



SECTION 6: EMISSIONS REDUCTIONS

This section discusses and presents an estimate of the reductions that will be achieved within the first five-year window of the Clean Air Action Plan by fully implementing the plan measures. The reductions represent the amount of emissions that would have been emitted in the absence of the corresponding control measure.

As discussed in Section 6.1, implementing the Clean Air Action Plan measures targeting vehicles, equipment, and vessels servicing the ports will result in a more than 50% reduction in diesel particulate matter (DPM) emissions (a known toxic air contaminant), over 45% reduction in oxides of nitrogen (NO_x), a precursor to the formation of photochemical smog, and greater than 40% reduction in oxides of sulfur (SO_x) which can form sulfuric acid when combined with water in the atmosphere. The estimated reductions achieved by the Clean Air Action Plan are over and above those reductions associated with regulatory programs either implemented or proposed by the California Air Resources Board. One such program, the ARB's Goods Movement Plan (GMP), is discussed in more detail in Section 6.2 and the estimated benefits of both the GMP and the Clean Air Action Plan are compared with the reductions projected to be achievable by the report issued by the No Net Increase (NNI) Task Force initiated by the former mayor of the City of Los Angeles.

While the NNI projections of emission reductions are often greater than those of the CAAP, it must be stressed that the NNI measures were conceptual measures developed without clear implementation methods and it is doubtful that all of the measures could have been implemented as written. In contrast, the CAAP measures have been designed with clear implementation mechanisms. The reduction estimates for CAAP measures have in many cases been conservative in that they are based on anticipated lease opening dates, while more aggressive implementation mechanisms, such as tariffs or early lease openings, will be evaluated and implemented if feasible, which would speedup the estimated emission reductions.

6.1 Clean Air Action Plan Reductions

It is important to note that the Clean Air Action Plan measures were developed in order to achieve the greatest amount of emission reductions possible, and thereby reducing the health risk associated with port-related operations as expeditiously as practicable given the implementation constraints of lease negotiation availability, potential funding sources and amounts, the limits of currently available emission reduction technology, and the viability of implementation by tariff. The plan does not focus on reducing emissions to, or maintaining emission at a particular level (such as the emissions estimated for some past year).

One issue that affects the presentation of emission reductions over a multi-year period is that of growth in port operations and resulting emissions. It is difficult to reliably estimate the growth in port operations over the period covered by the plan because of unknowns such as economic



development rates, manufacturing and shipping patterns, and physical or technological changes to transportation modes such as ocean-going vessels. Because of this difficulty, the Clean Air Action Plan has been developed without a specific set of growth assumptions. Instead, the measures have been developed with a focus on opportunities for implementation to ensure that what is planned has the highest probability of full implementation.

However, growth in port operations is important and is not being ignored. Growth will be separately addressed by the Ports after completion of the 2005 emissions inventory updates which are currently being developed. These inventories will provide a means of evaluating the changes in emissions (increases or decreases) that have occurred since the development of the 2001/2002 port emissions inventories, and will serve as a basis for estimating future growth rates. Before this process has been completed, and in order to compare the effectiveness of the Clean Air Action Plan with that of the GMP and NNI, the Clean Air Action plan emission reductions have been scaled to the growth estimates projected by ARB in their GMP (See Section 6.2).

Tables 6.1 and 6.2 present the DPM and NO_x emission reductions attributable to the Clean Air Action Plan. The ton-per-year inventory estimates included in these tables reflects the best information on emissions and growth available at this time, taking into account changes in methods and inventory data since the development of the 2001/2002 port emissions inventories. The emission estimates for heavy-duty diesel trucks were derived from the 2001/2002 mileage estimates for trucks serving the Ports of Los Angeles and Long Beach, respectively, updated to reflect new activity information from the Ports and revised emission rate information from the ARB. The emission estimates from ocean-going vessels are those from the 2001 Port of Los Angeles and 2002 Port of Long Beach emissions inventories. The Cargo Handling Equipment emission estimates are the draft estimates developed for the 2005 port-wide inventory updates for the Ports of Long Beach and Los Angeles. For all of these source categories, the year-by-year increase or decrease in emissions is based on the growth assumptions developed by the ARB for their GMP, using their estimates of “no-GMP” changes in emissions (changes that would occur due to existing regulations but not due to any GMP measures) for south coast international goods movement.

It should be noted that the ARB’s estimates of emissions related to international goods movement as presented in their GMP are not necessarily the same as the Ports’ estimates of port-related emissions. The 2005 emissions inventory updates for each port, due to be completed later this year, will provide information on the actual rate of emissions growth over the period from the 2001/2002 baseline emissions inventories through 2005, and annual updates to the emissions inventories will provide one mechanism for evaluating the effects and effectiveness of the Clean Air Action Plan. Although the ARB’s international goods movement emission estimates are not precisely the same as the Ports’ emission estimates, they cover essentially the same emission sources and have been used as a consistent basis for the comparison of the Clean Air Action Plan with the GMP and the NNI report.



For each measure, Tables 6.1 and 6.2 list the estimated emission reductions in tons per year, and the percentages that those reductions represent of the assumed base emissions. For the OGV measures, the overall percent reductions are also listed. Because there are several OGV measures with overlapping effects, the overall reductions depend upon the sequencing of implementation, such that the final magnitude of reductions achieved by any one measure will depend on the order in which measures are enacted. Therefore, the final sum of the OGV measure reductions is different from the total of the individual OGV measure reductions shown in the tables.

Although not listed in the tables, Clean Air Action Plan measures focused on locomotives and harbor craft will also result in emission reductions. For example, the MOU between the Ports and the local switching railroad will result in the replacement of 20 old switching locomotives with new Tier 2 units, and includes provisions for testing and installing DPM emission control devices, testing various alternative technology switching locomotives, and purchasing ultra-low emission locomotives whenever additional locomotives are added to the fleet. The estimated reductions from this measure are 3 tons per year of DPM and 163 tons per year of NO_x attributable to the change to Tier 2 locomotives. Additional reductions will come from control device installations and use of alternative technology locomotives.

Locomotive and harbor craft emission reductions will be estimated in more detail as these measures are more fully developed and implemented.



