



ECOSHIP

Aligning Incentives in the Shipping Industry to Achieve
Positive Economic & Environmental Impacts

Outline

□ Background

- Challenges: climate and health implications of shipping
- Opportunities: significant emissions reduction potential with low marginal costs
- Barrier: Split incentive

□ Solution: EcoShip Fund

- EcoShip Fund Model: A Win-Win approach
- Financial Incentive: Above average IRR
- Global Benefits: Significant emission reduction
- Risk: Disclosure and Mitigation

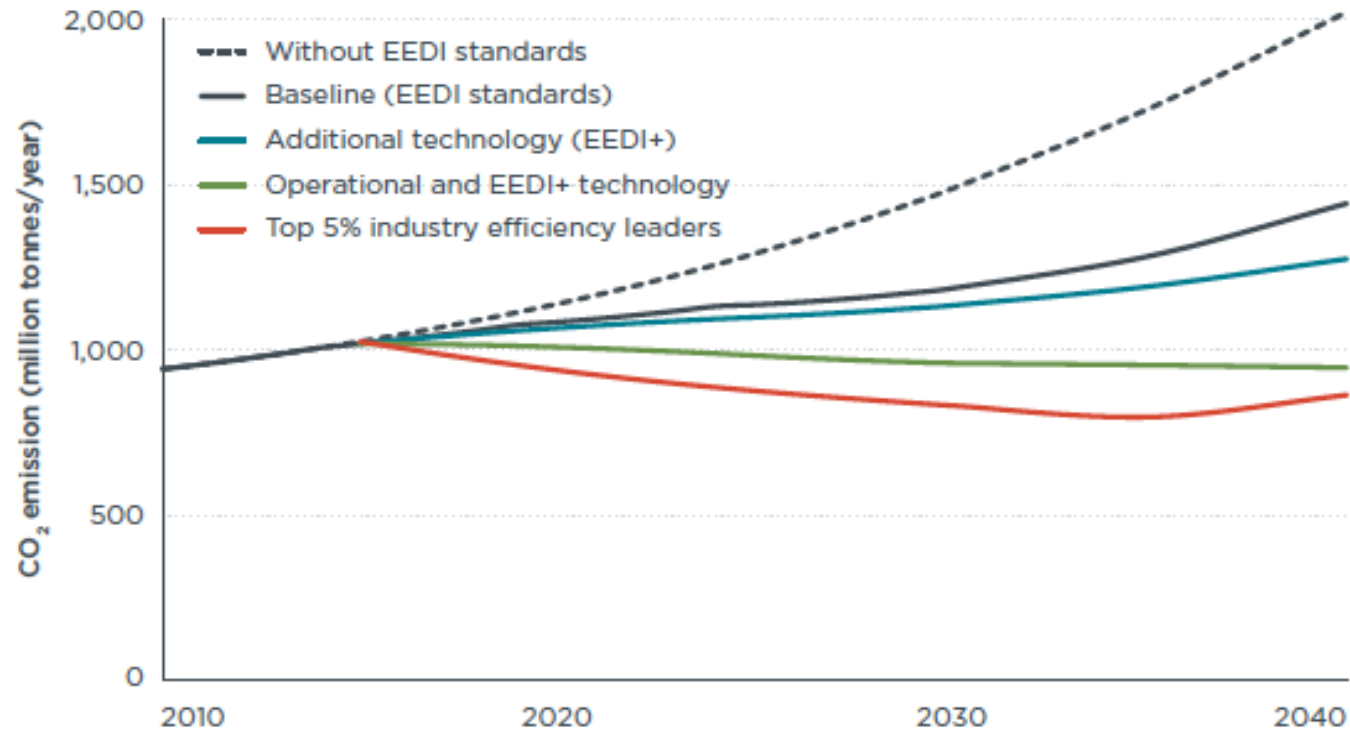
□ Path Forward

