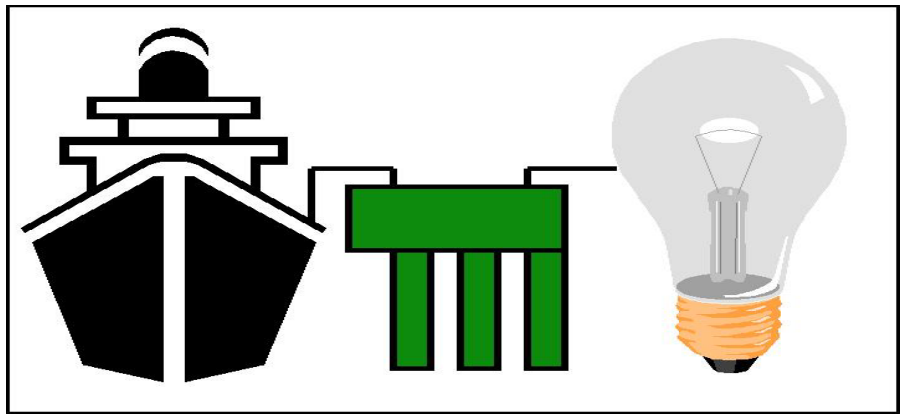

SHORE POWER

Emissions Reduction Alternative for Ships Docked in Port

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DOCK WATTS LCC

DOCK WATTS LLC

April 20, 2004

Average Auto Emissions Factors (CARB)

Based on 12,000 miles/year

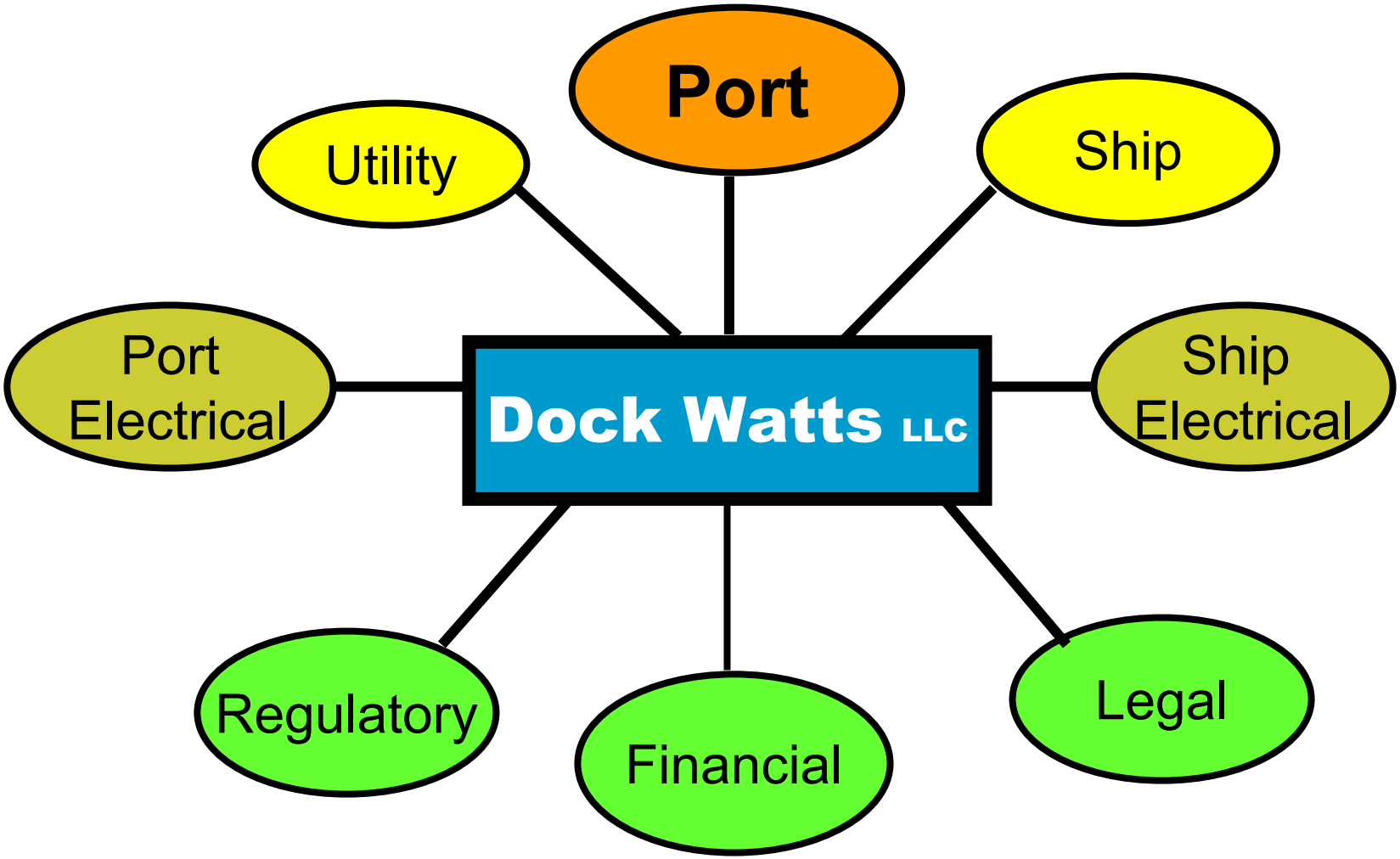
	NOx	HC	PM	CO
grams/vehicle mile	0.686	0.523	0.218	6.190
lb/year per vehicle	18.110	13.807	5.755	163.416
lb/day per vehicle	0.050	0.038	0.016	0.448

