Energy Efficiency Measure for Small Fishing Vessels

Presentation by
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Trend of Crude oil, CPUE, and No.of fishing Vessels of Thailand

Steady low CPUE

Source: Annual National Fisheries Statistics of Thailand, DOF

https://www.khaosod.co.th/special-stories/news_5909469
https://www.bbc.com/thai/international-39276030

Global Warming Impacts to Marine Resources

https://www.mdpi.com/2071-1050/12/14/5841
https://www.theglobaleconomy.com/Thailand/diesel_prices/
FAO AND SEAFDEC INITIATIVES ON FUEL AUDITS ON THAI TRAWL FISHING VESSELS PHASE I,II & III (2015-2018)

GOALS

Dependence on fossil fuels investment/requirements in fisheries (fishing boats) in the SEA region will be reduced

OBJECTIVES

- To estimate and optimize fuel consumption and CO₂ emission of fishing vessels
- Assessment of the use of fuel consumption in fishing operation through impact to fishermen
- Guidance on decreasing fuel consumption through appropriate adjustments and modifications to fishing boats, fishing gears, and fishing operation processes
Expenditures of small trawl fishing boats < 14 m, >18m

Source: Annual National Fisheries Statistics of Thailand, DOF

REGIONAL CONFERENCE ON GREEN SHIPPING IN MANILA, PHILLIPPINES, 15 – 18 MAY 2023
Six Demonstrated Trawlers Both Sea Water of Thailand
(LOA <14m, LOA 14-24m, LOA >24 m)
Tools and equipment for auditing fuel consumptions on trawl fishing vessels

Diesel Oil Tank
Revolution line
CCTV Camera line
GPS, Ship Speed
Digital tachometer
CCTV monitor
Revolution line
Wind speed measurement

Diesel Main Engine
Fuel return line
Fuel supply line
Fuel oil meter with small fuel accumulator

REGIONAL CONFERENCE ON GREEN SHIPPING IN MANILA, PHILIPPINES, 15 – 18 MAY 2023
Fuel consumption profile when fishing operation of Por Deangchareanchai

Speed during streaming: 5.5-8 knot
Speed during trawling: 2-2.5 knot
Fishing trip: 10 days

A: Voyage to the fishing ground
B: Voyage to the port
C: Voyage to anchor

Vessel speed (knot)

date (November)
Steaming

- 7 to 5 kts; 50% saving
- 150 THB/hr saving
- 445 THB/hr catch

Note:
Diesel oil : 25 THB/L
- Repeated for trawling
Optimum ship speed and Time Value of Por Deangchareanchai

Sea trial: 4.5-6 knot, 900 – 1100 rpm
Sea trial with net: 3.5-3.7 knot, 1000 – 1100 rpm

Diesel oil: 25 THB/liter
1USD: 30 THB

8.6x
12 %
PERCENTAGE OF FUEL CONSUMPTION DURING FISHING TRIP

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Steaming to fishing ground</th>
<th>Fishing operation phase</th>
<th>Steaming to other fishing ground phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: W. Yingcharoen</td>
<td>6.74</td>
<td>82.67</td>
<td>10.59</td>
</tr>
<tr>
<td>B: Chokpanthawee</td>
<td>2.14</td>
<td>94.34</td>
<td>3.51</td>
</tr>
<tr>
<td>C: Supsaitong</td>
<td>1.78</td>
<td>95.47</td>
<td>2.75</td>
</tr>
<tr>
<td>D: Choknimitr</td>
<td>10.43</td>
<td>78.19</td>
<td>11.38</td>
</tr>
<tr>
<td>E: S. Charoenchai 1</td>
<td>6.97</td>
<td>86.91</td>
<td>6.12</td>
</tr>
<tr>
<td>F: Chokchanapol</td>
<td>5.68</td>
<td>89.81</td>
<td>4.52</td>
</tr>
<tr>
<td>Average</td>
<td>5.62</td>
<td>87.9</td>
<td>6.48</td>
</tr>
</tbody>
</table>

Additional Resistance from Door + Trawl net
Hull + engine performance
**Economic perspectives:**