Table 6.1: Clean Air Action Plan Control Measure DPM Reductions

HDV Measures	'06/'07	'07/'08	'08/'09	'09/'10	'10/'11
Assumed base emissions	811	734	657	580	560
SPBP-HDV 1	22	180	301	367	454
	3%	25%	46%	63%	81%
	0	0	0	0	0
OGV Measures	'06/'07	'07/'08	'08/'09	'09/'10	'10/'11
Assumed base emissions before regulation	2,298	2,421	2,544	2,667	2,780
ARB Aux Engine Rule	83	174	183	197	211
	4%	7%	7%	7%	8%
Assumed base emissions after regulation	2,215	2,247	2,361	2,470	2,569
SPBP-OGV 1 (no PM reduction)	0	0	0	0	0
	0%	0%	0%	0%	0%
SPBP-OGV 2	5	5	11	26	64
	0.2%	0.2%	0.4%	1.0%	2.5%
SPBP-OGV 3	2	3	14	13	9
	0.1%	0.1%	0.6%	0.5%	0.4%
SPBP-OGV 4	66	250	506	586	634
	3%	11%	21%	24%	25%
SPBP-OGV 5	52	136	208	241	261
	2%	6%	9%	10%	10%
Overall percent reduction SPBPCAAP measures	6%	17%	30%	33%	35%
CHE Measures	'06/'07	'07/'08	'08/'09	'09/'10	'10/'11
Assumed base emissions before regulation	128	116	104	91	85
ARB CHE Regulation	8	35	52	51	52
	7%	30%	50%	56%	61%
Assumed base emissions after regulation	120	81	52	40	33
SPBP-CHE 1	3	5	6	6	6
	3%	6%	12%	14%	19%



Table 6.2: Clean Air Action Plan Control Measure NOx Reductions

HDV Measures	'06/'07	'07/'08	'08/'09	'09/'10	'10/'11
Assumed base emissions	9,817	9,591	9,365	9,139	9,129
SPBP-HDV 1	195	1,719	3,131	4,382	5,704
	2%	18%	33%	48%	62%

OGV Measures	'06/'07	'07/'08	'08/'09	'09/'10	'10/'11
Assumed base emissions	23,276	24,416	25,556	26,696	27,801
before regulation					
ARB Aux Engine Rule	226	473	495	517	539
	1%	2%	2%	2%	2%
Assumed base emissions	23,050	23,943	25,061	26,179	27,262
after regulation					
SPBP-OGV 1	2,950	4,508	6,198	6,475	6,743
	13%	19%	25%	25%	25%
SPBP-OGV 2	165	184	428	1,036	2,542
	1%	1%	2%	4%	9%
SPBP-OGV 3	0	9	27	32	35
	0.0%	0.0%	0.1%	0.1%	0.1%
SPBP-OGV 4	76	302	617	716	777
	0.3%	1.3%	2.5%	2.7%	2.8%
SPBP-OGV 5	457	1,210	1,850	2,147	2,330
	2%	5%	7%	8%	9%
Overall percent reduction					
SPBPCAAP measures	15%	24%	33%	35%	40%

CHE Measures	'06/'07	'07/'08	'08/'09	'09/'10	'10/'11
Assumed base emissions	3,689	3,575	3,462	3,348	3,145
before regulation					
ARB CHE Regulation	117	705	1,146	1,112	1,106
	3%	20%	33%	33%	35%
Assumed base emissions	3,572	2,870	2,316	2,236	2,039
after regulation					
SPBP-CHE 1	120	178	256	287	302
	3%	6%	11%	13%	15%

6.2 Comparison with Other Studies

Although the Clean Air Action Plan does not focus on reducing emissions to a particular level or to some “baseline year,” but rather attempts to define a series of specific, effective measures that will achieve significant emission reductions and form the basis for additional measures, comparisons will be made between the planned effectiveness of the Clean Air Action Plan measures and other, similar programs, specifically ARB’s GMP and the NNI report.



For purposes of this comparison, the “assumed base emissions” listed for each emission source type and calendar year is the inventory as estimated by CARB that served as the basis of their Goods Movement Plan.

Figures 6.1 and 6.2 provide a graphical illustration of the DPM and NO_x emissions estimated to remain after implementation of the Clean Air Action Plan, the GMP, and NNI. In these charts, the “projected growth” emissions line represents the emissions as estimated by the ARB that would occur with normal growth and the effect of regulations in place as of October, 2005. The “GMP” line represents the ARB’s estimates of emissions that will occur after implementation of their GMP measures for South Coast ports and international goods movement. The “NNI” line represents emissions that the NNI report estimated would have occurred had the measures contained in that report been successfully implemented. The “CAAP” line represents emissions after implementation of the Clean Air Action plan measures.

These charts have been prepared as a means of comparing the relative effectiveness of the plans as they have been conceived, independent of the synergies that will occur between, for example, the GMP and the Clean Air Action Plan. Because the GMP will affect many of the same types of emission sources as the Clean Air Action Plan (e.g., for cargo handling equipment), the actual emissions after implementation of both plans will be lower than either of the relevant lines on the charts would indicate.

Figure 6.1: Comparison of DPM “Emissions Remaining” – All Source Categories

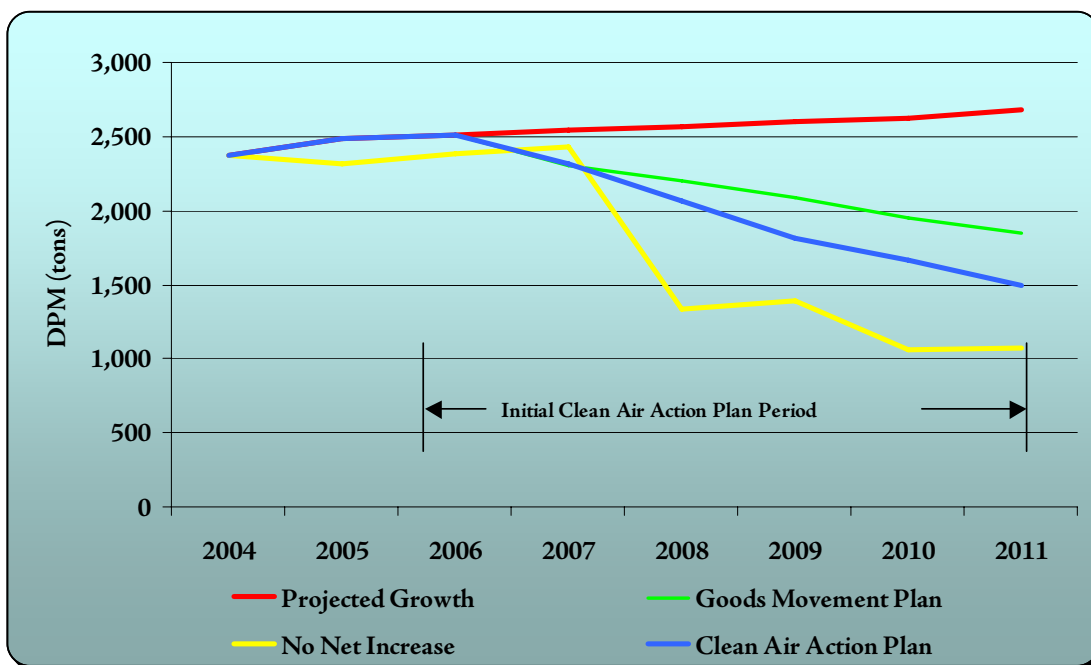
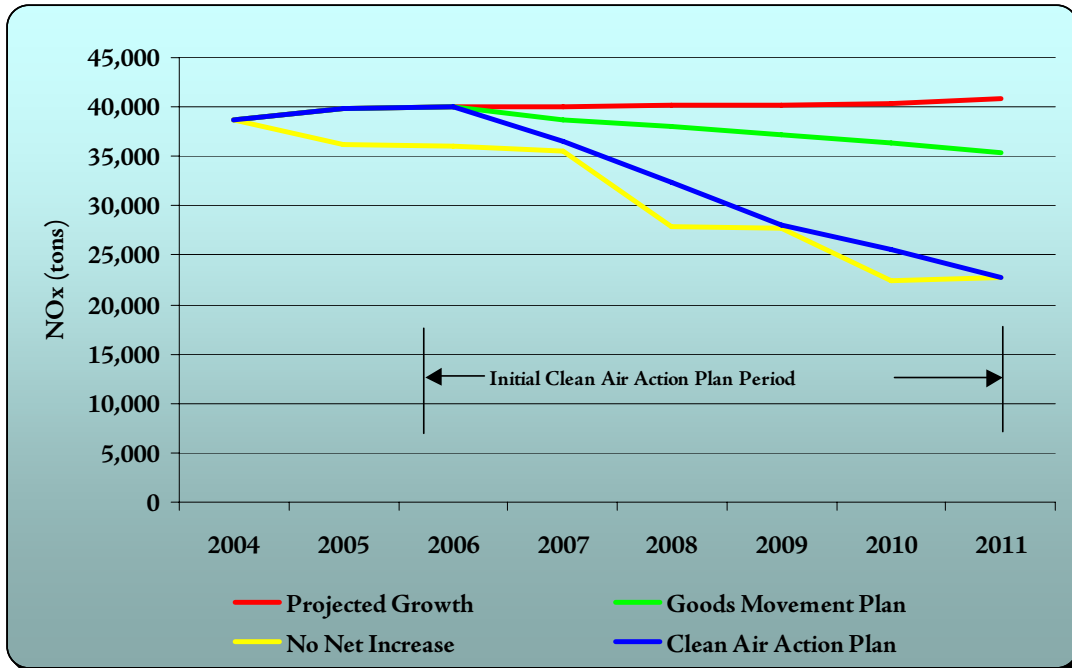




