

SHIP EFFICIENCY 2011  
3rd International Conference  
Hamburg, 26 – 27 September 2011

# **STX** Advanced Technologies for **Green Dream**

**stx** Offshore & Shipbuilding

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# 1. Ship Design Trend Based on Environmental Regulatory Requirement



# 1) Present Issues

## ❖ Emissions Control

### OZONE PRECURSORS

(NO<sub>x</sub>, VOCS)

### Green House Gases

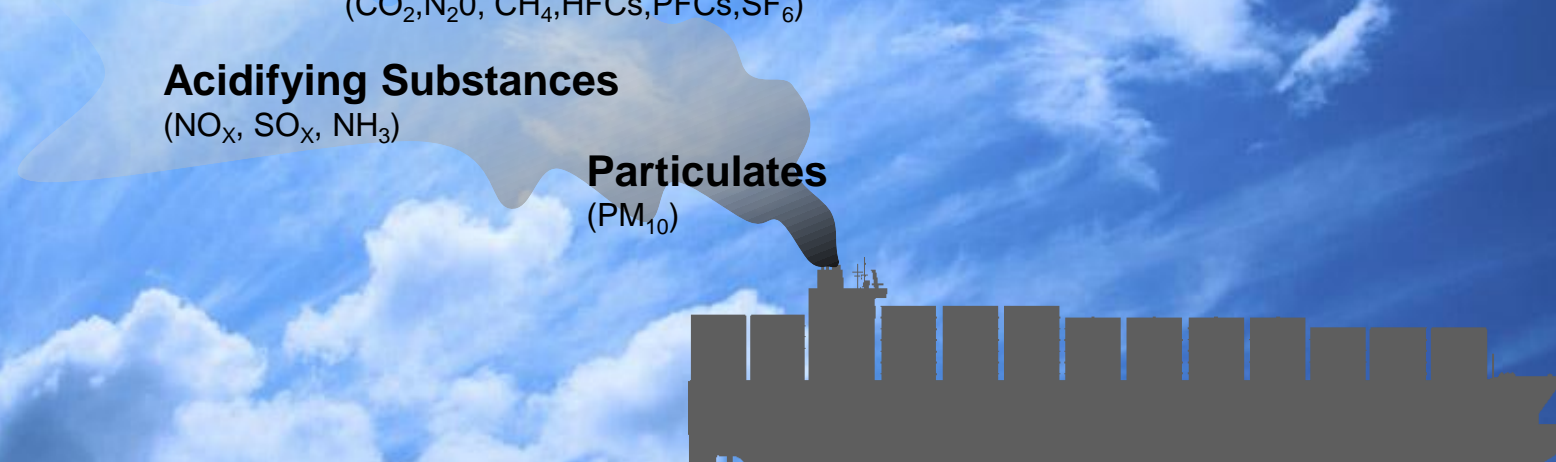
(CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>, HFCs, PFCs, SF<sub>6</sub>)

### Acidifying Substances

(NO<sub>x</sub>, SO<sub>x</sub>, NH<sub>3</sub>)

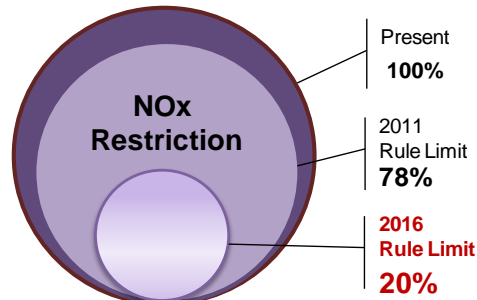
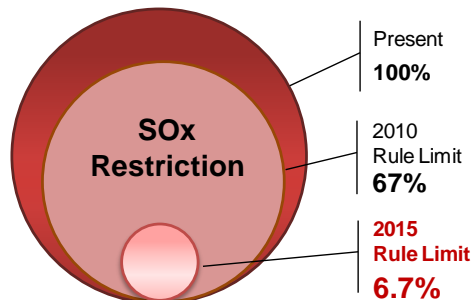
### Particulates

(PM<sub>10</sub>)



### ▪ Exhausted Gas Limitation

#### • MARPOL 73/78 Annex VI



### ▪ Soot, Smoke And Particulate Matter

#### • MARPOL 73/78 Annex VI

- Particulate matter is a part of the legislation
- Soot and smoke is not covered





# ❖ Water & Waste Treatment



**Black & Gray Water**

**Ballast Water**  
(Micro Organism, Bacteria..)

**Bilge Water**

**Oil Spills**

**Garbage**

**Chemicals**

## ▪ Waste Treatment

### • MARPOL 73/78 Annex V (Directive 2000/59/EC)

- The annex totally prohibits the disposal of plastics anywhere in the sea, and severely restricts discharge of other garbage from ships into coastal waters

## ▪ Water Treatment

### • Ballast Water Treatment

- According to IMO convention, **from 2012, all ships have to do treatment ballast water.**

### • Black Water & Grey Water (waste water from living space) MARPOL 73/78 – Annex IV

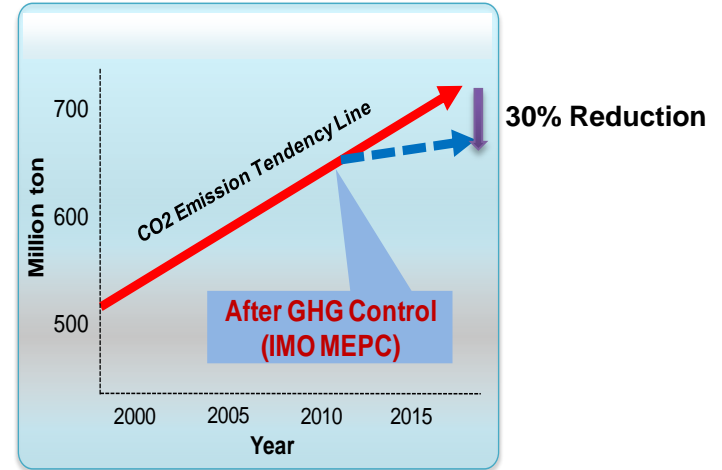
### • Bilge Water (waste water with oil) MARPOL 73/78-Annex I



