Addressing the Waste in Shipping Eco System

Sanjay Verma

Director Business Development – LNG & Hybrid
Marine Solutions
Wartsila Singapore Pte Ltd

At Wartsila everything we do in order to "enable sustainable societies" relies on combining technologies, solutions and business models to support our themes and encourage the industry to embrace technology and change, in order to remain viable.

Our vision of Smart Marine and Smart Energy is underpinned by everything we do in support of a clean environment, energy intelligence, and market shaping and innovation.

Our purpose paints a picture. What we do in practice is about making things happen, disrupting the status-quo, and shaping the future of the marine and energy markets.

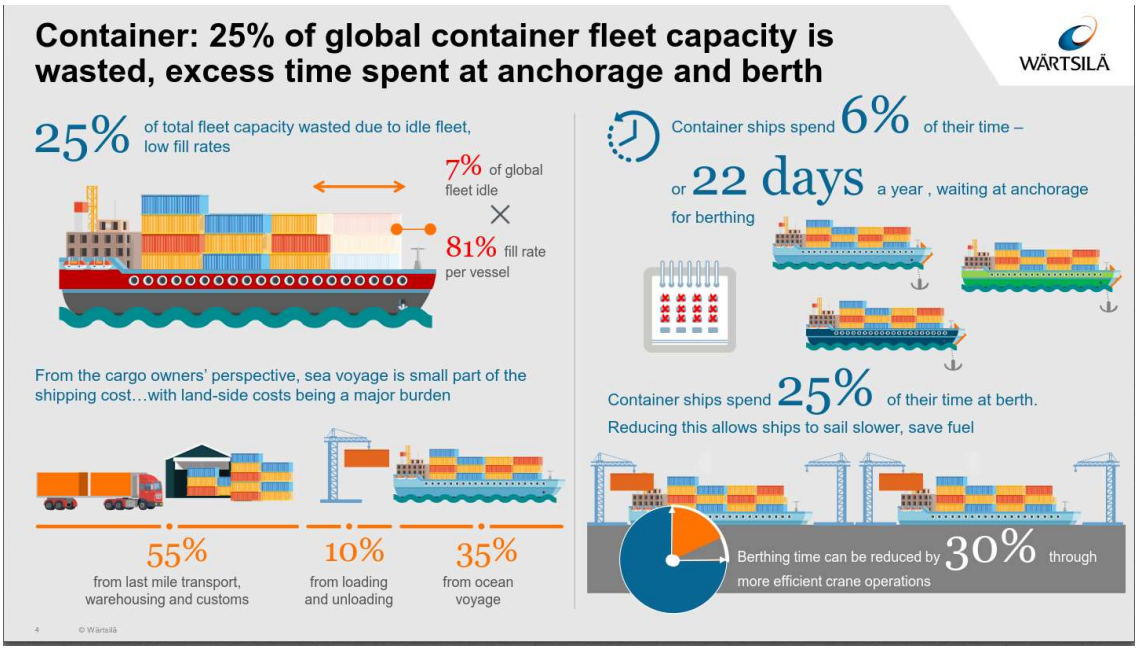
"**Enabling sustainable societies with smart technology**" means that we care about **pollution**, our **oceans**, the **environment**, **nature**, our **cities**, the **quality of our lives**, the **lives of our children**, **future generations**, our **legacy**, our **planet**!