Figure 6.2: Comparison of NO_x “Emissions Remaining” – All Source Categories



These charts show that the NNI projections of DPM reductions appear to be greater than the Clean Air Action Plan reductions. This is due in part due to differing implementation schedules and assumptions. The Clean Air Action Plan emissions reductions are based on a more detailed analysis of available implementation mechanisms. As an example, a large part of the DPM reductions projected by NNI relied on rapid and extensive implementation of the low-sulfur fuels requirements for ocean-going vessels without specifying particular, enforceable methods that would be used to implement these requirements. In contrast, the Clean Air Action Plan’s measures relating to low-sulfur marine fuels have been based on a detailed assessment of the timing of lease openings, because lease provisions will provide the most certainty in implementing the requirements. If faster methods of implementation (such as tariffs) are found to be feasible, then the emission reductions projected by the plan will be accelerated and will more closely match the NNI line.

The reduction in health risk associated with the Clean Air Action Plan will be roughly equivalent to the reduction in emissions of diesel particulate matter. Therefore, reducing DPM by half represents a significant step toward eliminating the public health risk associated with port operations. It is important to note, however, that the location where emissions are released plays an important role in terms of exposure and therefore health risk is not directly correlated to emissions.

The figures on the following pages compare the three plans in terms of projections of tons per year of DPM and NO_x remaining after implementation, and the percent reductions of DPM and



NO_x, for the HDV, OGV, and CHE measures, respectively. The corresponding tables detail the data underlying these figures, including the projected growth in emissions without additional measures (from GMP) and the estimated emissions remaining after independent implementation of the plans.

In the following four figures covering the plans' effects on HDV emissions, it can be seen that the fifth year of the Clean Air Action Plan will result in emissions of DPM and NO_x from HDVs that will be lower than the emissions projected by the GMP, emissions of DPM that are roughly equal to the emissions projected by the NNI, and emissions of NO_x that are lower than those projected by NNI. By the year 2011, all frequent caller trucks (those that visit the port once per day or more) and semi-frequent trucks (those that visit the port at least once every other day) will be required to meet, or be cleaner than required by the 2007 US EPA emission standards for on-road PM (0.1 gram per brake-horsepower hour) and the most stringent NO_x standard available at the time of purchase or replacement. The projected performance of the Clean Air Action Plan is largely due to this extensive replacement/retrofit measure that will replace many currently operating trucks with new lower emitting diesel or natural gas trucks, and install NO_x reducing catalyts on others.