- Next Steps: A Ten-Year Plan

BACKGROUND

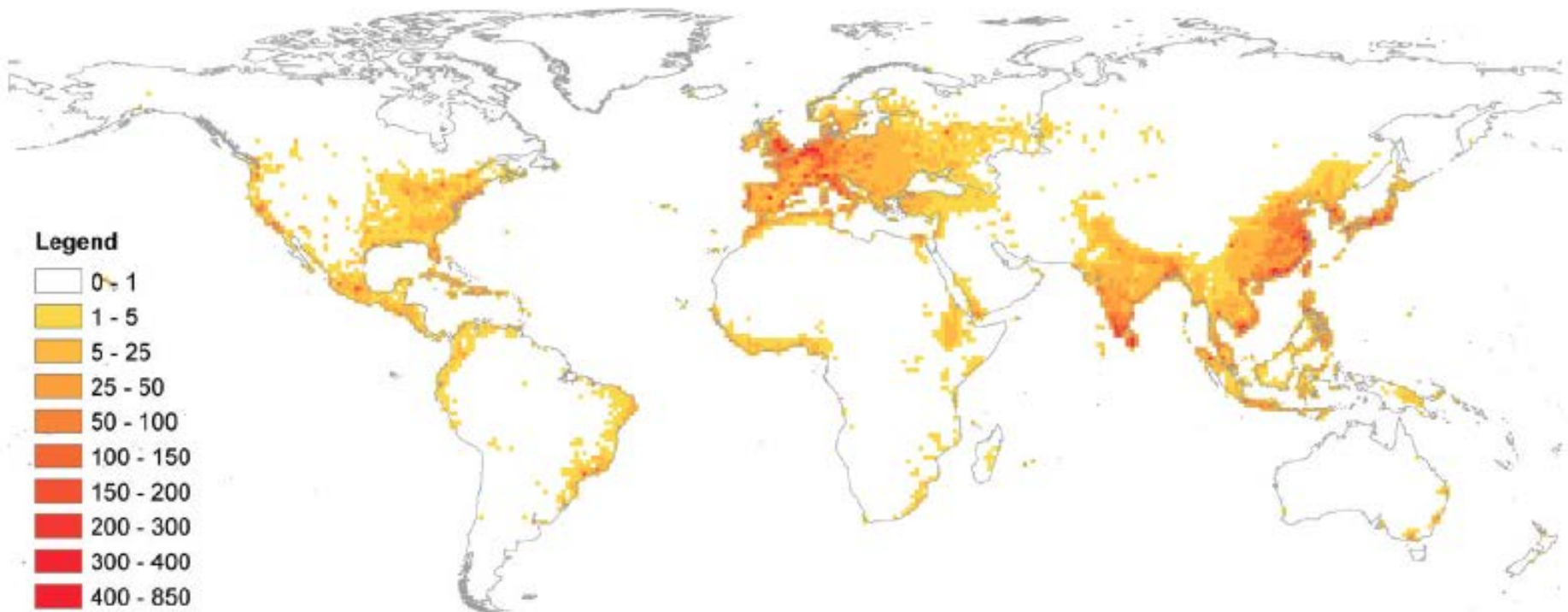
CO₂ Emissions from Shipping until 2040

- CO₂ emissions will continue to grow, doubling current level by 2040



Health Implications of High Sulfur Fuel

- High sulfur marine fuel generated a large amount of PM_{2.5}, responsible for 87,000 premature deaths in 2012



Substantial Technical & Operational Potential in Shipping Industry to Increase Energy Efficiency

Operational

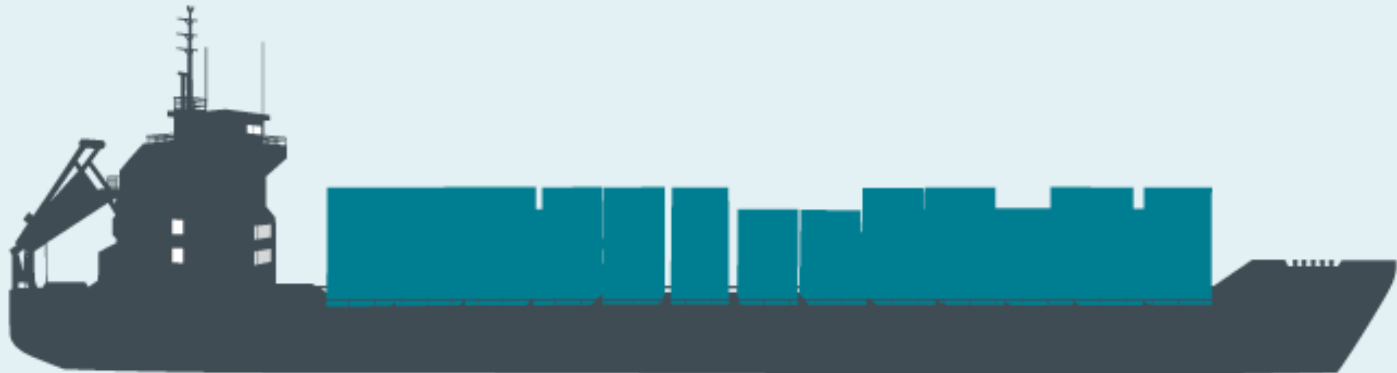
Weather routing 1-4%
Autopilot upgrade 1-3%
Speed reduction 10-30%