# ❖ Carbon Reduction



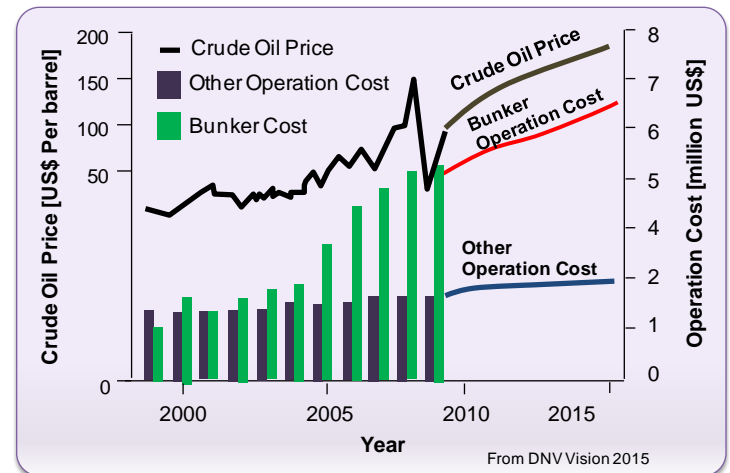
## ▪ Carbon Gas Control



## • Results of IMO MEPC 61

- Not Fixed for Approval and Adoption.
- But it still has a Possibility for Approval and Adoption at MEPC62 (Effectuation from '13.1.1)

## ▪ Trends of Operation Cost & Oil Price



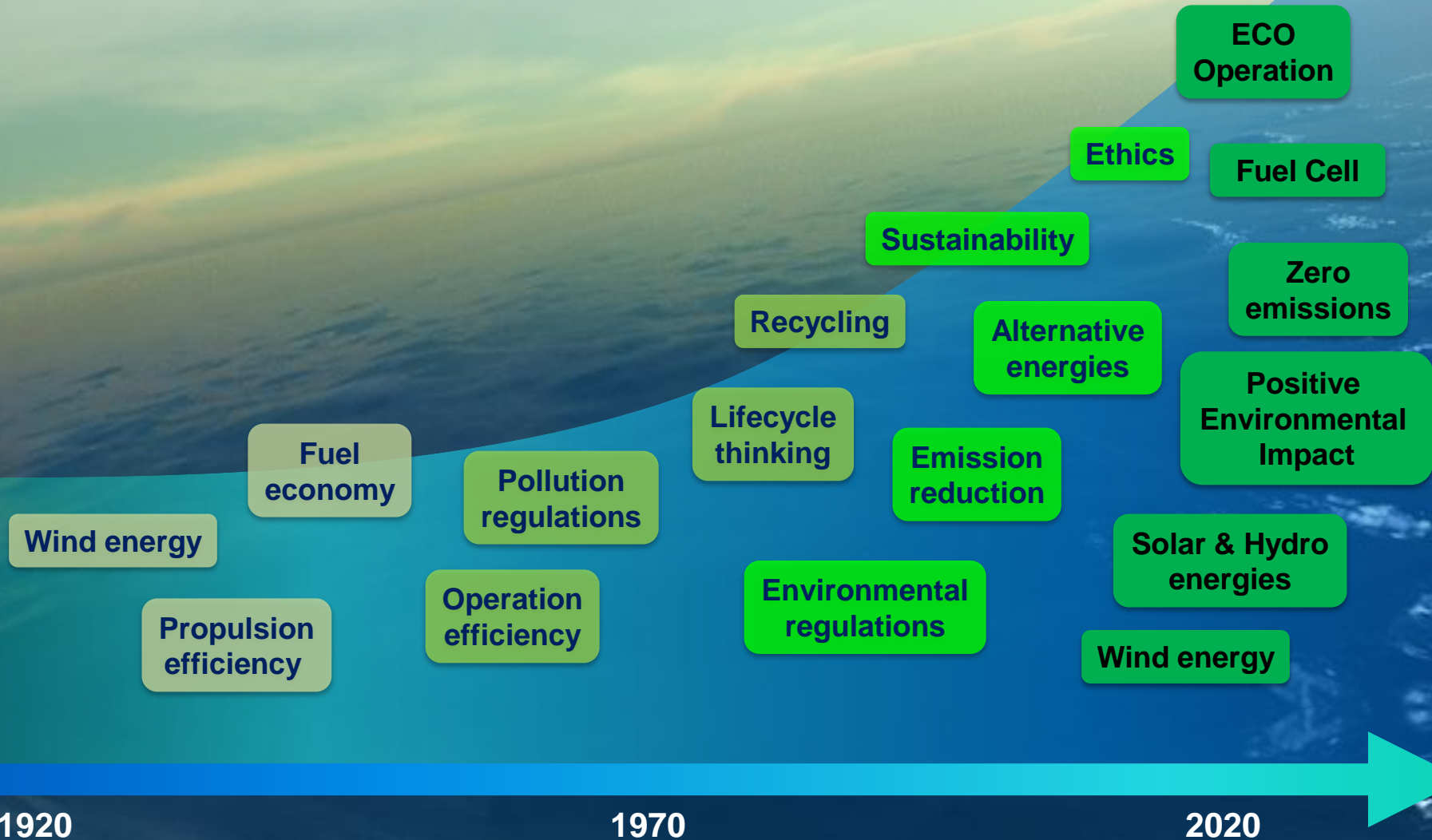
From DNV Vision 2015



The Offshore Society for Maritime Technology and Innovation (OSMTI) is a non-profit organization.



# 2) Green Design Trends



1920

1970

2020



Offshore & Shipbuilding  
Sustainable Energy for Maritime Technology  
STX Offshore & Shipbuilding

From Sustainable and Environmentally Viable Cruise Ships, STX Europe

**STX** Offshore & Shipbuilding

# 3) Green Technology for Marine Industry

## High Efficiency Design

- Energy efficiency driven concept design
- Volume reduction
- Weight optimisation
- High efficiency equipment
- Optimised capacities
- Low hull and appendage friction
- Efficient propulsion

## Optimum Operation

- Best practises
- Slow steaming
- Route planning
- Trim control
- Wind and wave observance
- Optimised tank volume
- Presence monitoring
- Recycling

## Efficient Energy Production

- Efficient machinery
- Optimized machinery
- Waste heat recovery
- Emission reduction
- LNG and bio fuels
- Fuel Cells
- Wind energy
- Solar power
- Bio gas plant