Figure 6.3: Comparison of DPM “Emissions Remaining” – HDVs

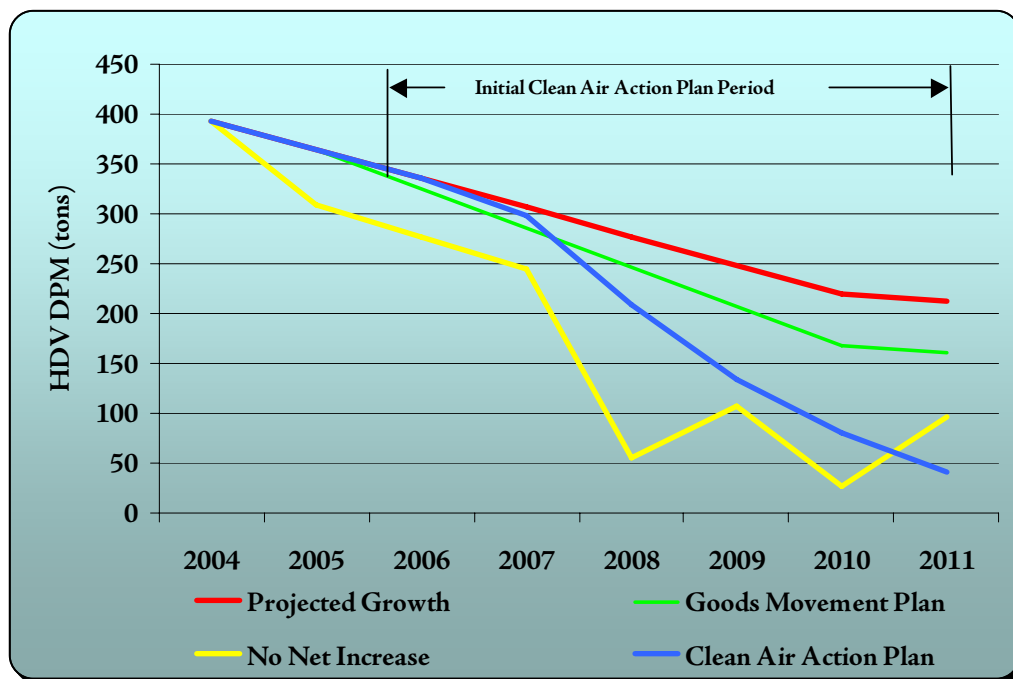




Figure 6.4: Comparison of DPM “Percent Reduction” – HDVs

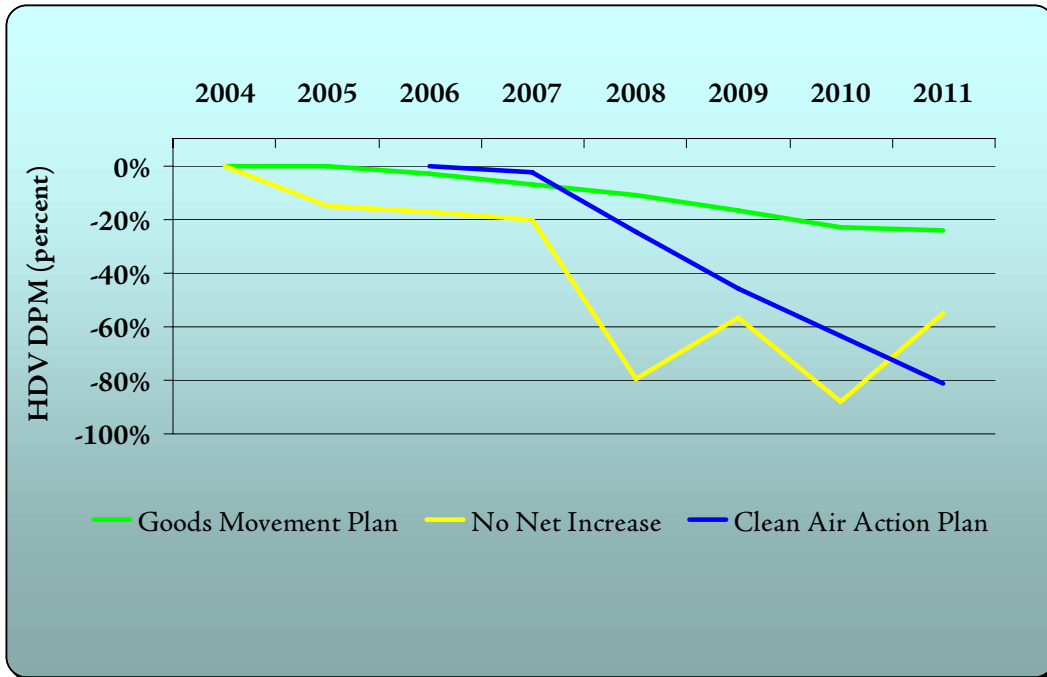


Figure 6.5: Comparison of NO_x “Emissions Remaining” – HDVs

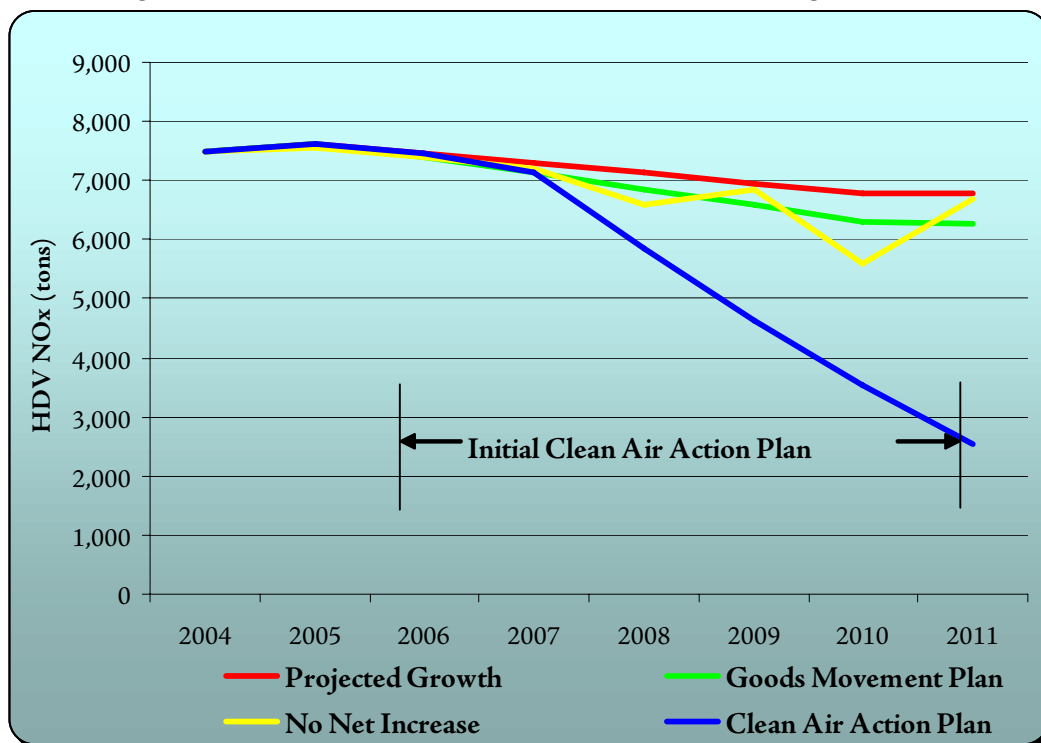




Figure 6.6: Comparison of NO_x “Percent Reduction” – HDVs

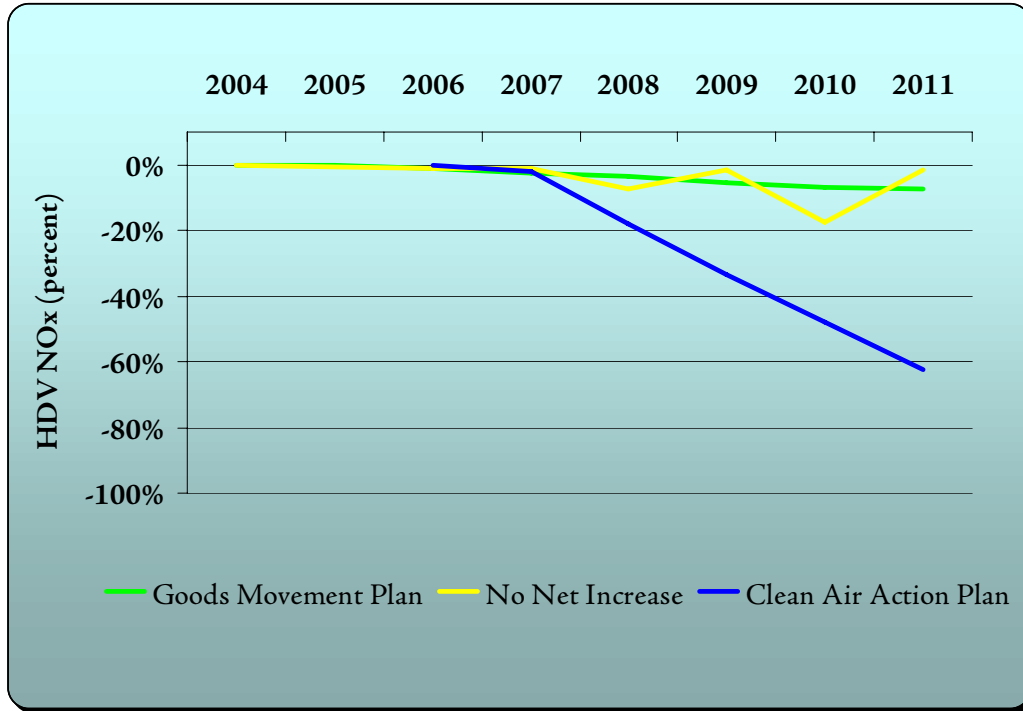


Table 6.3: Emissions Comparison by Plan – HDVs (tons/year)