Auxiliary power

Efficient pumps, fans 0-1%
High efficiency lighting 0-1%
Solar panel 0-3%

Aerodynamics

Air lubrication 5-15%
Wind engine 3-12%
Kite 2-10%



Thrust efficiency

Propeller polishing 3-8%
Propeller upgrade 1-3%
Prop/rudder retrofit 2-6%

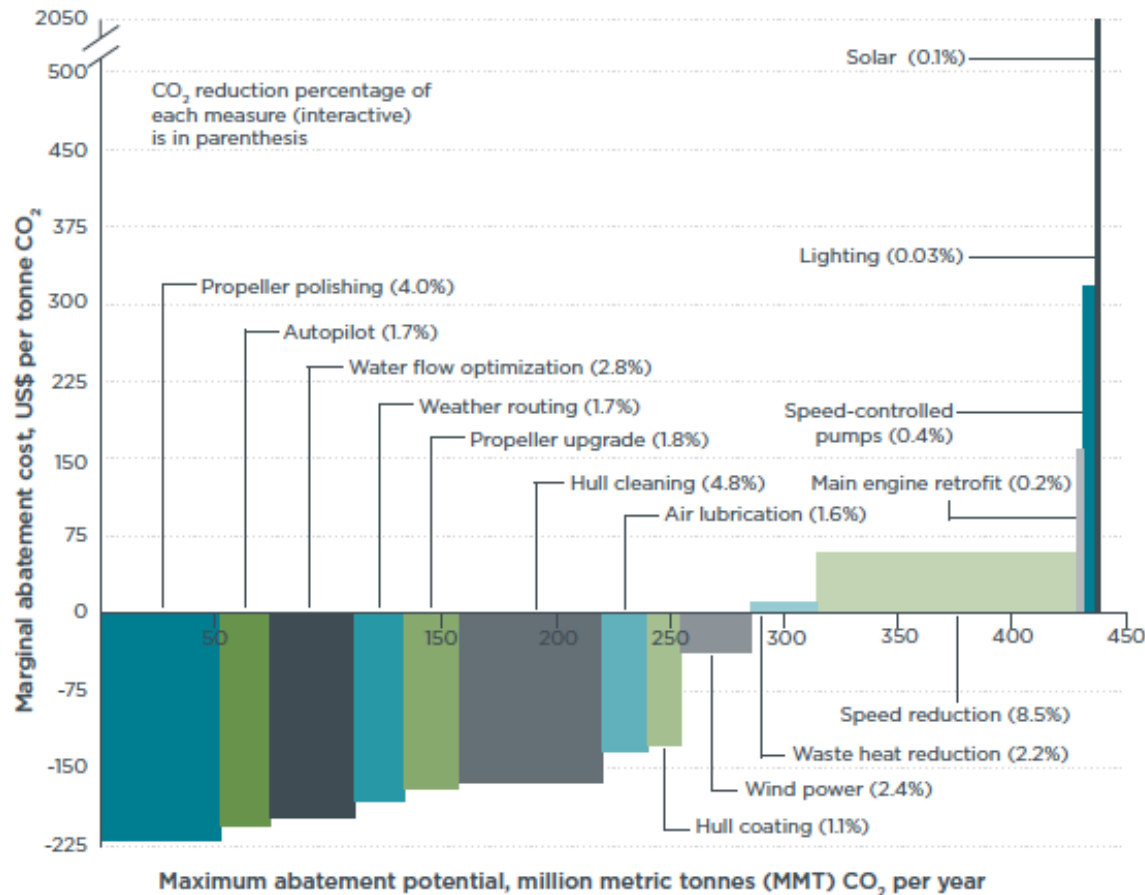
Engine efficiency

Waste heat recovery 6-8%
Engine controls 0-1%
Engine common rail 0-1%
Engine speed de-rating 10-30%