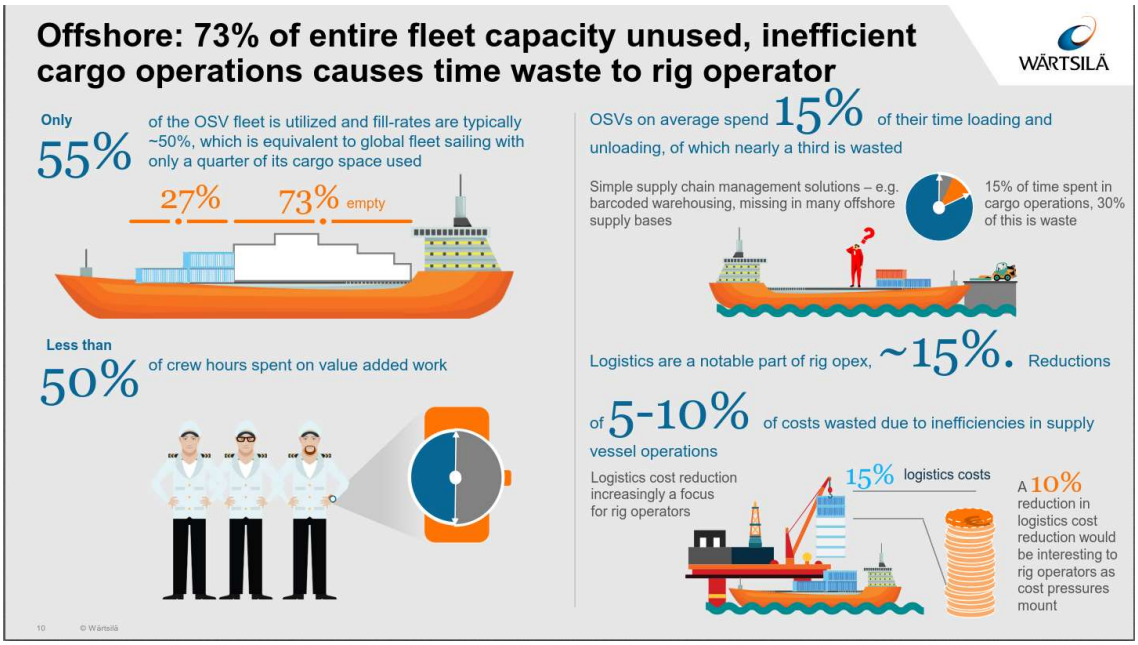
The time to ACT and be bold has come!

We see **a 'perfect storm' brewing**! Global prosperity has been built on cities and sea. But **urbanization** and **sustainability** are being held back by a **marine (& energy) ecosystem** that has **yet to fully embrace digitalization** and realize its full potential.

Shipping today is characterized by **waste**, **pollution** and **inefficiencies**: studies suggest that **around $30 billion annually** is wasted in **fuel efficiency & waiting times at ports** alone!

For example:





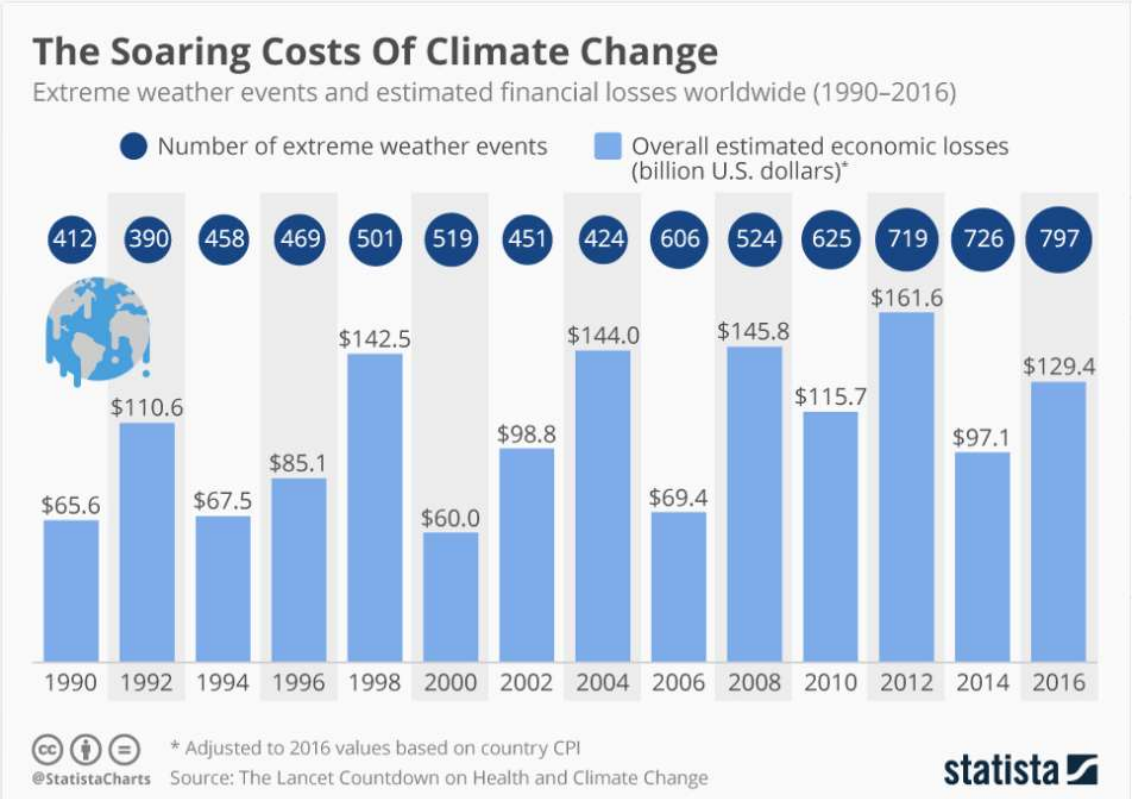
The cost to the economy is significant! Greenhouse gasses are heating up our planet and damaging our life and environment!