		2004	2005	2006	2007	2008	2009	2010	2011
Growth	NO_x	7,501	7,629	7,461	7,293	7,125	6,957	6,789	6,782
	DPM	392	365	336	307	277	248	219	212
GMP	NO_x	7,501	7,629	7,378	7,122	6,861	6,592	6,315	6,283
	% Red	0%	0%	1%	2%	4%	5%	7%	7%
	DPM	392	365	325	285	246	207	168	160
	% Red	0%	0%	3%	7%	11%	17%	23%	25%
NNI	NO_x	7,501	7,565	7,387	7,208	6,602	6,861	5,602	6,676
	% Red	0%	1%	1%	1%	7%	1%	17%	2%
	DPM	392	309	277	245	56	107	26	96
	% Red	0%	15%	18%	20%	80%	57%	88%	55%
CAAP	NO_x	7,501	7,629	7,461	7,148	5,847	4,631	3,534	2,545
	% Red	0%	0%	0%	2%	18%	33%	48%	62%
	DPM	392	365	336	298	209	135	80	40
	% Red	0%	0%	0%	3%	25%	46%	63%	81%



Under the Clean Air Action Plan, ocean-going vessels will be required to reduce their speeds when approaching or departing the port, resulting in lower emissions from their main engines, use lower sulfur, distillate fuels in their main and auxiliary engines when within 20 to 40 nautical miles from Point Fermin, utilize shore power while at berth rather than running their diesel fired auxiliary engines while hotelling, and utilize NOx and PM control devices on new vessels and existing frequent callers to the ports.

Figure 6.7 shows that the Clean Air Action Plan emissions of DPM from OGVs do not appear to meet the projected emissions of either the Goods Movement Plan or the NNI report. With respect to the Goods Movement Plan, the reductions from that plan include the effects of CARB’s auxiliary engine rule, while the reductions from the Clean Air Action Plan do not. In addition, the GMP emissions have been interpolated between the years 2010 and 2015 because these are the years reported in the GMP, possibly understating the 2011 emissions. With respect to the NNI projected reductions, the difference is primarily due to differences in implementation assumptions for the fuel improvement measures, with NNI assuming almost complete change-over of fuels by all vessels in a very short period of time, with no plan as to how that would actually be accomplished. In contrast, the implementation approach taken by the Clean Air Action Plan allows vessel operators a certain amount of time to refit their ships to carry sufficient fuel of the appropriate type, and relies on lease openings as a means of imposing the requirements. If a more expeditious method of implementation is determined to be effective, such as tariff requirements, then the CAAP reductions will be accelerated.