From Sustainable and Environmentally Viable Cruise Ships , STX Europe

## Innovative Green Ship Technology





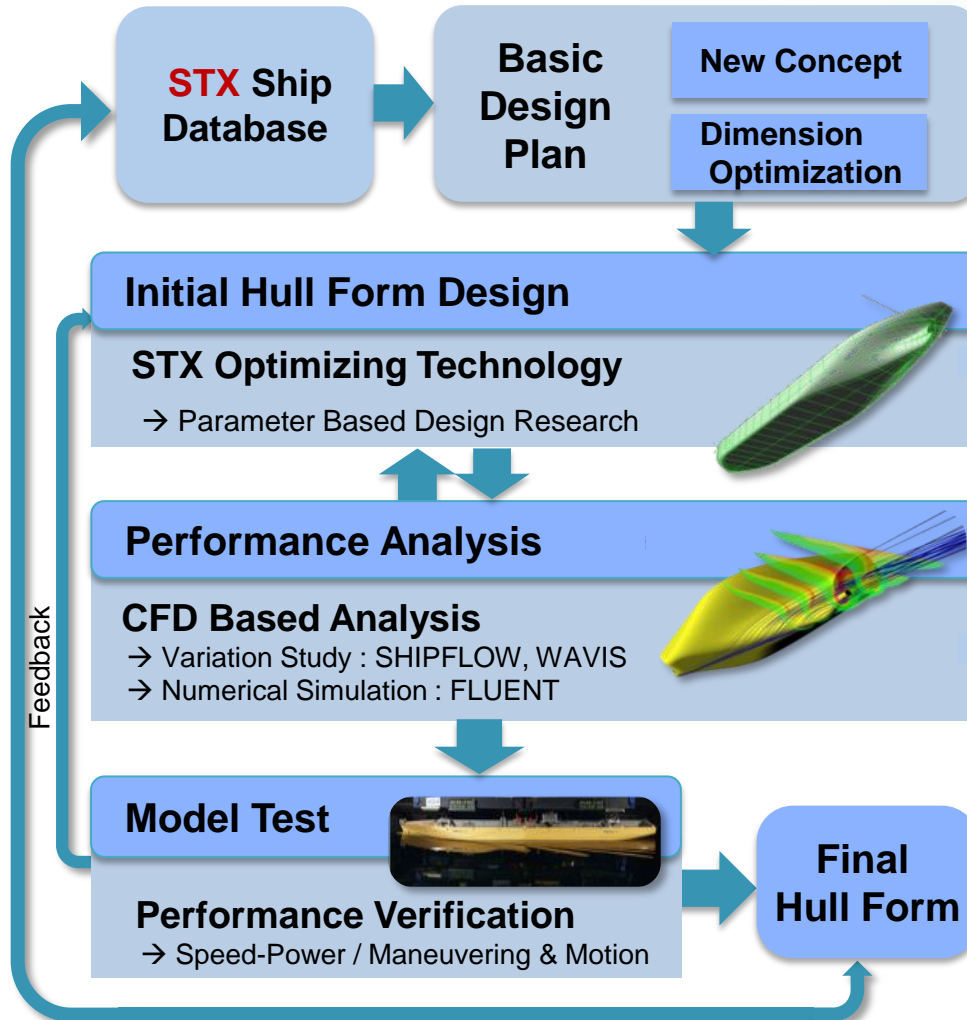
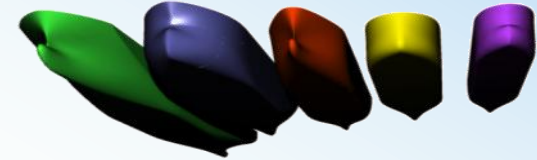


## 2. STX Practical Green Technology



# 1) STX Actual Green Technology for Application

## ❖ STX Optimum Hull Form Development



### ▪ STX Green Design Activity

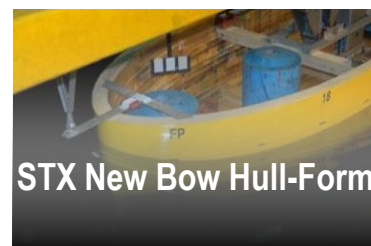
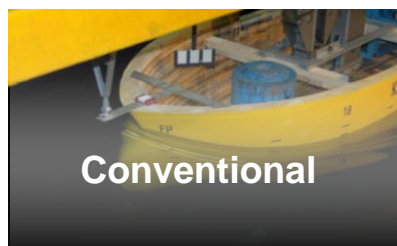
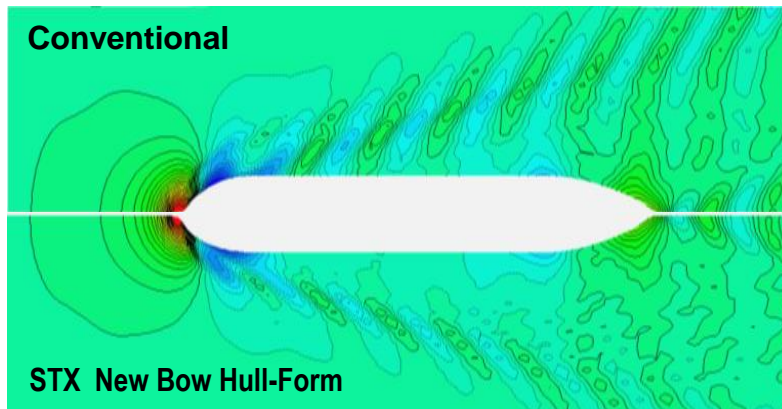
- New Design Concept Development
- Parameter Based Hull-form Design Optimization Algorithm Research
- Integrated Hull-form CAD Development
- Resistance Analysis
- Propeller-Hull Form Self Propulsion Simulation (Hull & Propeller Interaction Analysis)
- Maneuvering Performance Computation
- Propeller Design Development & Optimization (Performance & Vibration)
- Sea-keeping Performance Analysis (Considering Real Sea State)
- Slamming, Whipping, Springing Analysis
- Funnel Smoke & Heat Analysis for Optimization
- Ventilation System Analysis for Optimization



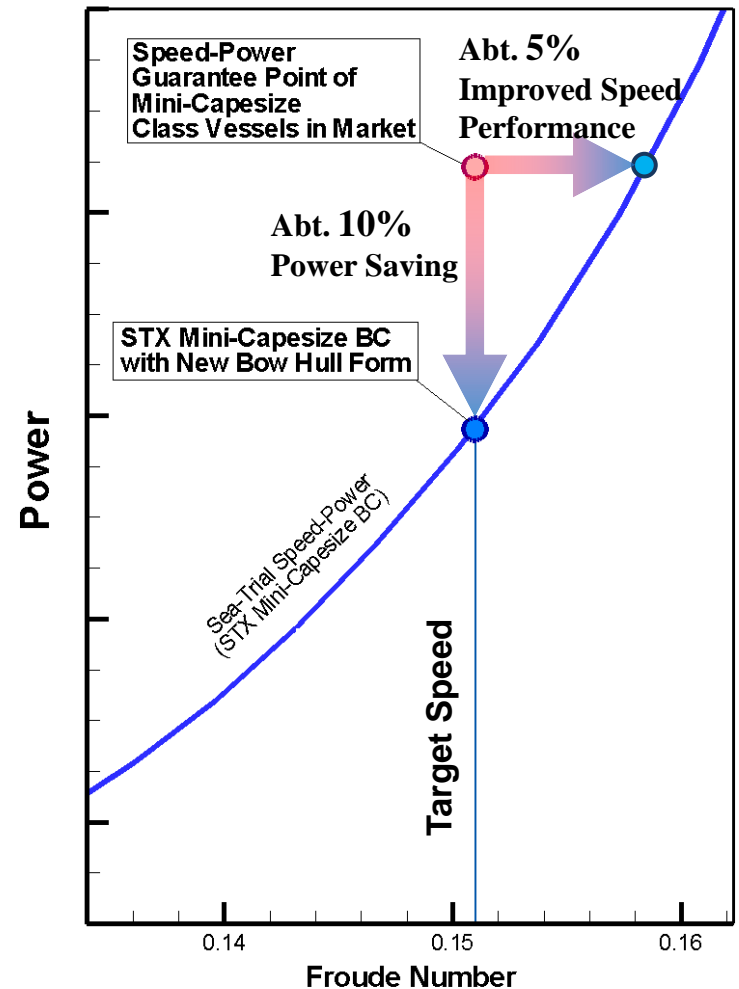
# ❖ STX New Concept for Tanker & Bulker (STX New Bow Hull Form for Extreme Full Ship)