	Marine Diesel Fuel Ship equivalent vehicles per day			Marine Diesel Fuel Ship equivalent vehicles per day		
	NOx	HC	PM	NOx	HC	PM
1.0 MW	14,792	558	1,005	15,643	558	2,679
2.0 MW	29,583	1,117	2,009	31,286	1,117	5,358
3.0 MW	44,375	1,675	3,014	46,929	1,675	8,037
4.0 MW	59,166	2,233	4,018	62,571	2,233	10,716
5.0 MW	73,958	2,792	5,023	78,214	2,792	13,394
6.0 MW	88,749	3,350	6,028	93,857	3,350	16,073
7.0 MW	103,541	3,908	7,032	109,500	3,908	18,752
8.0 MW	118,332	4,467	8,037	125,143	4,467	21,431
9.0 MW	133,124	5,025	9,041	140,786	5,025	24,110
10.0 MW	147,915	5,583	10,046	156,429	5,583	26,789

WHY SHORE POWER MAKES SENSE

- Port growth is essential for economic growth.
- On-board ship electric generation accounts for at least 20 % of in-port emissions.
- Per MWh, natural gas power plants produce less than 1/2 % of the emissions of ship on-board generators.
- Shore Power virtually eliminates emissions from ship generators while berthed in port.
- Shore Power is proven technology that can be implemented immediately.

SHORE POWER DEVELOPMENT HAS MANY LEGS



PERSPECTIVE

- **Key Economic Criteria (lb/MWh Emissions Driven)**
  - Berth Occupancy with electrified ships (hours/year)
  - Electric Loads (MW)
  - Port Call Duration (hours)
- **Cannot look at "One-Off" Projects**
  - Existing projects have considered one terminal, one set of ships
  - Electrified ships could call on more than one shore power Port
- **Adoption over time will improve Capital Utilization resulting in greater cost effectiveness.**