Figure 6.7: Comparison of DPM “Emissions Remaining” –OGVs

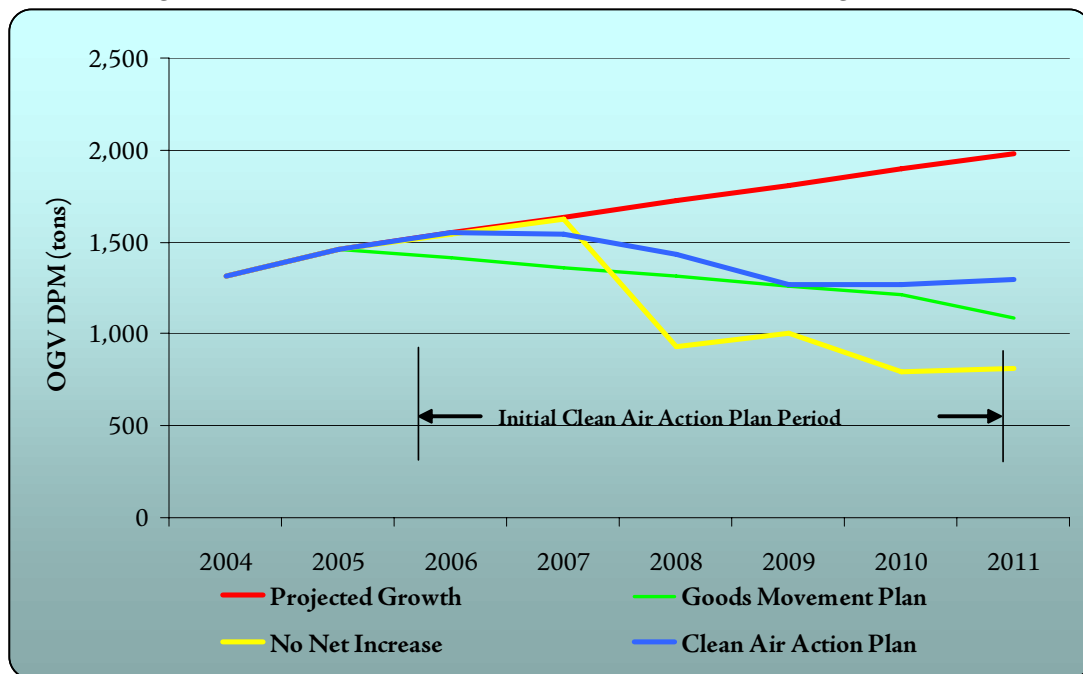




Figure 6.8: Comparison of DPM “Percent Reduction” – OGVs

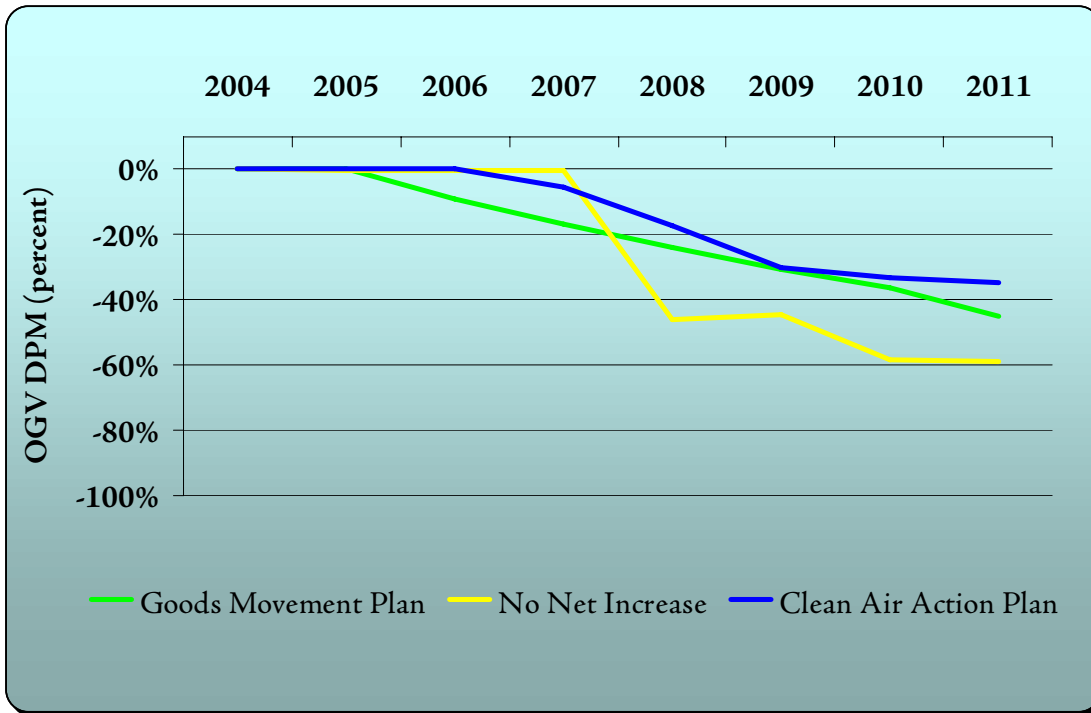


Figure 6.9: Comparison of NOx “Emissions Remaining” – OGVs

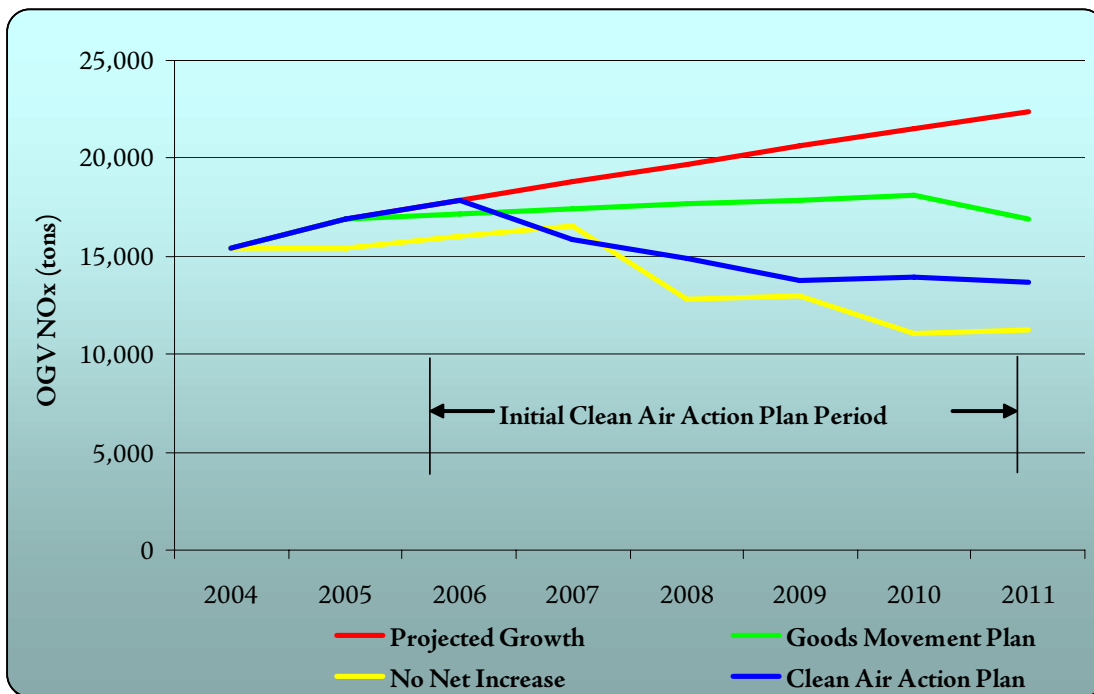




Figure 6.10: Comparison of NOx “Percent Reduction” – OGVs

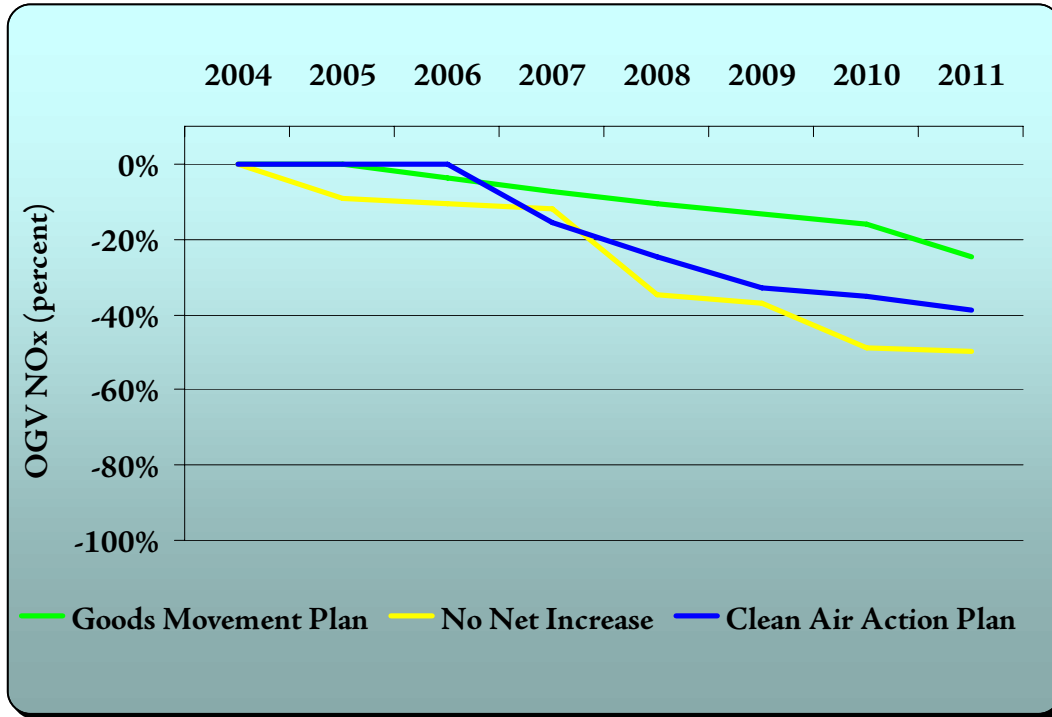


Table 6.4: Emission Reduction Comparison –OGVs (tons/year)

