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

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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

Winebrake et al (2013) “Mitigating the health impacts of pollution from Ocean-going shipping”
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

Time Charter Contract

Ship Owner
- Selects energy-efficient technology

Charterer
- Bears the capital spending
- Pays energy bills

SOLUTION
Offering Financial Incentives to All Stakeholders
ECOSHIP FUND
How EcoShip Works?

Aligning Incentives

Ship Owner

Charterer

EcoShip Fund

Fuel savings verifier

Third Party Verifier

Time Charter Contract

Right to reap fuel savings
Fund technology retrofit
Share savings
<table>
<thead>
<tr>
<th>Cash Outflow</th>
<th>Cash Generation</th>
<th>Cash Inflow</th>
</tr>
</thead>
</table>
| • Fund the ship-owner for 80% of CAPEX investment (maintenance & other costs incurred by the ship-owner) | • Cash is generated through net fuel savings  
• EcoShip and charterer split the fuel savings | • 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

- Initial Investment
- FCF from split with Charterer
- Interest Payment
- Principal payment

30% IRR
IRR for EcoShip – Different Scenarios
Environmental Benefits of EcoShip

Substantial CO₂ and SOx savings

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

![CO₂ savings](chart)

![SOx savings](chart)
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

*Oceania (2011) “Shipping Solutions: Technological and operational methods available to reduce CO₂”*
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

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<tr>
<td>Fuel savings</td>
<td>$252,274</td>
<td>$257,320</td>
<td>$262,466</td>
<td>$267,715</td>
<td>$273,070</td>
<td>$278,531</td>
<td>$284,102</td>
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<td>Depreciation</td>
<td>($68,889)</td>
<td>($68,889)</td>
<td>($68,889)</td>
<td>($68,889)</td>
<td>($68,889)</td>
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<td>Principle payment to bank</td>
<td>($39,720)</td>
<td>($42,897)</td>
<td>($46,329)</td>
<td>($50,035)</td>
<td>($54,038)</td>
<td>($58,361)</td>
<td>($63,030)</td>
<td>($68,072)</td>
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<td>Other extra cost</td>
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<td>After tax cash Flow</td>
<td>$93,566</td>
<td>$94,873</td>
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<td>$98,897</td>
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<td>Add depreciation back</td>
<td>$162,455</td>
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<td>$166,043</td>
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<td>Available FCF to equity owner</td>
<td>$122,775</td>
<td>$124,082</td>
<td>$125,283</td>
<td>$126,363</td>
<td>$127,309</td>
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<td>FCFE to creditor and charterer</td>
<td>$99,311</td>
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<td>$102,889</td>
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<td>$24,828</td>
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<td>Outlay</td>
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<td>Total FCF to</td>
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<td>$154,090</td>
<td>$158,314</td>
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<td>IRR for owner</td>
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## Impacts on the Bulk Carrier

<table>
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<th>Description</th>
<th>Value</th>
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<tr>
<td>The cost of technology: $620,000</td>
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<tr>
<td>Annual fuel use of the bulk carrier: 14,133 tonnes</td>
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<tr>
<td>Fuel cost of 0.5% sulfur Marine Diesel Oil: $700 per tonne</td>
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<td>Lifetime of water flow optimization technology: 9 years</td>
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<td>IRR for EcoShip: 30%</td>
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<tr>
<td>CO\textsubscript{2} reduction in 9 years: 10,017 tonnes</td>
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<tr>
<td>SO\textsubscript{x} reduction in 9 years: 178 tonnes</td>
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The Market Timing

Data from UNCTAD Review of Maritime Transportation, various years