Climate change is happening!

A report has found that climate change is having an enormous negative impact on global labour productivity, the spread of infectious diseases and exposure to heatwaves and pollution. The inaugural report from The Lancet Countdown on Health and Climate Change also found that weather-related disasters are becoming increasingly common with an average of 306 events attributable to extreme weather occurring every year between 2007 and 2016, a 46 percent increase since 2000.

Mainly storms and floods, these disasters are causing catastrophic levels of economic damage around the world. For example, Hurricane Katrina inflicted $108 billion (2005 dollars) in economic losses, about four times as much as Hurricane Andrew in 1992. The threat posed by climate change and resulting extreme weather can be seen from the following infographic. Ten years, ago there were 606 extreme weather losses with a bill of $69 billion. Last year, there were 797 weather-related disasters worldwide, resulting in $129 billion of economic losses.

The number of extreme events between 2008 and 2016 increased by 30%, but the cost to the economy doubled!



Governments across the globe are starting to take action to address pollution as a significant cause-of-death!

Did you know that our oceans are worth $24 trillion, generating (a GDP of) $2.5 trillion in goods and services annually? They are technically the seventh-largest economy worldwide.

And, according to the IMO, >90% of the world's trade is carried by Sea, which is in fact by far the most cost-effective way to move goods around the world. We need to protect our oceans if we are going to ensure a sustainable future for future generations.

Make no mistake about it! The world is "**waking up**"!

On April 13 2018 the IMO committed to reducing total annual GHG emissions by at least 50% by 2050 compared to 2008, and recently decided to set up a taskforce on autonomous ships, focussing on new technologies, efficiency, and safety at sea so there are great opportunities!

W**e should all join forces in promoting carbon-free shipping**, and that "a **clean-shipping future** must be based on **combining** different **technologies**" which "include **cleaner fuels**, **efficient vessel designs**, **hybrid** propulsion technologies, and **intelligent** vessels."

Our vision is about **leading the cooperation across an industry which is highly fragmented.** This will be beneficial for those in the industry, the **environment**, and our **oceans**

Today why there is such a focus on digitalisation? What advantages does digitalization bring to the marine industry?

Unprecedented convergence of rapidly evolving technologies enables new business models and disrupts existing ones.

Already today Four forces have started reshaping the maritime sector. These are:

Big Data Analytics:

Combining system and product engineering know-how, data depth and advanced computing allows us to transform raw data in value creating insights

- De-risking of decision making
- Performance optimization
- Predictive maintenance
- Anomaly detection
- Fleet optimization

Smart Ports:

Ports focus on autonomous operations and automated information exchange between vessels, port authorities and logistic partners

- Reduction of waiting time
- Optimization of sailing times and berth pricing
- Increased reliability and speed of vessel-to-port communication
- Automation of piloting, tug and berthing operations

Shared Capacity:

The introduction of platforms and marketplaces for vessel and port capacity sharing will lead to higher utilization and cargo fill rates