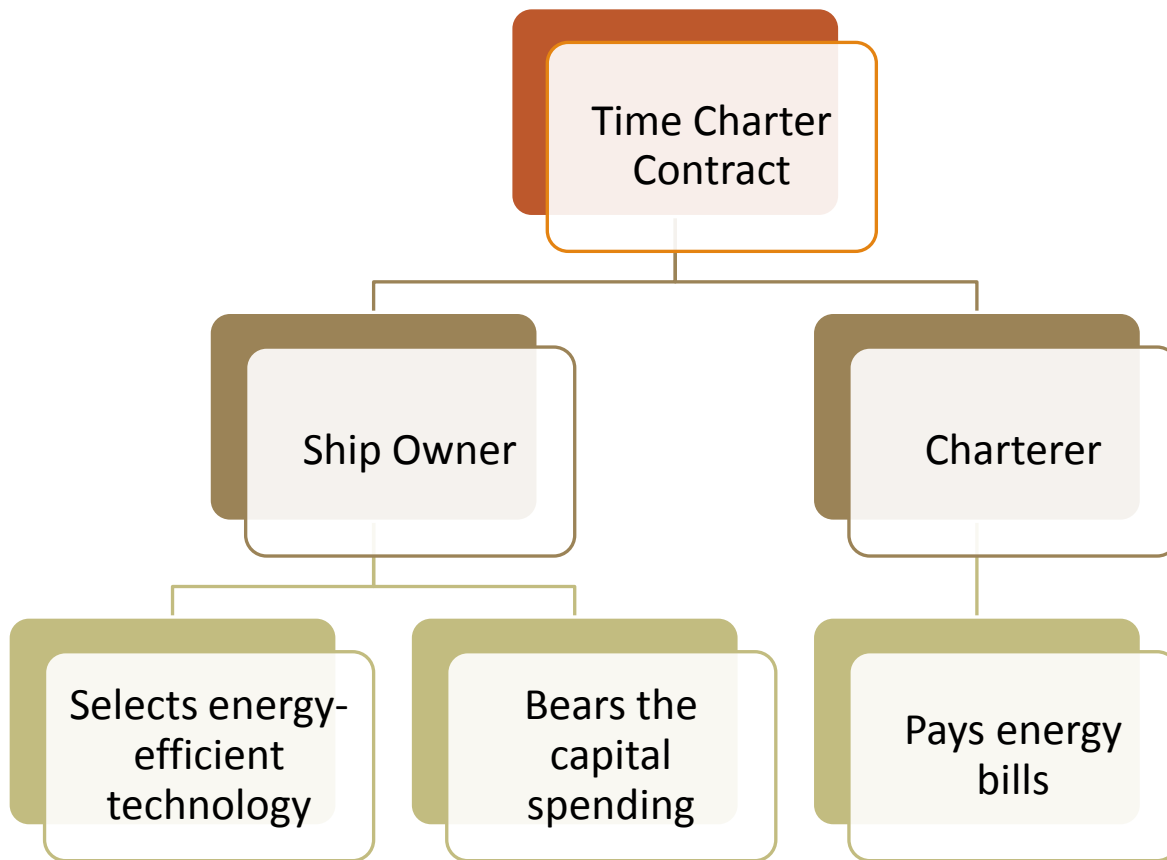
Hydrodynamics

Hull cleaning 1-10%
Hull coating 1-5%
Water flow optimization 1-4%

Significant portions of these opportunities are cost effective

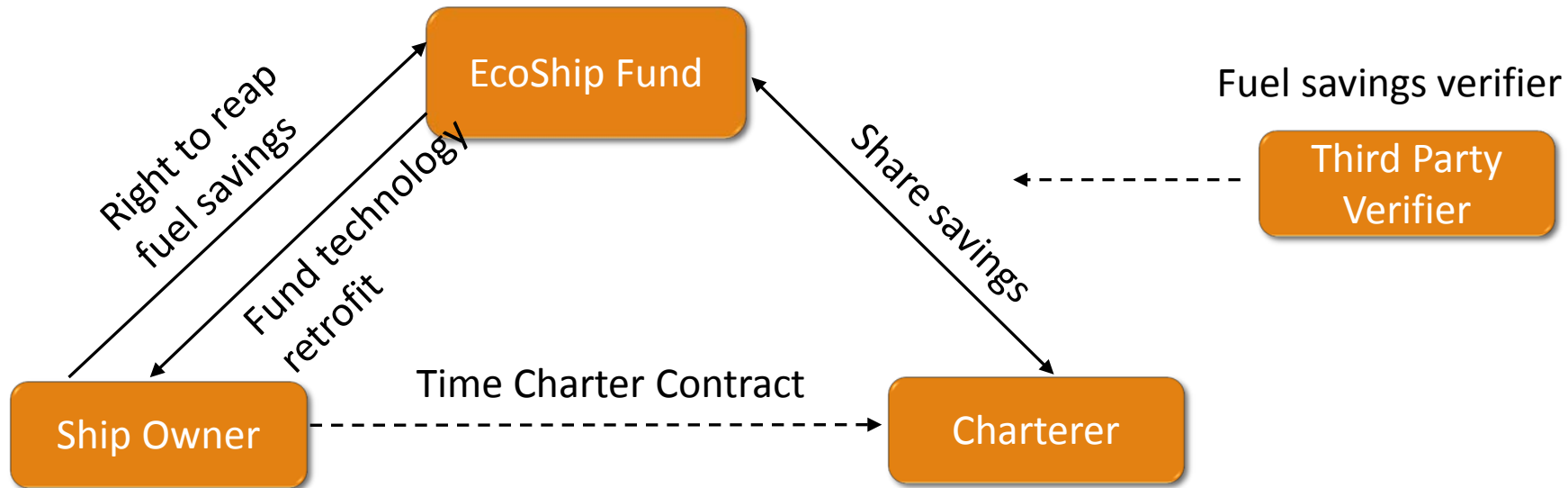


Split Incentive Barrier



ECOSHIP FUND

How EcoShip Works?



Aligning Incentives

Financial Perspective

Cash Outflow

- Fund the ship-owner for 80% of CAPEX investment (maintenance & other costs incurred by the ship-owner)

Cash Generation

- Cash is generated through net fuel savings
- EcoShip and charterer split the fuel savings