BALANCING SHORE POWER COSTS

PORT COSTS

A FACTOR OF 10 TIMES MORE THAN

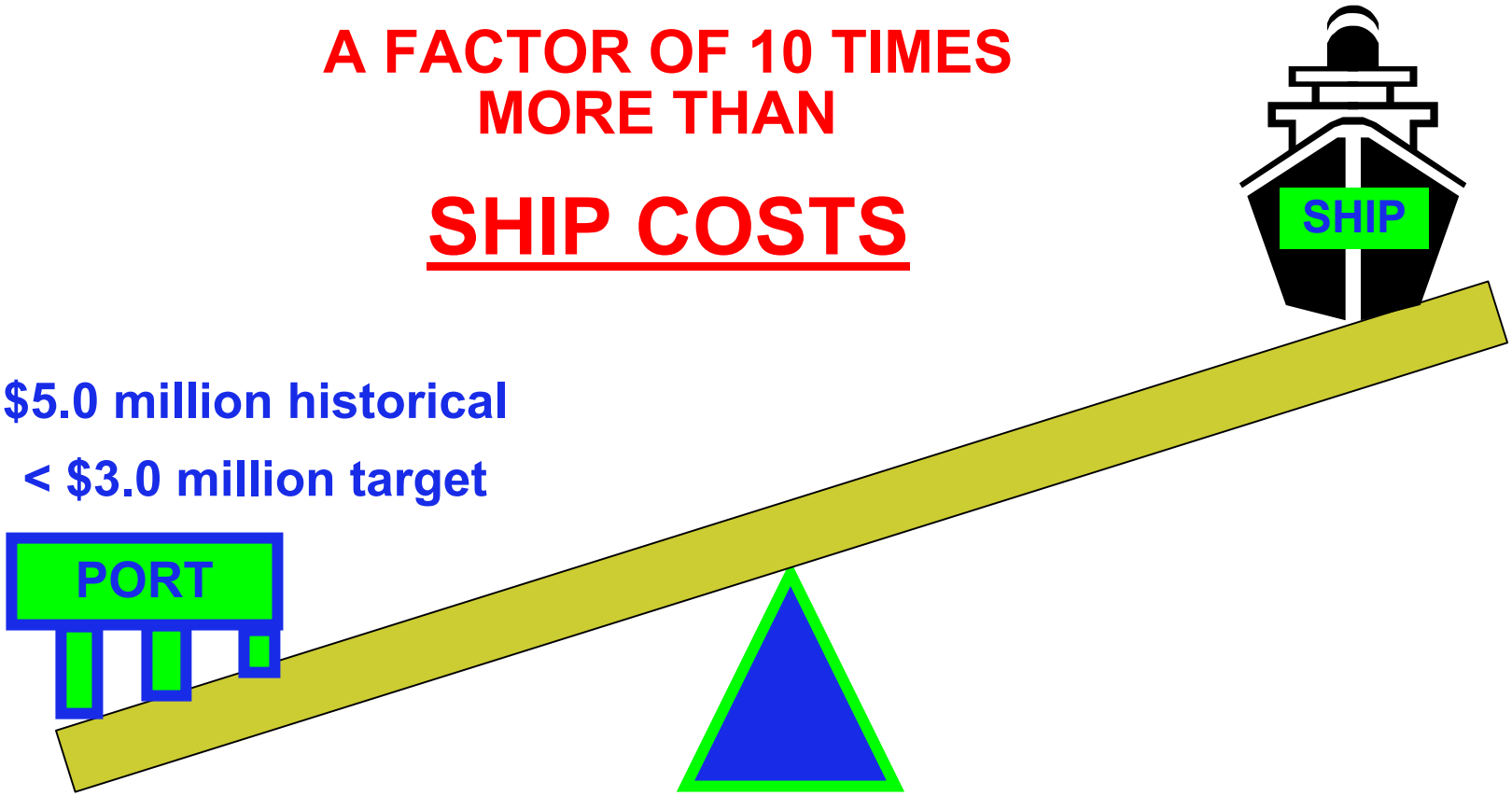
SHIP COSTS

$500,000 historical

< $250,000 target

$5.0 million historical

< $3.0 million target



ESTIMATED EMISSIONS REDUCTIONS

OPERATIONS ASSUMPTIONS	Port Call Frequency Days	Port Calls Per Year	Average * Hours in Port	Estimated Hours per Year	Average * Electric Load MW	MWh/Year
Container Ship	45	8	42.80	347	0.976	339
Tanker Ship	15	24	30.16	734	1.330	976
Cruise Ship	7	26	10.47	273	7.000	1,911

EMISSIONS FACTORS (grams/kWh)	NOx	SOx	CO2	HC	PM
Marine Aux Generators, Residual Fuel Oil **	14.70	12.30	722.00	0.40	0.80

