

DFMV Cold Ironing™

Air Pollution Comparison Between DFMV Cold Ironing™ and 0.5% Diesel Auxiliary Engines



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Diesel Pollution vs. Wittmar DFMV Cold Ironing – 2 Day Stay

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|---|--|
| <ul style="list-style-type: none">• Ship Aux Diesel Engine | <ul style="list-style-type: none">• Wittmar DFMV Cold Ironing™ System |
| <ul style="list-style-type: none">• 950 bhp – 725 kW | <ul style="list-style-type: none">• 950 bhp – 725 kW |
| <ul style="list-style-type: none">• NOx – 851 Lbs. | <ul style="list-style-type: none">• NOx – 15 Lbs. |
| <ul style="list-style-type: none">• CO – 139 Lbs. | <ul style="list-style-type: none">• CO – 60 Lbs. |
| <ul style="list-style-type: none">• PM10 – 7 Lbs. | <ul style="list-style-type: none">• PM10 – 0 Lbs. |
| <ul style="list-style-type: none">• SOx - 139 Lbs. | <ul style="list-style-type: none">• SOx - 0 Lbs. |
| <ul style="list-style-type: none">• CO2 - 85,955 Lbs. | <ul style="list-style-type: none">• CO2 - 49,018 Lbs. |
| <ul style="list-style-type: none">• 3,840 Gallons of 0.5% Diesel Fuel Are Consumed During Each 2 Day Stay | <ul style="list-style-type: none">• 4752 Gallons of LNG Fuel Are Consumed During Each 2 Day Stay |

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Diesel Pollution vs. Wittmar DFMV™ Cold Ironing – 4992 hours per year (96 hrs/wk)

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|---|--|
| <ul style="list-style-type: none"> • Ship Aux Diesel Engine • 950 bhp – 725 kW • NOx – 88,504 Lbs. • CO – 14,456 Lbs. • PM10 – 728 Lbs. • SOx - 14,456 Lbs. • CO2 - 8,939,320 Lbs. | <ul style="list-style-type: none"> • Wittmar DFMV Cold Ironing™ • 950 bhp – 725 kW • NOx – 1,560 Lbs. • CO – 6,240 Lbs. • PM10 – 0 Lbs. • SOx - 0 Lbs. • CO2 - 5,097,872 Lbs. |
| <ul style="list-style-type: none"> • 399,360 Gal of 0.5% Diesel Fuel Used per Year | <ul style="list-style-type: none"> • 494,208 Gallons LNG Fuel Used per Year |

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2 ships per week staying 48 hours over 1 year

Diesel Pollution vs. Wittmar DFMV™ Cold Ironing – Pollution Reduction

- Using Wittmar DFMV™ to Cold Iron a typical 48 Hour Ship Stay Will Reduce Pollution by:
 - NOx - 836 Pounds
 - CO - 79 Pounds
 - PM₁₀ - 7 Pounds
 - Sox - 139 Pounds
 - CO2 - 36,937 Pounds

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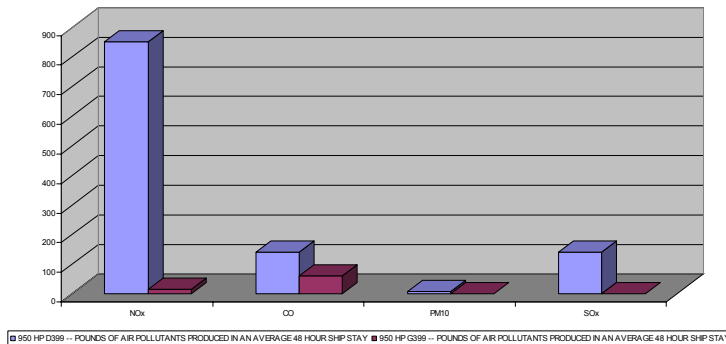
Diesel Pollution vs. Wittmar DFMV™ Cold Ironing – Pollution Reduction

- Depending on the Length of Stay and Hotelling kW load, the Air Pollution Reduced by using Wittmar DFMV™
- NOx - is Reduced **98%**
- CO - is Reduced **57%**
- PM10 - is Reduced **100%**
- Sox - is Reduced **100%**
- CO2 - is Reduced **57%**

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Uncontrolled Diesel Pollution vs. Controlled LNG Pollution