- **Advanced Hull Form Design Concept**
  - Improving L/B Coefficient
  - Reducing Blockage Coefficient
  - Increasing Hull Sharpness
  - Increasing Smoothness of Prismatic Curve

## ▪ Comparison of Hull Forms



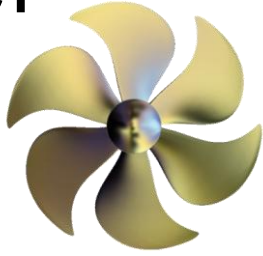
Sea-Trial Speed Power Curve of STX Mini-Capesize BC



# ❖ WCT : STX Low Vibration Design Technology

(Record : 120 vessels)

STX self-developed  
Low Vibration Propeller  
**WCT™**

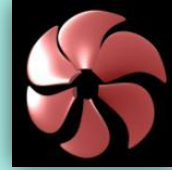
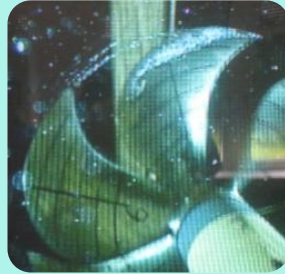


**Anti-Cavitation & Vibration  
Design Technology**

(Patent No. 10-2008-0038236)

▪ WCT propeller is applied for all of the actual projects in STX

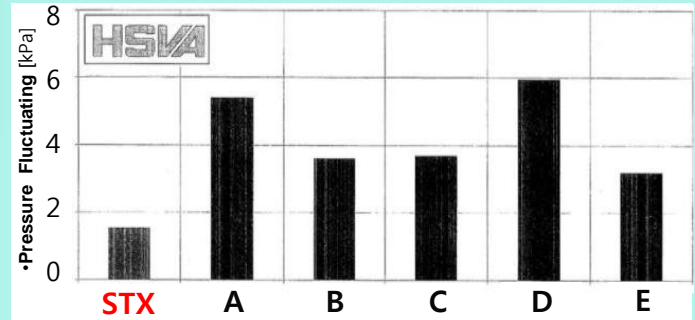
**13,000 TEU CV**



**1.46 kPa**

**5% Vibration Level Of Rule  
Criteria at M/E Room**

• Record of the lowest Fluctuating Pressure  
on 13K TEU Class CVs in HSVA



**174K CBM LNGC**



**2.49 kPa**

**6% Vibration Level Of Rule Criteria  
at M/E Room**

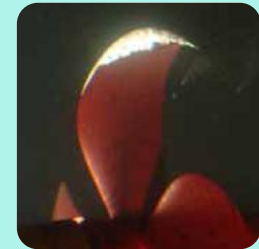
**181K DWT BC**



**1.15 kPa**

**3% Vibration Level Of Rule Criteria  
at M/E Room**

**320K DWT VLCC**



**1.67 kPa**

be scheduled Sea trial Test





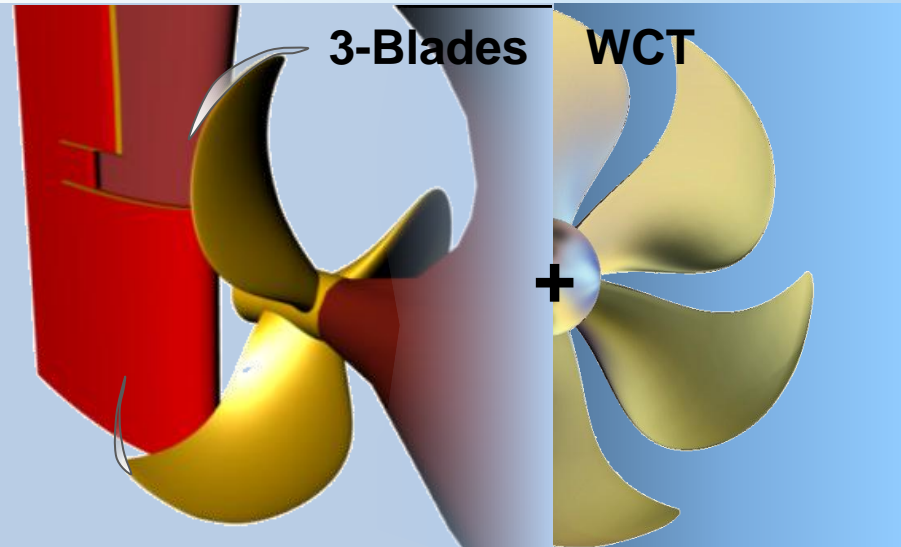
# ❖ New Technology of High Efficiency WCT Propeller