- Lower shipping prices
- Real time match to potential customers
- Reduction of the number of intermediators
- Improved E2E cargo tracking

Intelligent Vessel:

A continous development of modular solutions will make ships smarter adding advanced navigation capabilities, increased levels of automation, connected systems and insight driven value added services

- Advanced route planning
- Collision prevention
- Autodocking
- Remote and automated operations
- Holistic energy and emission management
- Fleet coordination

Digitalization redefines how companies create value for their customers. The on-going digitalization is blurring the line that traditionally separates supplier's and customer's business model. The focus is shifting from the product and its standalone performance to the actual outcome the customer expects from it.

<u>New forms of collaboration must be explored to maintain the fast pace of transformation: the smart marine ecosystem</u>

<u>Case Study</u>

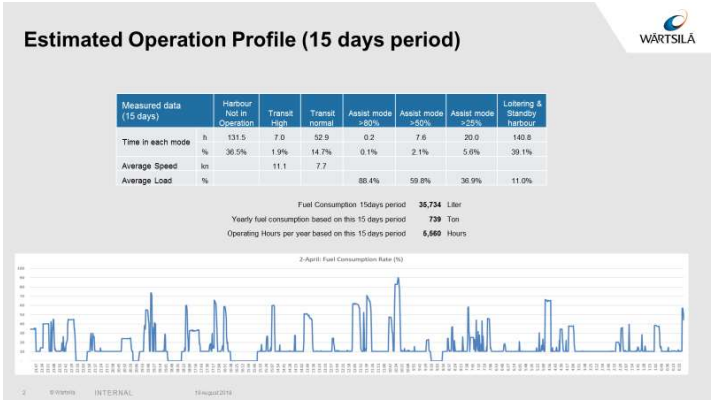
"Intelligent Vessels does not mean Unmanned vessel"

In the following case study, I take an example of a Harbour Tug which most of you are familiar with and would like to highlight the advantages of applying new available technologies to make the Tug more efficient in terms of total cost of ownership.

With this example, I want to highlight how even a small vessel can contribute towards reducing waste and saving the environment at the same time. Making the business more sustainable.

<u>60 T Harbour Tug:</u>

Following is a typical operating profile of a harbour tug



It is well known in the industry that these tugs only use the maximum bollard pull or installed power for less than 2% of its life time. However, the main machinery is installed for this requirement.

In the case study, we have considered several propulsion configuration and compared it with the traditional solution.

Comparison of Propulsion Configuration

Equipment	DM Conventional	DM FPP - Hybrid	DM CPP – Hybrid	DE FPP – Hybrid
Main engines	2 x High-speed (2 x 1860kWm, 1800rpm)	2 x W8L20 (2 x 1600kWm, 1000rpm)	2 x W8L20 (2 x 1600kWm, 1000rpm)	2 x W6L20E (2 x 1320kWm, 1200rpm)
Aux gensets - High speed	2 x 99kw	1 x 99kw	1 x 99kw	-
Emergency Genset	Battery (or 1 x 97kWm)	Battery (or 1 x 97kWm)	Battery (or 1 x 97kWm)	Battery (or 1 x 97kWm)
Available Battery Power	-	1000kW	1000kW	1600kW
Battery Capacity	-	339kWh	339kWh	565kWh
Thrusters	2 x WST-18 FP (1860kW, 2.4m,1800rpm)	2 x WST-18 FP (1860kW, 2.4m,1000rpm)	2 x WST-21 CP (1940kW, 2.4m,1000rpm)	2 x WST-18 FP (1860kW, 2.4m,1200rpm)
Thruster E-Motor	-	2 x 400kW @ 640rpm	2 x 400kW @ 640rpm	2 x 1860kW @ 1200rpm
Other		Heavy Duty Clutch		

DM: Diesel Mechanical Propulsion
DE: Diesel Electric Propulsion
Hybrid: Batteries installed

FPP: Fixed Pitch Propeller
CPP: Controllable Pitch Propeller

We have compared the installed power in all solution and the running hours for the main and auxiliary engines with and without batteries. Traditional versus hybrid systems.