- Experience of fisherman
- Difference revenue of trawlers
- Fuel cost: 50-80% of total cost
- Fishing Season:
  - Abundance of fishing ground
  - High value target catches:
    - live blue swimming crab
  - Efficiency of trawl fishing boat, gear

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**REGIONAL CONFERENCE ON GREEN SHIPPING IN MANILA, PHILLIPPINES, 15 – 18 MAY 2023**
**CATCH PERFORMANCE AND CARBON EMISSION CONSIDERATION**

**Fuel consumption per catch (L/kg) for Bottom trawlers**

<table>
<thead>
<tr>
<th>LOA&lt;14m</th>
<th>14&lt;LOA&lt;24m</th>
<th>LOA&gt;24m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel A: Chokpanthawee</td>
<td>1.04</td>
<td>0.18</td>
</tr>
<tr>
<td>Vessel B: Subsaitong</td>
<td>1.33</td>
<td>0.17</td>
</tr>
<tr>
<td>Vessel C: Chokchanapol</td>
<td>0.35</td>
<td>0.32</td>
</tr>
<tr>
<td>Vessel D: Pordaengcharoenchai</td>
<td>0.35</td>
<td>0.32</td>
</tr>
<tr>
<td>Vessel E: Sormongkontong 19</td>
<td>0.0</td>
<td>0.17</td>
</tr>
<tr>
<td>Vessel F: Chorchoknirun</td>
<td>0.0</td>
<td>0.17</td>
</tr>
</tbody>
</table>

**Fuel consumption (L) per kg catch**

- **Vessel A: Chokpanthawee**
- **Vessel B: Subsaitong**
- **Vessel C: Chokchanapol**
- **Vessel D: Pordaengcharoenchai**
- **Vessel E: Sormongkontong 19**
- **Vessel F: Chorchoknirun**

**Carbon Emission Calculation**

Calculate CO2 by amount of fuel used:

- **LOA<14m**
  - Vessel A: Chokpanthawee
  - Vessel B: Subsaitong
  - Vessel C: Chokchanapol
  - Vessel D: Pordaengcharoenchai
  - Vessel E: Sormongkontong 19
  - Vessel F: Chorchoknirun

**Source:** [http://www.fleetnews.co.uk/content/carbon-footprint-calculator/](http://www.fleetnews.co.uk/content/carbon-footprint-calculator/)

**Regional Conference on Green Shipping in Manila, Philippines, 15 – 18 May 2023**
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Est. cost (USD)</th>
<th>Est. annual fuel saving (%)</th>
<th>Est. annual fuel saving (THB)</th>
<th>Est. payback period (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce engine revolutions</td>
<td>0</td>
<td>5</td>
<td>37,500</td>
<td>-</td>
</tr>
<tr>
<td>Install fairing pieces</td>
<td>500</td>
<td>5</td>
<td>37,500</td>
<td>0.43</td>
</tr>
<tr>
<td>Reduce underwater fouling</td>
<td>1,000</td>
<td>5</td>
<td>37,500</td>
<td>0.87</td>
</tr>
<tr>
<td>Modify ventilation to engine room</td>
<td>1,000</td>
<td>5</td>
<td>37,500</td>
<td>0.87</td>
</tr>
<tr>
<td>Install streamlined rudder</td>
<td>2,000</td>
<td>5</td>
<td>37,500</td>
<td>1.73</td>
</tr>
<tr>
<td>Install fuel flow meter</td>
<td>3,000</td>
<td>15</td>
<td>112,500</td>
<td>0.87</td>
</tr>
<tr>
<td>Install more efficient propeller</td>
<td>5,000</td>
<td>15</td>
<td>112,500</td>
<td>1.44</td>
</tr>
<tr>
<td>Install larger mesh netting or finer twine</td>
<td>5,000</td>
<td>10</td>
<td>56,250</td>
<td>2.89</td>
</tr>
<tr>
<td>Install autopilot</td>
<td>8,000</td>
<td>5</td>
<td>37,500</td>
<td>6.93</td>
</tr>
<tr>
<td>Install hydrodynamic otter boards</td>
<td>8,000</td>
<td>10</td>
<td>56,250</td>
<td>4.62</td>
</tr>
<tr>
<td>Install propeller nozzle</td>
<td>20,000</td>
<td>20</td>
<td>150,000</td>
<td>4.33</td>
</tr>
<tr>
<td>Incrase waterline length</td>
<td>30,000</td>
<td>15</td>
<td>112,500</td>
<td>8.66</td>
</tr>
</tbody>
</table>
A STAKEHOLDER MEETING IN SATUN PROVINCE (A PILOT SITE)