**3 Blades Propeller  
(High Efficiency)**

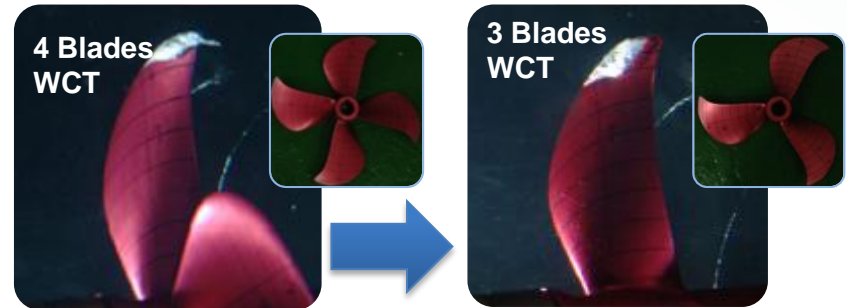
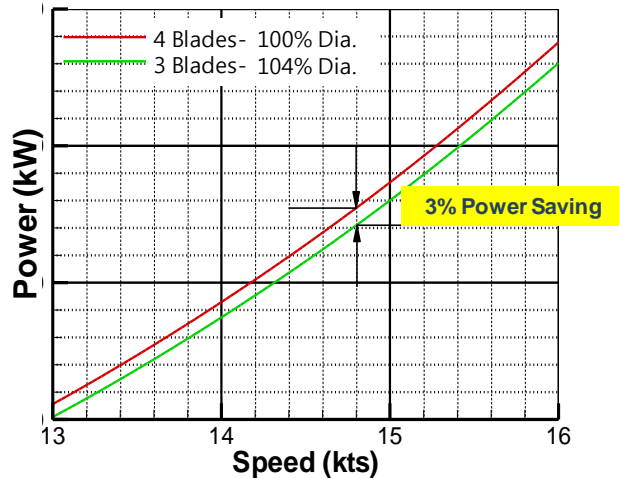
**+**

**WCT  
(Low Vibration)**

- Improving Propulsion Efficiency with the Low Vibration & Noise Level



## ▪ Applied Case: STX 400K VLOC



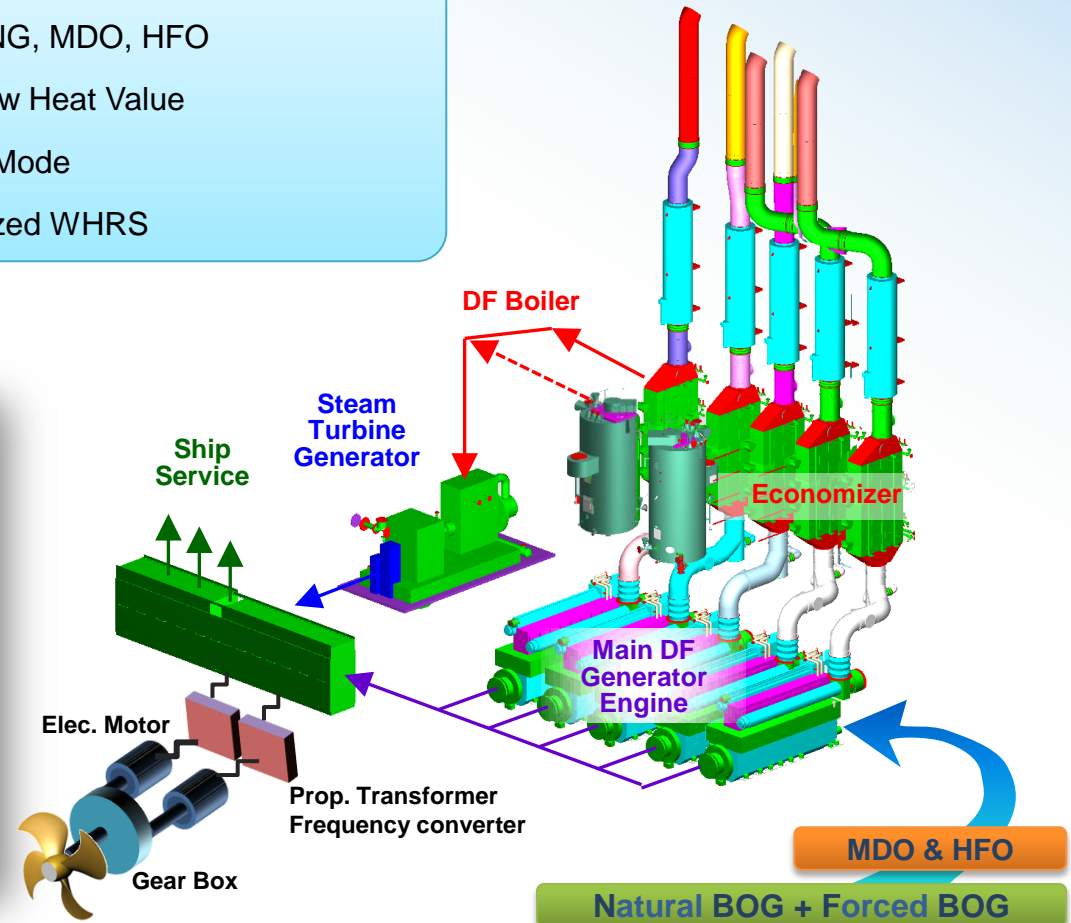
	4 Blades Conv.	4 Blades WCT	3 Blades WCT
Fluctuating Pressure	1.85kPa	1.65 kPa	2.56 kPa

# ❖ STX 174K CBM LNG Carrier Dual Fuel Diesel Engine & Electric Propulsion System (+ Waste Heat Recovery System)

## ▪ Advantage of DFDE & Electric Propulsion System

- Flexibility of Usable Fuel : Vaporized LNG, MDO, HFO
- High Power Output with Fuel Gas of Low Heat Value
- High Efficiency in Liquid Fuel and Gas Mode
- Added Effect of Fuel Saving by Optimized WHRS