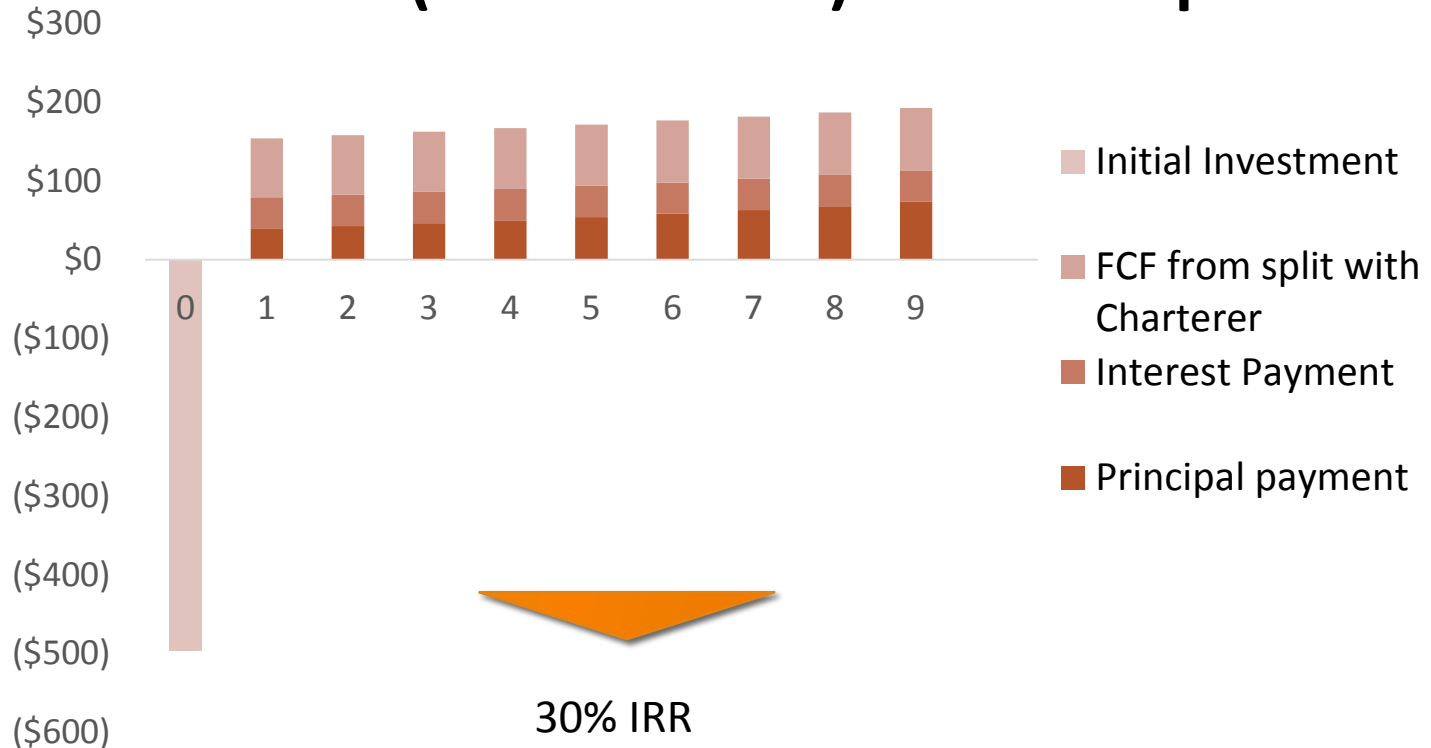
Cash Inflow

- Principal and interest payments
- 2.5% management fee
- Free cash flow split between EcoFund and Charterer
- Target IRR of at least 20% for EcoShip

