The Operational Strategy of Alternative Maritime Power at YGPA’s container port in South Korea

HYOWON KANG*, JAMES A. FAWCETT**

*Andong National University, Gyeongbuk, SOUTH KOREA
**University of Southern California, SEAGRANT PROGRAM
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I. Motivation

1) Background

- Nature(2016) estimate that these ten ports contribute 20% of port emissions worldwide.

Source: JTBC Newsroom (Jun-5, 2018)

Source: https://www.nature.com/news/pollution-three-steps-to-a-green-shipping-industry-1.19369#ten (Apr-19, 2016)
I. Motivation

2) Challenging New Environmental Protection Measure in Korea

- In an effort to reduce air pollution, the S. Korea 4 port authorities (Busan, Incheon, Ulsan and Yeosu Gwangyang) are set to install AMP. (Ship & Bunker, 2017)
3) Emerging New electric vessels

- Nicknamed the “Tesla ship”, the emission-free boats are the latest offerings in a fleet of new electric vessel in Europe.

- Company : Port-Liner (Dutch Company)

- Barges spec.
  - all-electric barges
  - 52 metres(Length) and 6.7m(Width)
  - to carry 280 containers
  - to serve 17 inland terminals in the Northwest Europe region.

Source: https://www.dw.com/en/are-electric-vessels-the-wave-of-the-future-in-shipping/a-43046309
2) Objectives

- Meanwhile, ports are in competition with one another, especially in Northeast Asia.

- Deutsche Welle(2018) said, “These intense competition makes them resistant to press ahead with green port schemes.

- Nonetheless, South Korea’s government (MOF) has been enacting rules and measures such as ECA(Emission Control Area), AMP(Alternative Maritime Power).

- Research Question 1
  - How are AMP facilities operated in YGPA's container port?

- Research Question 2
  - What is AMP operational performance?
II. Literature Review

1. Chen et. al. (2019), Alternative Maritime Power application as a green port strategy: Barriers in China

- Ships using power generators when hoteling can cause serious air pollution and thus pose a threat to port community.

2. LAHD (2016), San Pedro Waterfront Project EIS/EIR

- When in port, ships burns marine diesel in on-board generators to produce electricity.
- Those activities are significant contributors to poor local and regional air quality.
- 100% tugboats shall use AMP while hoteling at the LA Port since 2014.

3. Cannon (2008), U.S. Container Ports and Air Pollution: A Perfect Storm

- More than 10,000 visits to ports in the U.S from around the world each.
- Burning diesel fuel releases health threatening toxic air contaminants, smog forming air pollutions, and climate changing greenhouse gases.
III. Operational Strategy

1. Yeosu-Gwangyang Port Authority (YGPA) Facilities

Source: Google map (http://maps.google.com)
III. Operational Strategy

2. AMP for Tugboat

- In S. Korea’s ports have been operating low voltage AMP for tugboats.
  - 51 tugboats
  - 56 panel board

Power Outlet
On board

Panel Board
Shore side

Ship to Ship connection
Berth
IV. Results

1. Economic Value

- Basically, the electric rate is stable than the bunker price. Whereas, the oil price is highly volatile.

- The former is related to AMP cost and the latter is linked with MGO.

- Economic Value (4yrs)
  
  - Total AMP $447K vs. Total MGO $2.6M
  
  - Shipowners’s savings : about $2.1M

<table>
<thead>
<tr>
<th>Cost (US$)</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019*</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMP** (A)</td>
<td>87,756.02</td>
<td>112,127.96</td>
<td>144,402.78</td>
<td>102,881.18</td>
</tr>
<tr>
<td>MGO*** (B)</td>
<td>370,283.38</td>
<td>507,043.21</td>
<td>712,905.51</td>
<td>1,044,801.17</td>
</tr>
<tr>
<td>Economic Value (B-A)</td>
<td>282,527.36</td>
<td>394,915.25</td>
<td>568,502.74</td>
<td>941,919.99</td>
</tr>
</tbody>
</table>

* : 2019 Present
** : Invoice amount
*** : Estimation [Avg. MGO consumption(ton/day) x total tugboats x 365 days x Global 20 ports Avg. MGO price (ton)]

Source: YGPA, Ship & Bunker (http://www.shipandbunker.com)
IV. Results

2. Social Value

- It is linked to pollutants. (such as O₃, CO, NO₂, SO₂, PM₂.₅, PM₁₀)

- Social Value (4yrs)

  - Total carbon emission 2,032 ton from AMP but MGO is 9,146 ton. AMP emits less carbon than MGO: 7,114 ton
  
  - Decreasing noise and oscillation when the tugboats hotel at the berth. Increasing welfare for seaman.

### Carbon emission (ton)

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019*</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMP** (A)</td>
<td>360.8</td>
<td>526.6</td>
<td>651.8</td>
<td>493.0</td>
</tr>
<tr>
<td>MGO*** (B)</td>
<td>1,662.9</td>
<td>1,995.5</td>
<td>2,494.4</td>
<td>2,993.3</td>
</tr>
<tr>
<td>Social Value (B-A)</td>
<td>1,302.2</td>
<td>1,468.9</td>
<td>1,842.6</td>
<td>2,500.2</td>
</tr>
</tbody>
</table>

* : 2019 Present
** : Invoice amount
*** : Estimation [Avg. carbon emission(ton) x Avg. MGO consumption(ton) x 365 days]
Source: YGPA

Source: Google Images
V. Conclusion

- Though it makes an additional investment between terminal operators and shipping companies, in various efforts to reduce air pollutants nearby port community are getting more important.

- Inter alia, AMP facility is one of proper alternatives.

- the S. Korea 4 port authorities had been operating AMP for tugboats only.

- The benefits of the operating AMP generated a huge economic and social value.

- For 4yrs, the economic value of tugboat’s ship-owners is $2.2M.
  - Ship-owners can expect their expenditure for the electrical fare, they also can escape the volatile of MGO price.

- In the social value, after the introduction of AMP, tugboats reduced the carbon exhaust 7.1K ton for 4yrs.
  - In addition to, the stress of seaman was improved whereas they await at the berth for a few hours.

- Thus, the invests for protecting environment bring about the economic performance and the social benefits.
References


- Port of LA (2013), High Voltage Shore Connection (HVSC) Systems Guidelines

- OIES (2018), A review of demand prospects for LNG as a marine transport fue

- Port of LB (2008), Pier T Berth T121 BP Cold Ironing Project For Alaska Class Tankers
THANK YOU
FOR YOUR ATTENTION

Contact info.
hwkang@anu.ac.kr
fawcett@usc.edu