## ▪ STX LNGC Power System



# ❖ STX 13,000 TEU Container Vessel World's First EEDI Certification



- STX 13,000 TEU Container Vessel, World's first EEDI is certificated by GL





# ❖ STX 320K DWT VLCC

## Waste Heat Recovery System : ECO-TG SYSTEM



Investment  
Cost of WHRS

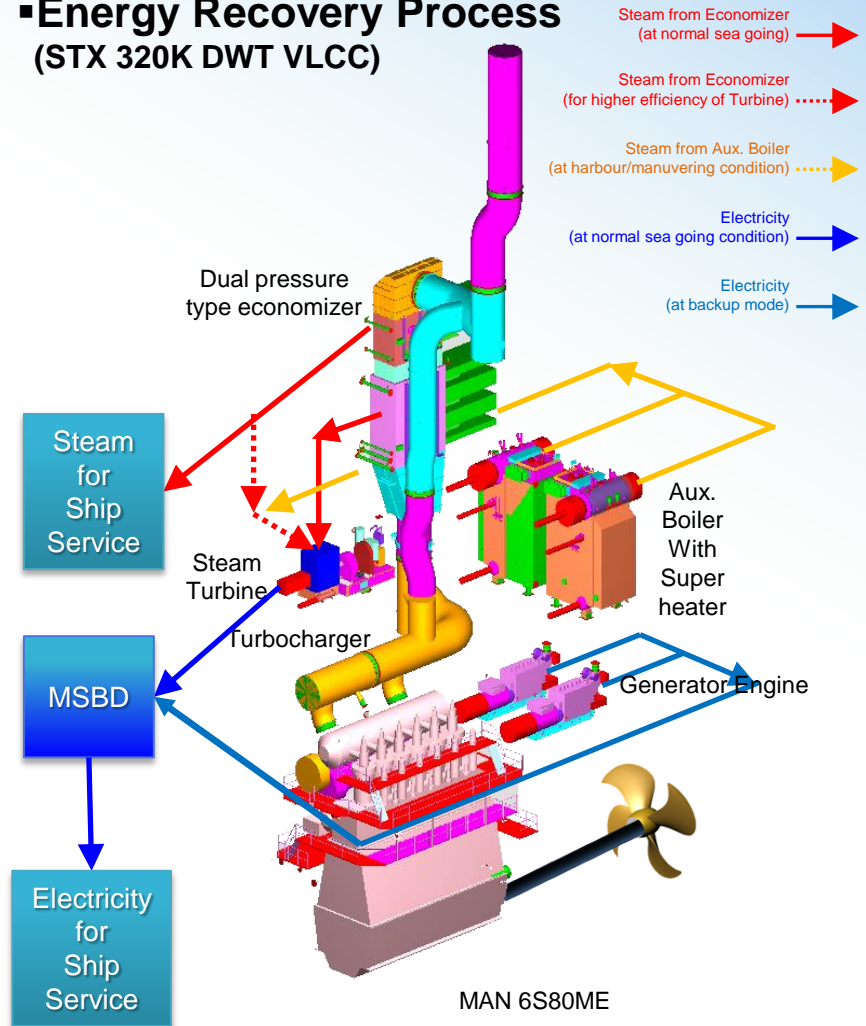
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Fuel Saving  
Profit per Year

Pay Back Time  
**4.1 years**

(Based on IFO380 Price 600 \$/MT)

### Energy Recovery Process (STX 320K DWT VLCC)





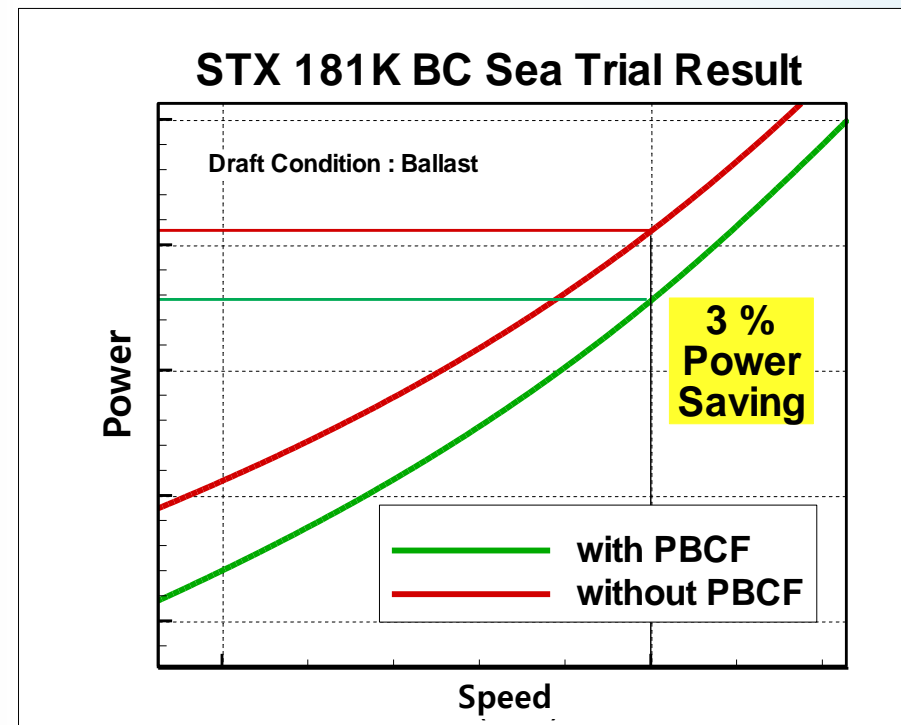
# ❖ STX 181K DWT Bulk Carrier

## PBCF™ Performance Comparison Test Project

(Record : 65 vessels)

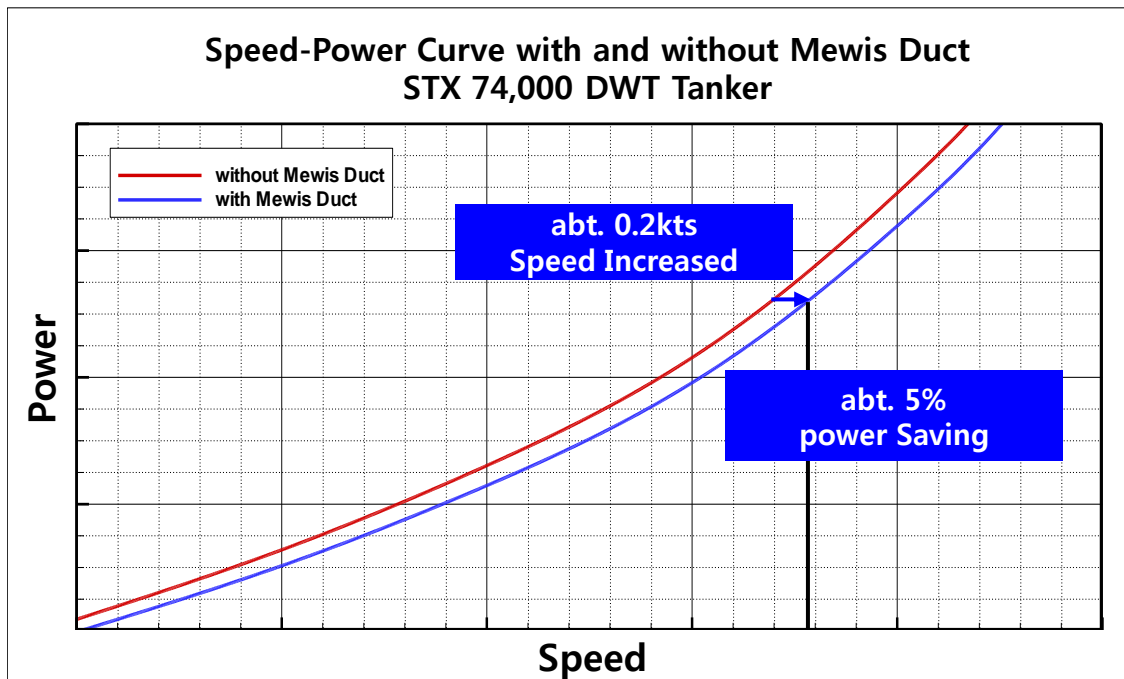
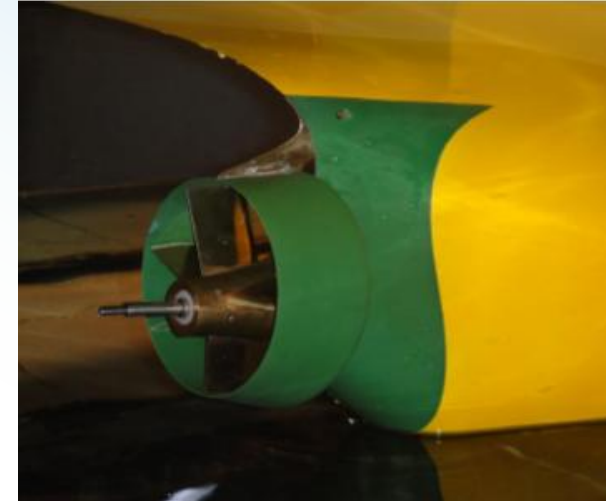