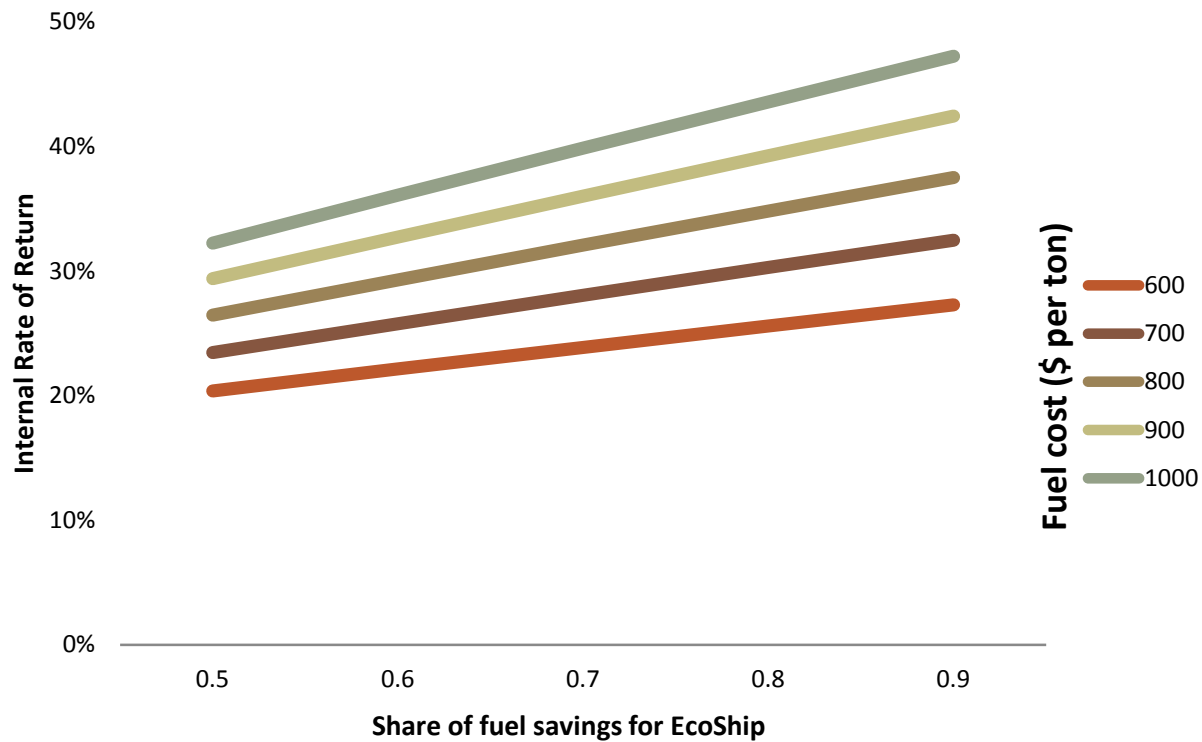
Return to EcoShip

Application of Water Flow Optimization Technology to 150,000 deadweight bulk carrier

FCF (in thousands) for EcoShip



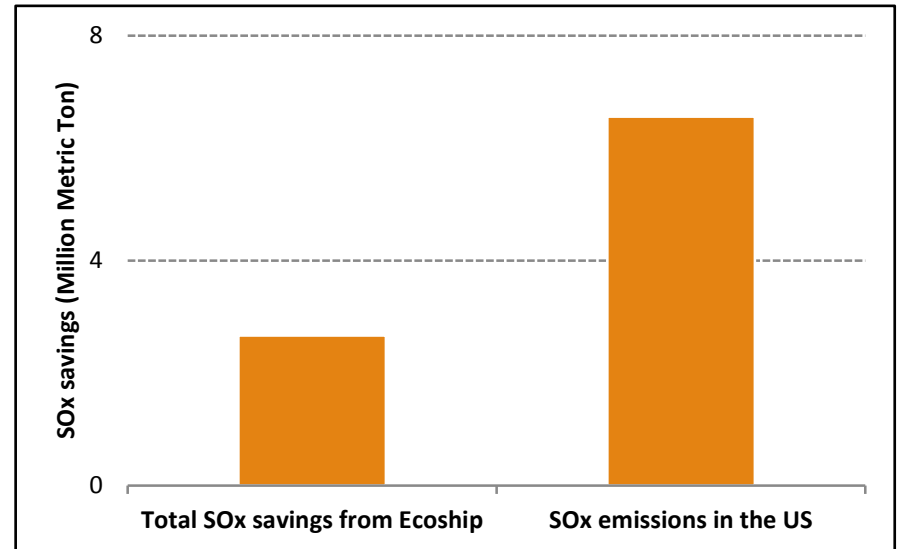
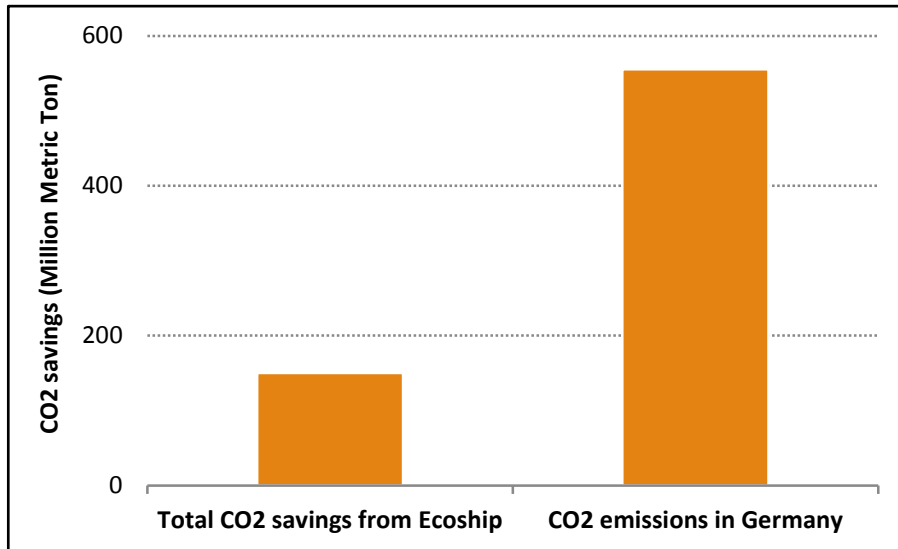
IRR for EcoShip – Different Scenarios



Environmental Benefits of EcoShip

Substantial CO₂ and SO_x savings

- 150 mmt CO₂ savings: 27% of fossil fuel based CO₂ in Germany
- 2.7 mmt SO_x savings: 40% SO_x emissions in the US



Risk Mitigation

Default risks

- **Risk:** Ship owners or charters may default in the event of economic hardship
- **Solution:** The fund will have the asset of ship owners (i.e. ships where the energy-saving technologies are retrofitted) as a collateral
- **Risk:** Ship owners or charters may collude and default from the fund arrangement
- **Solution:** The fund can create an escrow account where charterers deposit part of their cash flows as a collateral

Fuel risk

- **Risk:** Persistently low fuel price decreases the fuel saving
- **Solution:** The fund can enter the futures market to lock in a target fuel price