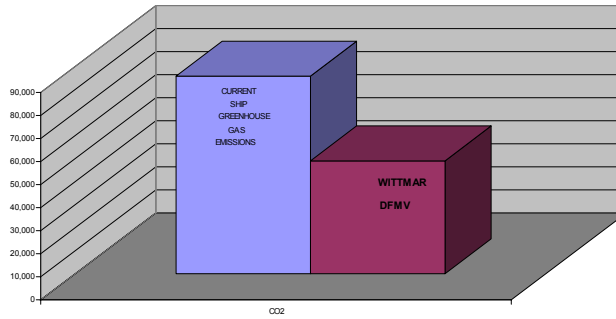
Pollution From Diesel Aux engines vs Wittmar DFMV



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Uncontrolled Diesel CO2 vs. LNG CO2 W/ Wittmar DFMV

Diesel Ships Aux Greenhouse Gas Pollution vs Wittmar DFMV



■ 950 HP D399 -- POUNDS OF AIR POLLUTANTS PRODUCED IN AN AVERAGE 48 HOUR SHIP STAY ■ 950 HP G399 -- POUNDS OF AIR POLLUTANTS PRODUCED IN AN AVERAGE 48 HOUR SHIP STAY

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The DFMV Capital Cost To Reduce Pollution for 2 Ships per Week is:

NOx = \$8,010 per Ton

Table ES-3: NOx Reduction Cost Effectiveness for Cold-Ironing Ships at POLA/POLB* (Dollars/ton)

Category	All Ships	Ships with 3+ Visits	Ships with 6+ Visits
Container			
--POLA/POLB	\$18,500	\$14,500	15,500**
--Oakland	\$56,000	\$50,500	\$48,500**
--Oakland w/o ship costs	\$25,500	\$24,000	\$26,000**

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Based on 10 Year Minimum Life

Wittmar DFMV Cold Ironing™ Investment Cost

- Wittmar DFMV Cold Ironing™ Operating Cost Is \$4.75 To \$9.00 Per Container (Depending On Each Situation)
- Wittmar DFMV Cold Ironing™ Investment Cost For NOx Reduction = \$8,010 Per Ton
- The California ARB Believes That An Investment Cost Of \$4 To \$13 Per Container Is Reasonable
- The California ARB Believes That Nox Reduction Investments Of \$18,000 Per Ton In POLB/POLA Is Reasonable
- The California ARB Believes That NOx Reduction Investments Of \$56,000 Per Ton In Oakland Is Reasonable

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Moving Forward with DFMV Cold Ironing™

- Wittmar Has Begun An Advertising And Literature Campaign In The Ports Of California.
- Outside Investors Are Evaluating The Construction Of A Demonstration Unit In The Port Of Oakland. Operation Is Expected To Begin In 3rd Quarter 2007
- One DFMV Cold Ironing™ System Will Be Able To Cold Iron At Least 8 Ships Per Week.
- Wittmar Believes That A 3 Unit System Can Cold Iron 80% Of The Ships Calling On Oakland By The End Of 2008

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DFMV™ Long Story Made Short

- Low Cost- 400% less than POLB/POLA ship electrification projects
- Defined cost for the operator – Operator Pays a Daily Fee or a Per Container Fee.
- NO PUBLIC MONEY IS REQUIRED – Works in all Ports
- Dual Frequency Cold Irons More Ships Than POLA/POLB Ship Electrification Projects
- Multi Voltage Cold Irons More Ships Than POLA/POLB Ship Electrification Projects

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DFMV™ Long Story Made Short

- DFMV™ Especially Suited For Irregular And Infrequent Ship Visits.
- Bulk Ships Are Easily Cold Ironed
- Flexible, Mobile, Effective- Preferred By Operators Over AMP Or The POLB Ship Electrification Project.
- 43 Units Can Be Up And Running By 2012. This Equates To 4,472 Ships Cold Ironed Per Year.

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DFMV™ Long Story Made Short

- Achieves Emissions Targets Years Ahead Of The CARB Plan – 2010 Goals In 2008
- NO Impact To Power Grid
- Can Enforce The Non Low Sulfur Diesel ACP Immediately.
- Utilize Existing Work Skills And Create New High Paying Jobs.

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Wittmar U. S. Trademarks

- DFMV Cold Ironing™ System
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Wittmar DFMV Cold Ironing™

- A SOLUTION MADE SIMPLE by:



Pacific
SPILL CONTROL SCHOOL



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