- STX O&S was carried out comparison sea-trial test for PBCF as same vessels
- STX O&S makes effort to increasing the flexibility of products using open innovative technology.



# ❖ STX 74,000 DWT Tanker MEWIS DUCT Application

- **Application result of Panamax Tanker** (model tested)
  - abt. 5% of Power Saving (at design draft)
  - Speed performance increased abt. 0.2kts



# ❖ INOVELLA : STX Design Brand



INOVELLA

- STX prestigious design brand for accommodation
- Comfortable & convenience space design for crew
- Application of the anti-bacterial textiles

Exterior



Interior



Bacterial Activity  
**99%**  
Reduction



# 2) STX Green Ship Technology

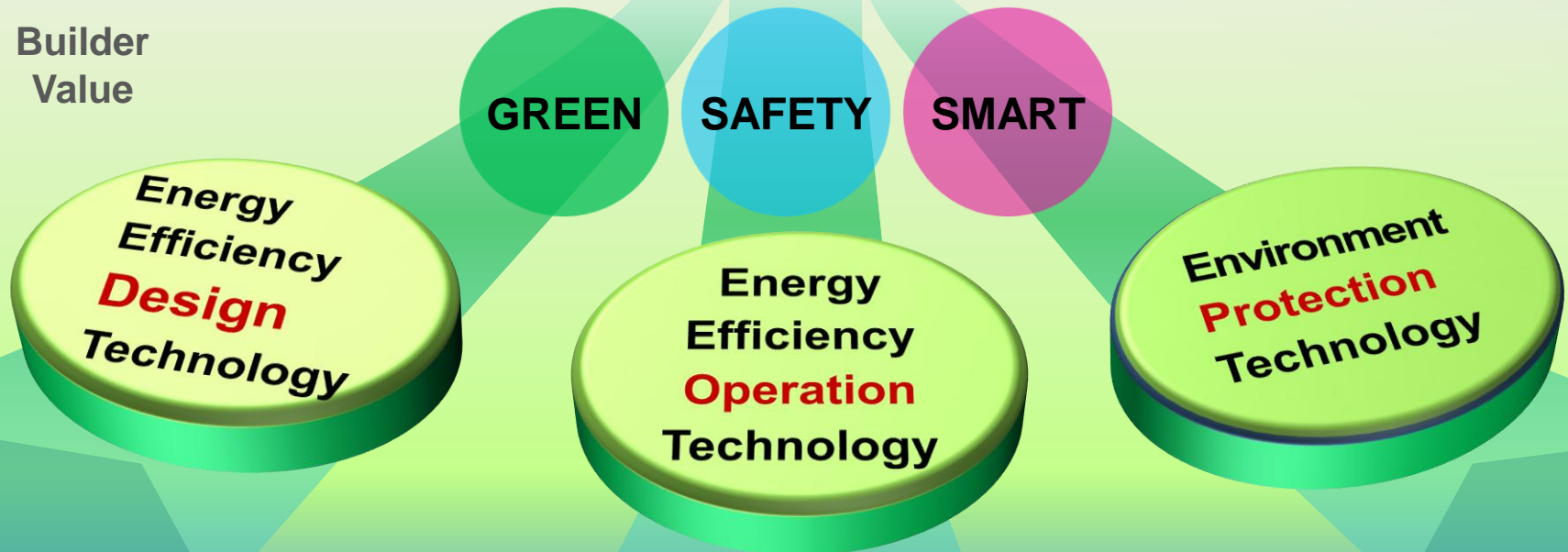