Disposition risk

- **Risk:** When ship owners want to resell or re-charter the ship, they may not be able to find willing buyers or charterers for this arrangement
- **Solution:** The fund can sell the cash flow to ship owners or other financial institutions

PATH FORWARD

Next Steps

Phase I: Year 1-2

- Work with a U.S. ship owner
- Collaborate with America Bureau of Shipping
- Leverage knowledge basis to build up the success of EcoShip

Phase II: Year 3-7

- Scale up the success in international market
- Work on the platform of International Maritime Organization
- Take the opportunity of ongoing regulatory pressure on ship efficiency and sulfur levels in marine diesel fuels

Phase III: Year 8-10

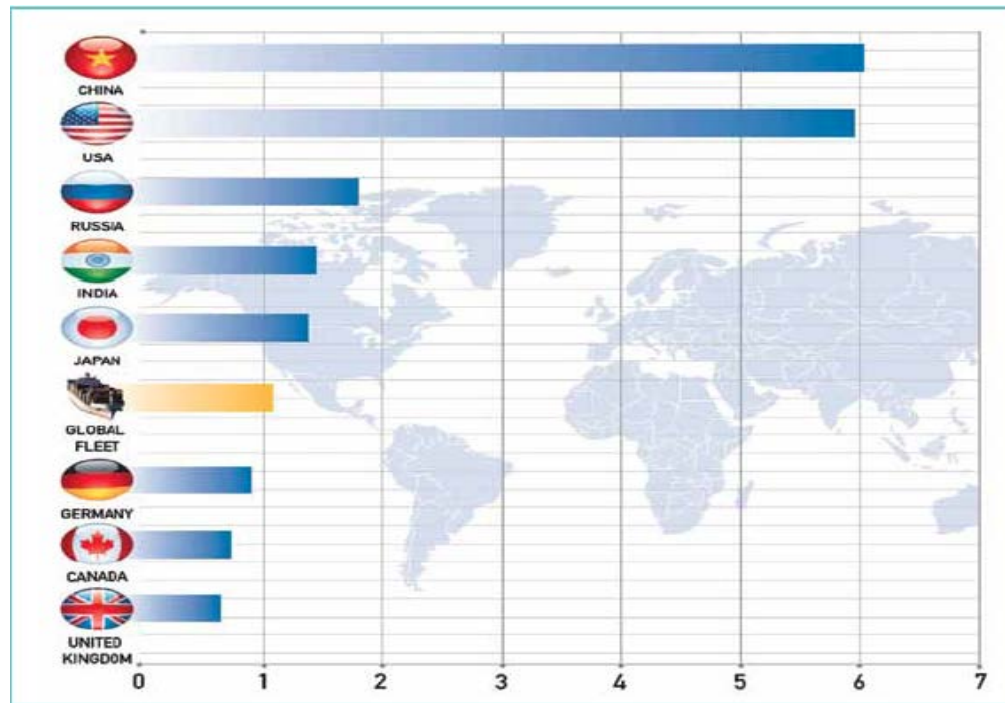
- Time the market and prepare for an exit strategy

QUESTIONS

APPENDIX

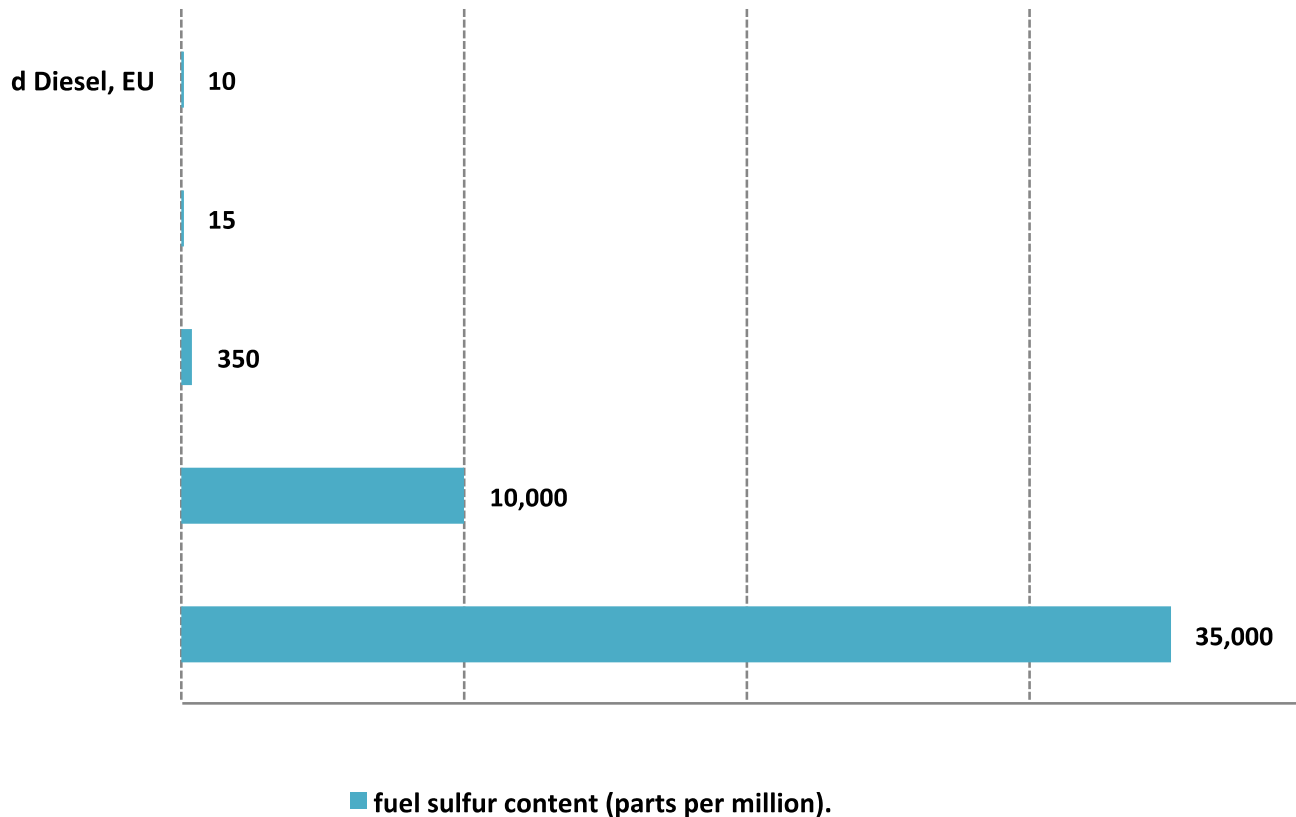
Climate Impact of International Shipping