* Data Source: June 2004 Port of Los Angeles Emissions Inventory

** Data Source: July 2002 ENTEC Report prepared for the Eurpoean Community

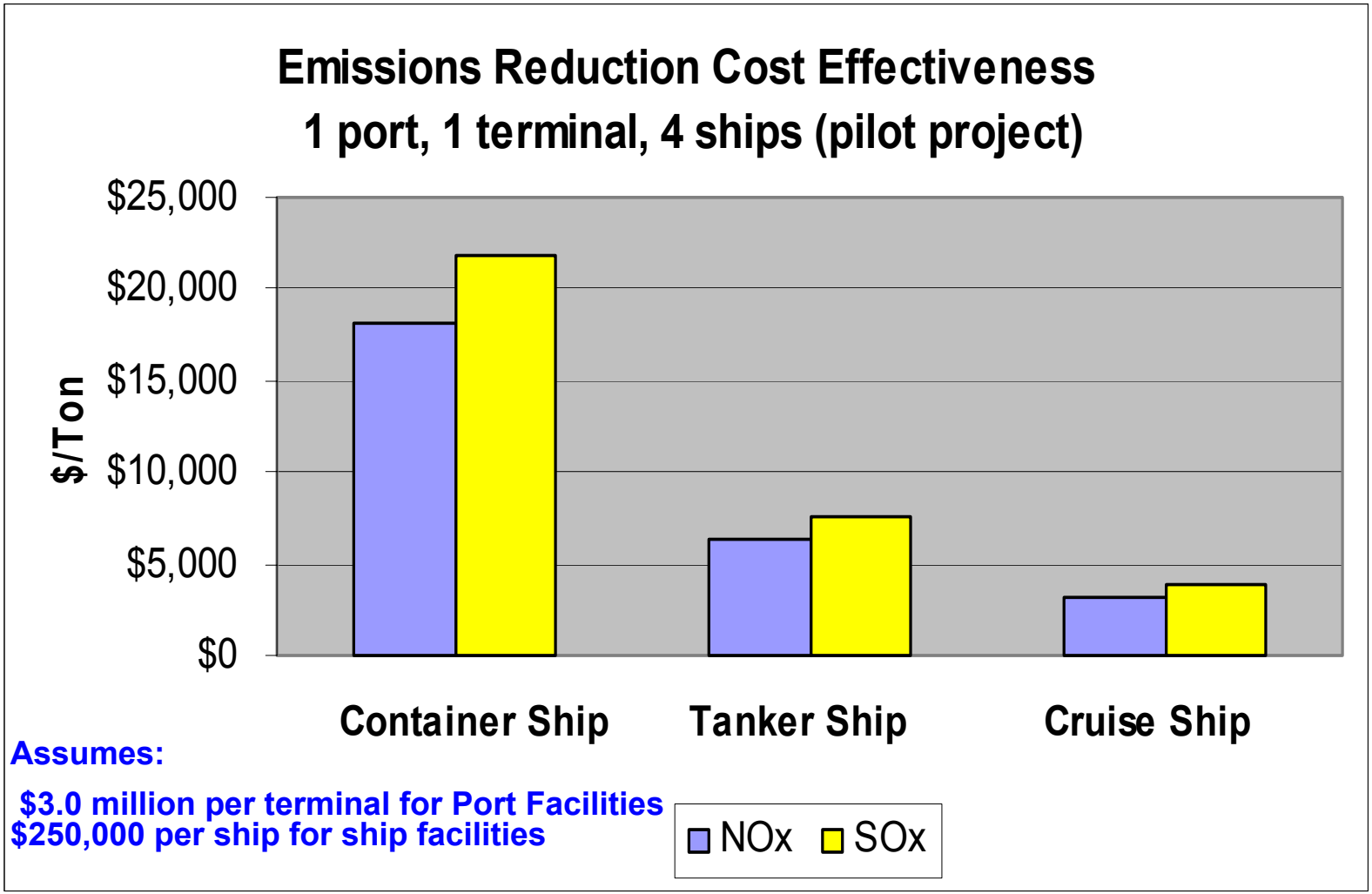
Assumes auxiliary generators are medium speed engines

EMISSIONS FACTORS (lb/MWh)	NOx	SOx	CO2	HC	PM
Marine Aux Generators, Residual Fuel Oil	32.4	27.1	1591.7	0.9	1.8
New Power Plant (2x1 F Comb Cyc, nat gas)	0.126	0.008	151.741	0.069	0.026