- Dissemination of the results of the energy consumption scale carried out on the demonstration fishing vessel
- Raising awareness of fishermen about more efficient use of energy
- Engage stakeholders in a dialogue to gather their perspectives on resolving energy cost and CO₂ emission challenges
THE MAIN REFERENCE DOCUMENTS THAT PROVIDES GUIDANCE FOR ENHANCING THE ENERGY EFFICIENCY OF SMALL FISHING VESSELS

Fuel savings for small fishing vessels

A manual

Fuel and financial savings for operators of small fishing vessels

FAO FISHERIES TECHNICAL PAPER 838

Fuel use in fisheries in Southeast Asia

Rusdi Chohmequean, Steve Rayner and Sulpring Thaisongsak

Optimizing Energy Use in Fisheries in Southeast Asia

Fuel use in fisheries in Southeast Asia

Rusdi Chohmequean, Steve Rayner and Sulpring Thaisongsak

Fishing Vessels Energy Audit: Operational Benchmarking of Fuel Consumption in Southeast Asian Trawl Fisheries – Pilot Project in Thailand

Rusdi Chohmequean, Steve Rayner and Sulpring Thaisongsak

The main reference documents that provide guidance for enhancing the energy efficiency of small fishing vessels include:

1. Fuel savings for small fishing vessels
   - A manual
2. Fuel and financial savings for operators of small fishing vessels
   - FAO Fisheries Technical Paper 838
3. Optimizing Energy Use in Fisheries in Southeast Asia
   - Rusdi Chohmequean, Steve Rayner and Sulpring Thaisongsak
   - Rusdi Chohmequean, Steve Rayner and Sulpring Thaisongsak

These documents provide comprehensive guidance on enhancing energy efficiency in small fishing vessels through various strategies, including fuel savings and financial optimization. They are particularly relevant for operators and policymakers looking to reduce the environmental impact and operational costs of fishing vessels.
FUEL-SAVING RECOMMENDATIONS FOR SMALL FISHING VESSELS BASED ON THE PROVIDED DOCUMENTS

<table>
<thead>
<tr>
<th>External Factors Affecting Fuel Efficiency of Fishing Vessels</th>
<th>Internal Factors Affecting Fuel Efficiency of Fishing Vessels</th>
</tr>
</thead>
</table>
| **Water resistance, Wave making resistance, wind resistance:**  
  • Reject unnecessary weight  
  • Use optimum vessel speed  
  • Decrease water resistance  
    - hydrodynamic improvements by remodeling hull shape, appendages, bulbous bow, aerodynamic of upper deck, steam line of astern hull shape, low astern wage, etc.  
    - bigger mesh size of fishing net  
  • Maintain the stability of the fishing vessel | **Loss or inefficiency in fuel consumption and propulsion system:**  
  Inefficient performance of the diesel engine:  
  • Issues with the fuel injection system  
  • Problems with the cooling system, such as blockages in the heat exchanger or malfunctioning water pump  
  Ineffective performance of the propeller:  
  • Damaged or broken propeller blades  
  • Impact of the cavity effect  
  • Inappropriate propeller diameter selection  
  • Absence of a ducted propeller system  
  Inefficient performance of the refrigeration system:  
  • Leakage or degradation of the insulation in the fish hold, among other potential issues. |
Ways and means of reducing the use of fossil fuel in fisheries

• Alternative fuel use
  • LPG
  • LNG
  • CNG
  • Hydrogen, HHO
  • Bio-diesel
  • Diesel-water emulsion*

• Alternative energy use
  • Wind
  • Solar

* Diesel-water emulsion refers to a mixture of diesel fuel and water, which is designed to reduce pollution and improve fuel efficiency.
Thank You very much for your kind attention

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