- Shipping emits 1,000 million metric tons (mmt) CO₂ per year



The fuel quality of marine diesel fuel

- Shipping uses the type of diesel fuel with extremely high sulfur level



Barriers to Energy Efficiency Implementation Measures

Market failures

- Principal- agent problem
- Imperfect asymmetric information

Non-market failures

- Hidden costs
- Access to capital
- Risks

Organizational & Behavioral

- Power, culture
- Values, priorities, inertia, credibility and trust

Cash flow estimate in the example of the EcoFund

Cash flow calculation

	1	2	3	4	5	6	7	8	9
Fuel savings	\$252,274	\$257,320	\$262,466	\$267,715	\$273,070	\$278,531	\$284,102	\$289,784	\$295,579
Depreciation	(\$68,889)	(\$68,889)	(\$68,889)	(\$68,889)	(\$68,889)	(\$68,889)	(\$68,889)	(\$68,889)	(\$68,889)
Principle payment to bank	(\$39,720)	(\$42,897)	(\$46,329)	(\$50,035)	(\$54,038)	(\$58,361)	(\$63,030)	(\$68,072)	(\$73,518)
Other extra cost	(\$10,000)	(\$10,000)	(\$10,000)	(\$10,000)	(\$10,000)	(\$10,000)	(\$10,000)	(\$10,000)	(\$10,000)
After tax cash Flow	\$93,566	\$94,873	\$96,074	\$97,154	\$98,100	\$98,897	\$99,528	\$99,976	\$100,221
Add depreciation back	\$162,455	\$163,762	\$164,963	\$166,043	\$166,989	\$167,786	\$168,417	\$168,865	\$169,109
Minus cash flow to creditor	(\$39,680)	(\$39,680)	(\$39,680)	(\$39,680)	(\$39,680)	(\$39,680)	(\$39,680)	(\$39,680)	(\$39,680)
Available FCF to equity owner	\$122,775	\$124,082	\$125,283	\$126,363	\$127,309	\$128,106	\$128,737	\$129,185	\$129,429
FCFE to owner	\$23,464	\$23,464	\$23,464	\$23,464	\$23,464	\$23,464	\$23,464	\$23,464	\$23,464
FCFE to creditor and charterer	\$99,311	\$100,619	\$101,819	\$102,899	\$103,845	\$104,642	\$105,273	\$105,721	\$105,966
FCFE to bank	\$74,483	\$75,464	\$76,364	\$77,174	\$77,884	\$78,481	\$78,955	\$79,291	\$79,474
FCFE to charterer	\$24,828	\$25,155	\$25,455	\$25,725	\$25,961	\$26,160	\$26,318	\$26,430	\$26,491
Outlay	(\$625,000)								
Total FCF to	(\$125,000)	\$23,464	\$23,464	\$23,464	\$23,464	\$23,464	\$23,464	\$23,464	\$23,464
Total FCF to	(\$496,000)	\$150,036	\$154,090	\$158,314	\$162,717	\$167,312	\$172,109	\$177,123	\$182,367

IRR for owner	12%
IRR for bank	29%
Fuel savings	3180
CO2 savings	10017

Impacts on the Bulk Carrier

The cost of technology: \$620,000

Annual fuel use of the bulk carrier: 14,133 tonnes

Fuel cost of 0.5% sulfur Marine Diesel Oil: \$700 per tonne

Lifetime of water flow optimization technology: 9 years

IRR for EcoShip: 30%

CO₂ reduction in 9 years: 10,017 tonnes

SOx reduction in 9 years: 178 tonnes

The Market Timing