		2004	2005	2006	2007	2008	2009	2010	2011
Growth	NOx	15,440	16,936	17,856	18,776	19,695	20,615	21,535	22,426
	DPM	1,314	1,460	1,548	1,635	1,723	1,810	1,898	1,978
GMP	NOx	15,440	16,936	17,177	17,417	17,656	17,894	18,132	16,878
	% Red	0%	0%	4%	7%	10%	13%	16%	25%
	DPM	1,314	1,460	1,410	1,360	1,310	1,260	1,210	1,089
	% Red	0%	0%	9%	17%	24%	30%	36%	45%
NNI	NOx	15,440	15,409	15,992	16,579	12,825	13,014	11,056	11,236
	% Red	0%	9%	10%	12%	35%	37%	49%	50%
	DPM	1,314	1,457	1,543	1,628	931	1,003	795	816
	% Red	0%	0%	0%	0%	46%	45%	58%	59%
CAAP	NOx	15,440	16,936	17,856	15,884	14,873	13,802	13,980	13,702
	% Red	0%	0%	0%	15%	24%	33%	35%	39%
	DPM	1,314	1,460	1,548	1,544	1,430	1,267	1,267	1,295
	% Red	0%	0%	0%	6%	17%	30%	33%	35%



The Clean Air Action Plan measure CHE1 was designed to be complimentary to the ARB’s cargo handling rule adopted in December of 2005. It requires that new purchases conform to the cleanest available technology for NOx and meet or emit less than the standard of 0.1 gram per brake-horsepower-hour for PM. By the end of 2011, all remaining equipment must meet or emit at rates lower than the standards required by U.S. EPA’s Tier 4 emission standards. The emissions resulting from the implementation of both the Clean Air Action Plan measure CHE1 and CARB’s cargo handling equipment rule are illustrated in figures 6.11 through 6.14 and are compared to the GMP and the NNI. This line shows that the combination of the two measures will result in DPM emissions, which are lower than those resulting from the GMP and are on a par with the NNI projections, and NOx emissions substantially less than those resulting from the GMP.