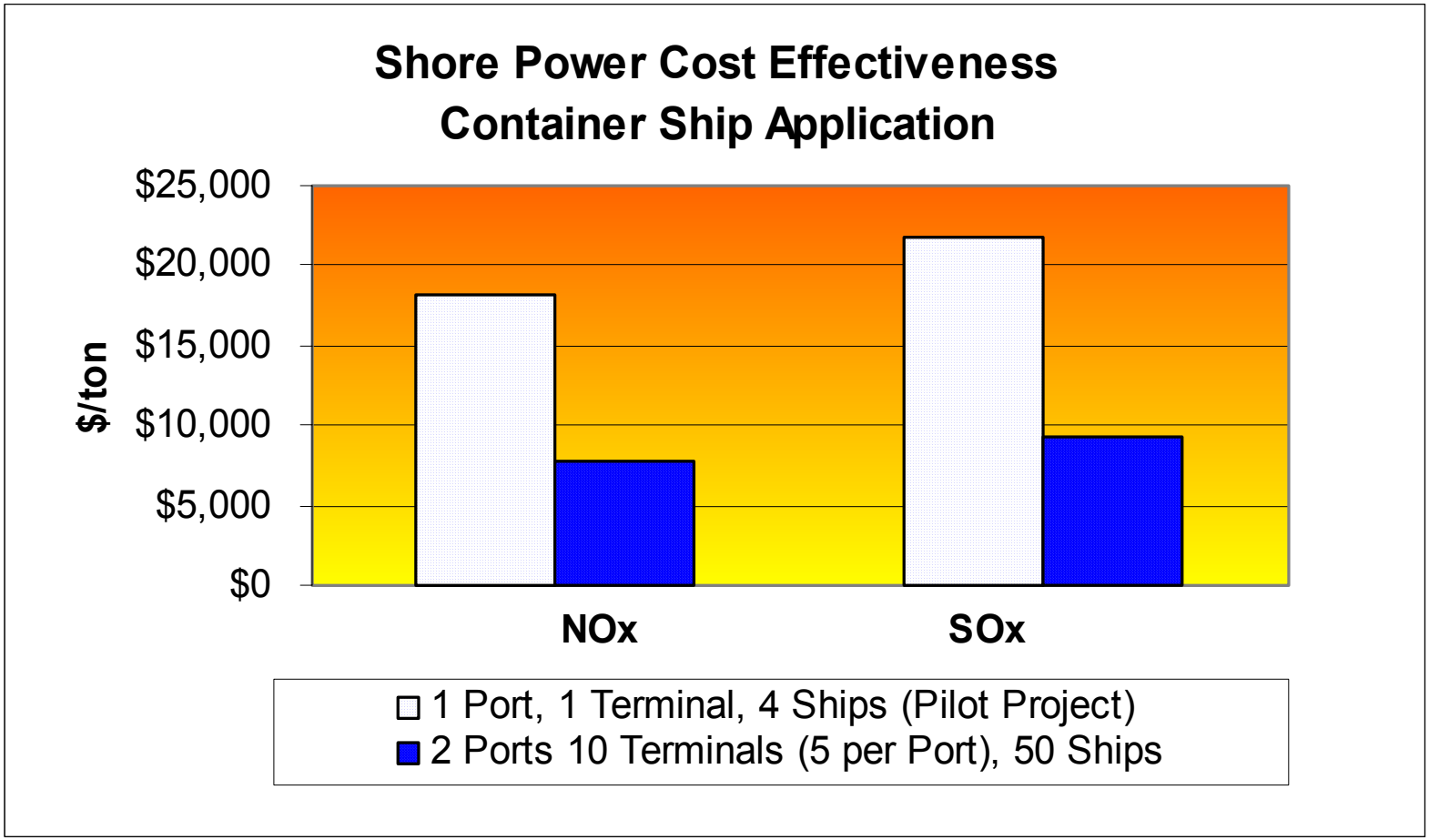
* 2x1 F emission based on Siemans Westinghouse 501 F gas turbines

SHIP EMISSIONS IN PORT (Tons/Year)	NOx	SOx	CO2	HC	PM
Container Ships Aux Generators, Residual Fuel Oil	5.5	4.6	270	0.149	0.299
Tanker Ships, Residual Fuel Oil	15.8	13.2	777	0.430	0.861
Cruise Ships Aux Generators, Residual Fuel Oil	31.0	25.9	1,521	0.842	1.685

SHORE POWER
COST EFFECTIVENESS



COST EFFECTIVENESS
MULTIPLE PORTS, MORE SHIPS



WHO SHOULD PAY FOR SHORE POWER

- **Ships should be economically and financially indifferent to shore power**
  - Ship on-board cost subsidized by other funding sources
  - Ship cost of power no more than avoided on-board generation
- **Ports and Society need to develop means to fund shore power infrastructure**
  - Monitized value of Emission Reduction Credits
  - Port Fees (cargo volume or passenger based)
  - Incentive structures (discounts to ships that use shore power)
  - Government backed financing structures, long term debt

Shore Power In Alaska

Transformer

Cable Trench

Tunneling Under Road

Gantry

Connecting the plugs

Connection Room