A	116	2167	57	16	609	2167	57	19
MECO - Kahului	50.16	N/A	N/A	N/A	N/A	119	2221	84	48	603	2221	84	58
MECO - Maalaea	48.49	2776	235	144	65	955	235	144	28	2786	235	144	65

Facility: After All Control Methods within Control Cost Threshold Are Applied	d (Km)	Control Methods within Cost Threshold						Q (tpy)			Final Q/d
		ULSD	SNCR	Comb. Cntrls.	FITR	SCR	Shut Down	NOx	SO2	PM10	
		HELCO - Kanoelehua-Hill: Shut Down Hill 5 and Hill 6	147.66						✓	4.2	0.0
MECO - Kahului: Shut Down K-1, K-2, K-3, K-4	50.16						✓	0.0	0.0	0.0	0.00
MECO - Maalaea: FITR for M1, M2, M3; SCR for M7	48.49				✓	✓		944.6	N/A	N/A	19.48
MECO - Maalaea: FITR for M1 and M3; Shut Down M7, and M10 - M13	48.49				✓		✓	636.2	N/A	N/A	13.12



The Effect of Emission Controls on Q/d Metric - Volcanoes NP

Facility: Before Controls	d (Km)	2014				2017			
		Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	34.53	611	1852	56	73	609	2167	57	82
HELCO - Puna	27.46	70	524	29	23	23	187	11	8
MECO - Kahului	176.82	483	1634	60	12	603	2221	84	16
MECO - Maalaea	169.61	2114	549	148	17	2786	235	144	19

Facility: After Single Control Method Applied	d (Km)	After Fuel-Switch to ULSD				After SNCR				Combustion Controls			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	34.53	421	1.73	8.6	12	276	2167	57	72	333	2167	57	74
HELCO - Puna	27.46	4.8	0.15	1.65	0.2	15	187	11	8	15	187	11	8
MECO - Kahului	176.82	314	1.78	12.7	2	356	2221	84	15	247	2221	84	14
MECO - Maalaea	169.61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Facility: After Single Control Method Applied	d (Km)	FTR				After SCR				Shut Down			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	34.53	N/A	N/A	N/A	N/A	116	2167	57	68	609	2167	57	82
HELCO - Puna	27.46	N/A	N/A	N/A	N/A	9.8	187	11	8	23	187	11	8
MECO - Kahului	176.82	N/A	N/A	N/A	N/A	119	2221	84	14	603	2221	84	16
MECO - Maalaea	169.61	2776	235	144	19	955	235	144	8	2786	235	144	19

Facility: After All Control Methods within Control Cost Threshold Are Applied	d (Km)	Control Methods within Cost Threshold						Q (tpy)			Final Q/d
		ULSD	SNCR	Comb. Cntrls.	FTR	SCR	Shut Down	NOx	SO2	PM10	
		HELCO - Kanoelehua-Hill: Shut Down Hill 5 and Hill 6	34.53					✓	4.2	0.0	0.1
HELCO - Puna	27.46	✓					18.5	3.1	2.3	0.87	
MECO - Kahului: Shut Down K-1, K-2, K-3, K-4	176.82					✓	0.0	0.0	0.0	N/A	
MECO - Maalaea: FTR for M1, M2, M3; SCR for M7	169.61				✓	✓	944.6	N/A	N/A	5.57	
MECO - Maalaea: FTR for M1 and M3; Shut Down M7, and M10 - M13	169.61				✓	✓	636.2	N/A	N/A	3.75	

The Effect of Emission Controls on Q/d Metric - Volcanoes NP Olaa Tract

Facility: Before Controls	d (Km)	2014				2017			
		Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	25.69	611	1852	56	98	609	2167	57	110
HELCO - Puna	23.01	70	524	29	27	23	187	11	10
MECO - Kahului	197.82	483	1634	60	11	603	2221	84	15
MECO - Maalaea	191.85	2114	549	148	15	2786	235	144	16

Facility: After Single Control Method Applied	d (Km)	After Fuel-Switch to ULSD				After SNCR				Combustion Controls			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	25.69	421	1.73	8.6	17	276	2167	57	97	333	2167	57	100
HELCO - Puna	23.01	4.8	0.15	1.65	0.3	15	187	11	9	15	187	11	9
MECO - Kahului	197.82	314	1.78	12.7	2	356	2221	84	13	247	2221	84	13
MECO - Maalaea	191.85	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Facility: After Single Control Method Applied	d (Km)	FITR				After SCR				Shut Down			
		Q (tpy)			Q/d	Q (tpy)			Q/d	Q (tpy)			Q/d
		NOx	SO2	PM10		NOx	SO2	PM10		NOx	SO2	PM10	
HELCO - Kanoelehua-Hill	25.69	N/A	N/A	N/A	N/A	116	2167	57	91	609	2167	57	110
HELCO - Puna	23.01	N/A	N/A	N/A	N/A	9.8	187	11	9	23	187	11	10
MECO - Kahului	197.82	N/A	N/A	N/A	N/A	119	2221	84	12	603	2221	84	15
MECO - Maalaea	191.85	2776	235	144	16	955	235	144	7	2786	235	144	16

Facility: After All Control Methods within Control Cost Threshold Are Applied	d (Km)	Control Methods within Cost Threshold						Q (tpy)			Final Q/d
		ULSD	SNCR	Comb. Cntrls.	FITR	SCR	Shut Down	NOx	SO2	PM10	
		HELCO - Kanoelehua-Hill: Hill 5 and Hill 6	25.69						✓	4.2	0.0
HELCO - Puna	23.01	✓						18.5	3.1	2.3	1.04
MECO - Kahului: K-1, K-2, K-3, K-4	197.82						✓	0.0	0.0	0.0	N/A
MECO - Maalaea: FITR for M1, M2, M3; SCR for M7	191.85				✓	✓		944.6	N/A	N/A	4.92
MECO - Maalaea: FITR for M1 and M3; Shut Down M7, and M10 - M13	191.85				✓		✓	636.2	N/A	N/A	3.32