Figure 6.11: Comparison of DPM “Emissions Remaining” – CHE

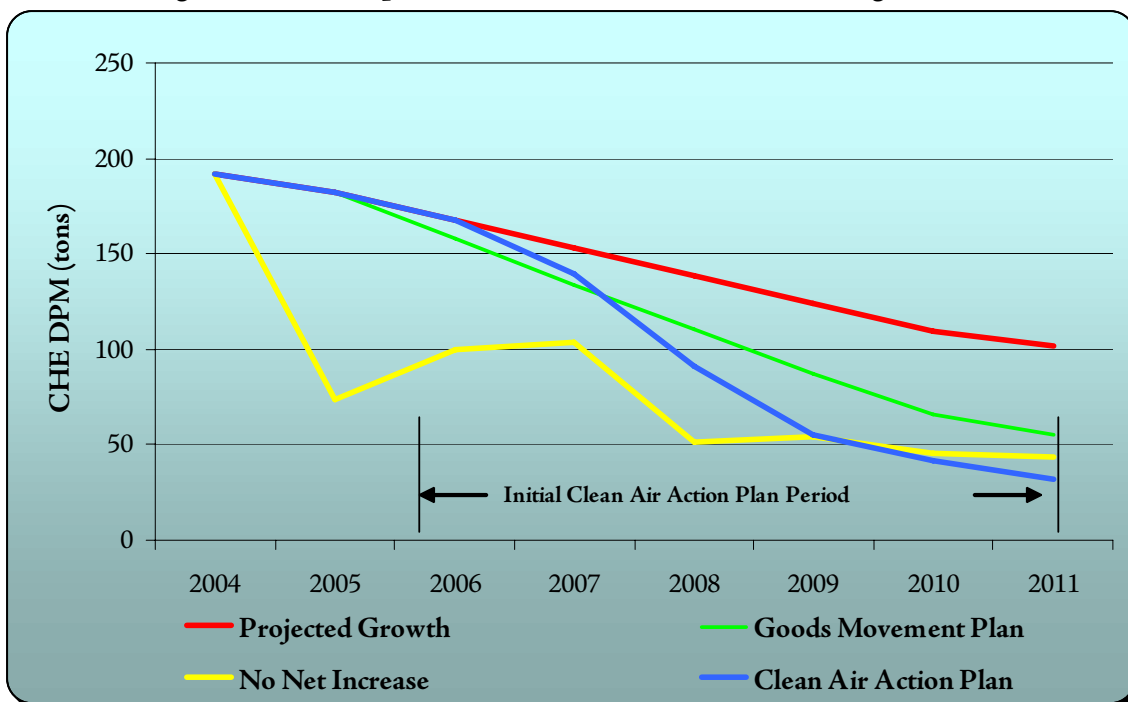




Figure 6.12: Comparison of DPM “Percent Reduction” – CHE

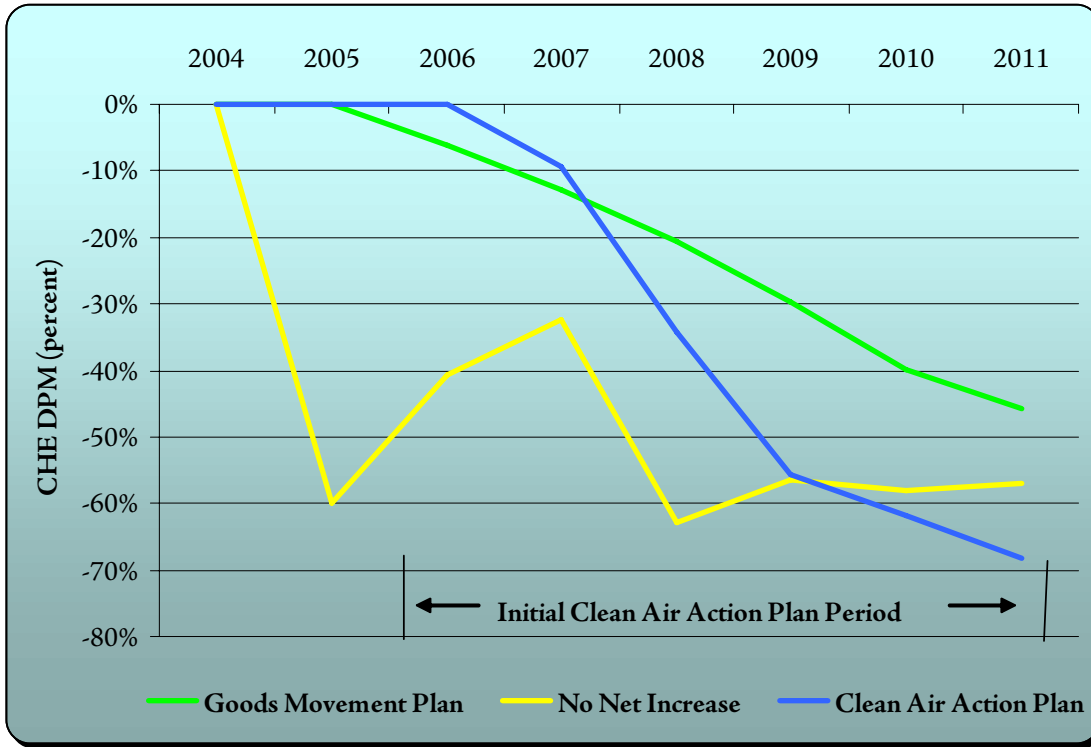


Figure 6.13: Comparison of NOx “Emissions Remaining” – CHE

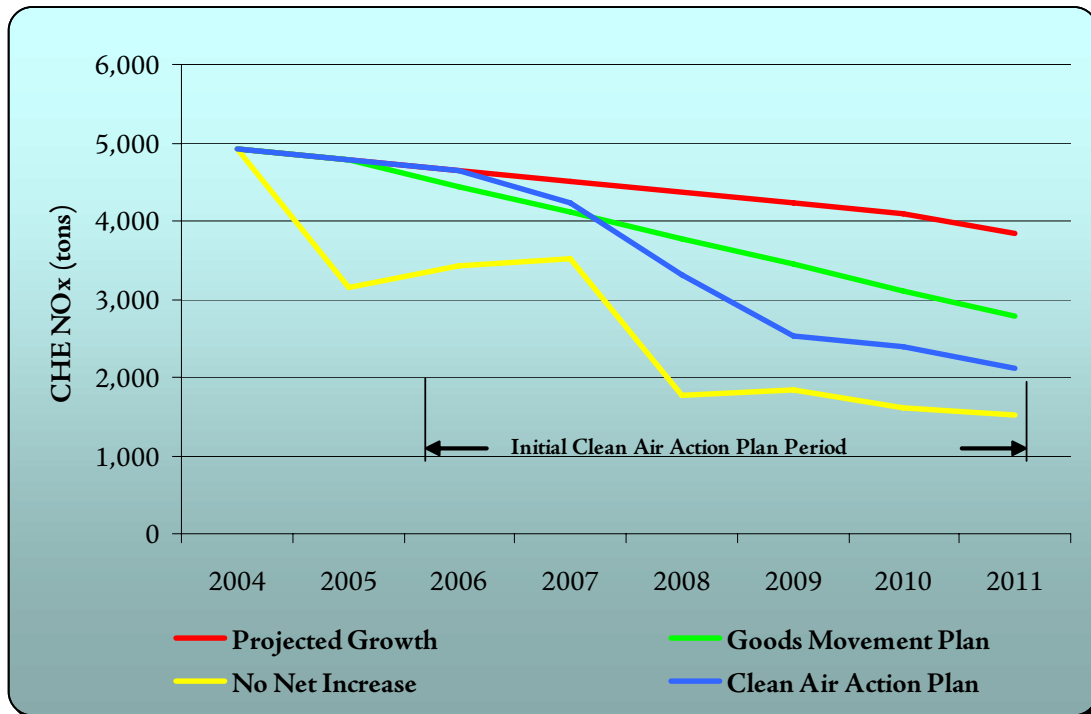




Figure 6.14: Comparison of NOx “Percent Reduction” – CHE

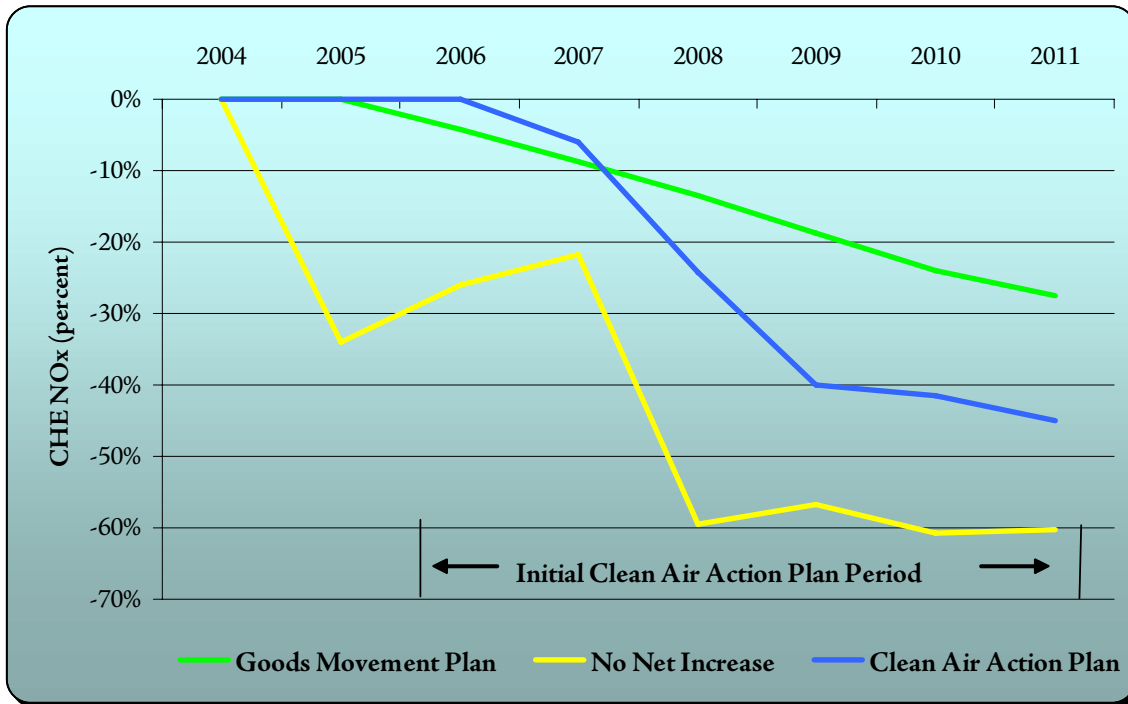


Table 6.14: Emission Reduction Comparison –CHE(tons/year)

		2004	2005	2006	2007	2008	2009	2010	2011
Growth	NOx	4,918	4,782	4,643	4,504	4,365	4,227	4,088	3,840
	DPM	192	183	168	153	139	124	110	102
GMP	NOx	4,918	4,782	4,446	4,110	3,774	3,439	3,104	2,782
	% Red	0%	0%	4%	9%	14%	19%	24%	28%
	DPM	192	183	158	134	110	87	66	55
	% Red	0%	0%	6%	12%	21%	30%	40%	46%
NNI	NOx	4,918	3,151	3,432	3,526	1,772	1,831	1,608	1,529
	% Red								
	DPM	192	73	99	104	51	54	46	44
	% Red	0%	34%	26%	22%	59%	57%	61%	60%
CAAP	NOx	4,918	4,782	4,643	4,234	3,310	2,538	2,394	2,113
	% Red	0%	0%	0%	6%	24%	40%	41%	45%
	DPM	192	183	168	139	91	55	42	32
	% Red	0%	0%	0%	9%	34%	56%	62%	68%