Comparison of Propulsion Configuration

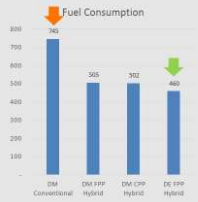
Comparison		DM Conventional	DM FPP Hybrid	DM CPP Hybrid	DE FPP Hybrid
Total Installed Mechanical Power:	kWm	4,015	3,299	3,396	2,640
Available Battery Power	kW	-	1,000	1,000	1,600
Battery Capacity	kWh	-	339	339	565
Main Engine running hours:	Hours/year	5,200	3,120	3,094	2,034
Aux. Engines running hours	Hours/year	4,068	52	52	-
Fuel Type		MGO	MGO	MGO	MGO

As we can see here that the installed mechanical power can be brought down by about 40% and the running hours can be brought down by more than 60%

Comparison of Propulsion Configuration (Cont.)

Comparison		DM Conventional	DM FPP Hybrid	DM CPP Hybrid	DE FPP Hybrid
Fuel Type		MGO	MGO	MGO	MGO
Fuel consumption in GJ:	GJ/year	32,440	22,250	22,120	20,347
Fuel consumption in Ton:	Ton/year	745	505	502	460
Comparison relative to Alt. 1	%	100.0 %	67.8 %	67.4 %	61.7 %
El. Power consumption from shore	MWh/year	175	200	200	200
Max Bollard Pull continous (Main Engines only)	T BP	63	54	54	40
Max Time in Peak Bollard Pull	Min	No limit	22	20	16
Max Time in Transit Eco 10kn on Battery	Min	-	19	19	33
Max Time in Transit Eco 8kn on Battery	Min	-	48	50	83

Fuel Cost	823	DM Conventional	DM FPP Hybrid	DM CPP Hybrid	DE FPP Hybrid
Fuel consumption in Ton:	Ton/year	745	505	502	460
Fuel Cost in USD:	USD	389,607	264,130	262,715	240,381
Reduced Fuel consumption:	Ton	-	240	243	285
Reduced Fuel cost:	USD	-	125,477	126,891	149,226



Thus, we can see that by having a hybrid propulsion for the tug we can bring down the fuel consumption of the ship by almost 40 %. The Opex is reduced considerably because of smaller installed engines and reduced running hours. The savings are estimated to be in the range of 55-60%. The payback of the additional Capex required for the hybrid solution is only 3-4 years,

The benefits are not just in terms of fuel and maintenance, The environmental impact of an intelligent solution is substantial as can be seen from the chart below.

Emissions		DM Conventional	DM FPP Hybrid	DM CPP Hybrid	DE FPP Hybrid
Summary of Yearly consumption of MGO	Ton/year	745	505	502	460
Emissions, CO2	Ton/year	2,481	1,656	1,648	1,485
Comparison CO2 - relative to Alt. 1.0	%	100.0%	66.8%	66.4%	59.8%
Emissions, NOx - Tier II (without SCR)	Ton/year	58.1	31.5	31.3	22.1
Comparison NOx - relative to Alt. 1.0	%	100.0%	54.2%	53.9%	38.0%
Emissions, Sox (without Scrubber)	Ton/year	1.5	1.0	1.0	0.9
Comparison SOx - relative to Alt. 1.0	%	100.0%	67.8%	67.4%	61.7%
Emissions, Particles	Ton/year	0.489	0.248	0.247	0.151
Comparison particles - relative to Alt. 1.0	%	100.0%	50.8%	50.6%	30.8%

However, in order to bring about these changes we need to challenge our existing way of contracting and tendering of such tugs. The charterers in most cases pay for the fuel and therefore the tug providers are not incentivised to adopt any newer solution to bring the change much needed in this industry.

My request to the industry and I know there are many change leaders and decision makers are present in this event is to challenge the age old method of contracting and evaluating. Bring the change and make a difference.

Tugs are just an example to show how the intelligent vessels can reduce the waste in the Marine Eco System. Adopt the newer technologies available to support the cause towards a greener and efficient tomorrow.

Thank you and good luck.