Customer Value

CO<sub>2</sub> Reduction    Efficiency Increase  
**STX GD ECO 5050**

Product Value

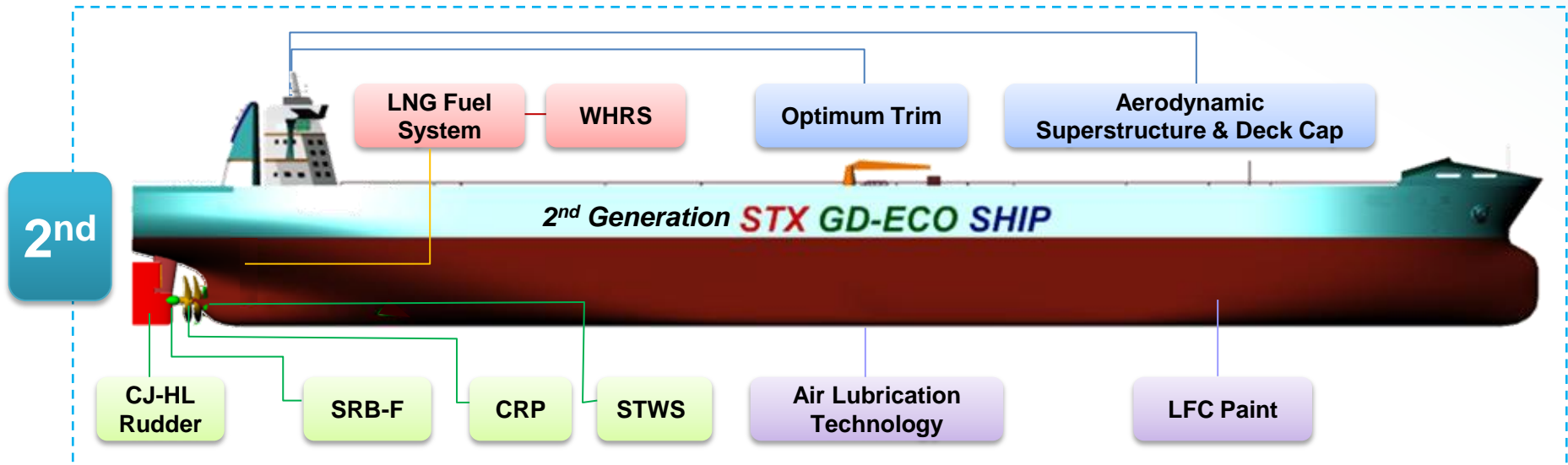
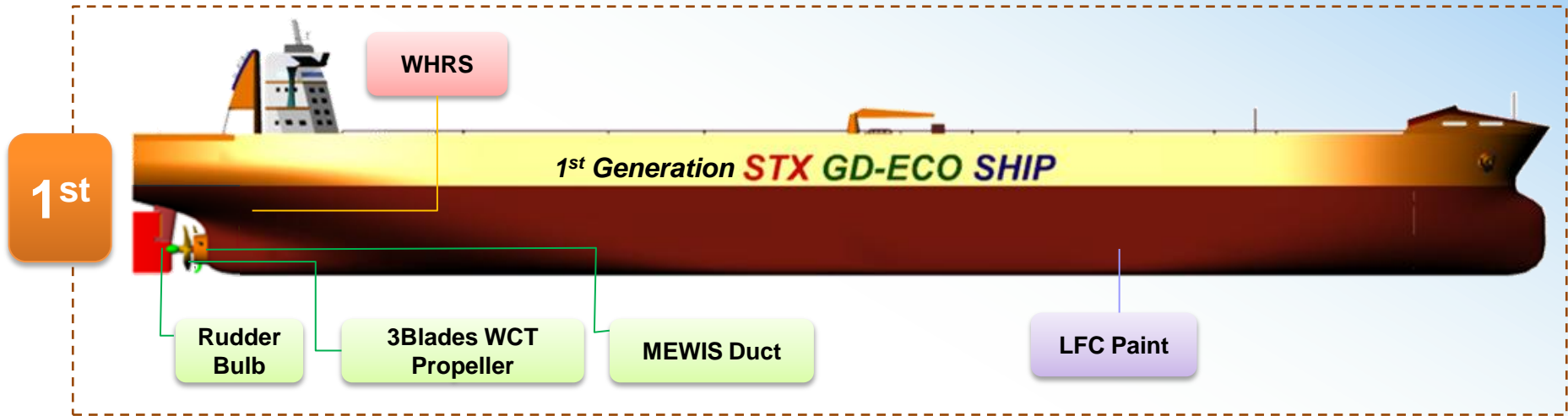


Builder Value



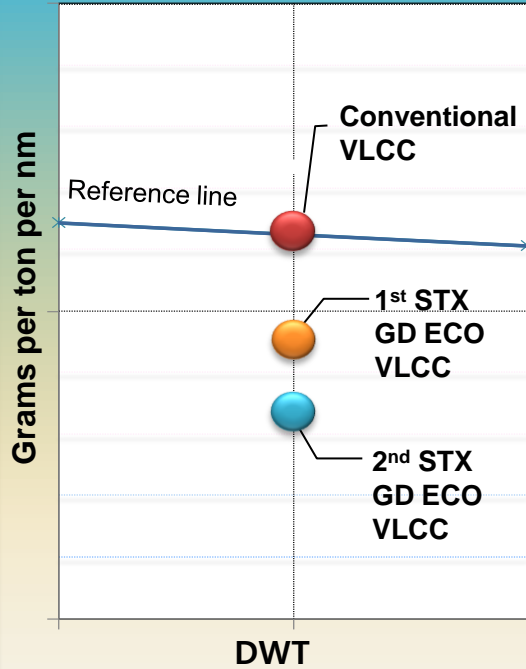


# ❖ Applied Green Items of STX GD-ECO Ship



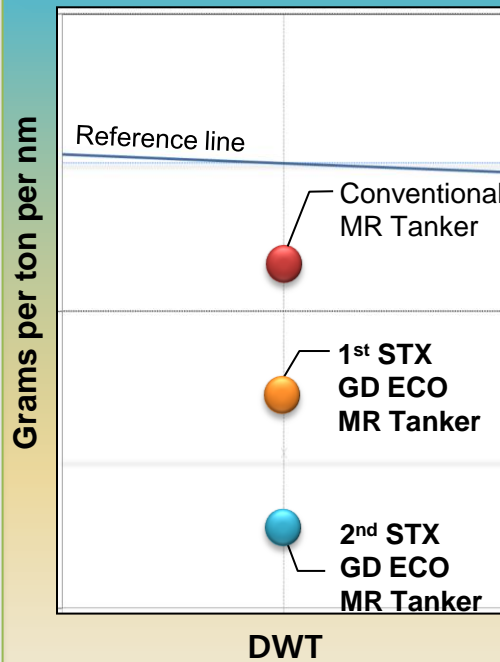
# ❖ EEDI Position of STX GD-ECO Ships

## EEDI Level : VLCC



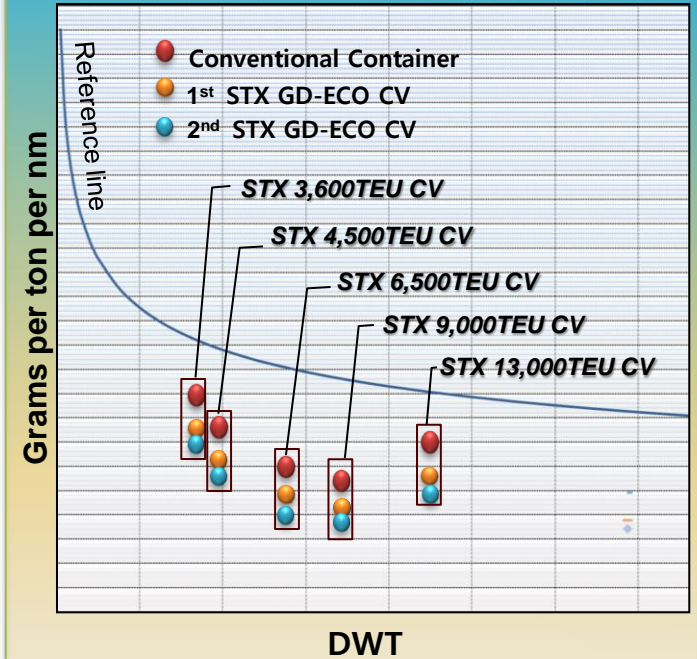
	1st STX GD ECO VLCC	2nd STX GD-ECO VLCC
CO2 Reduction	32%	54%
Efficiency Upgrade	30%	50%

## EEDI Level : MR-Tanker



	1st STX GD ECO MR Tanker	2nd STX GD-ECO MR Tanker
CO2 Reduction	20%	40%
Efficiency Upgrade	17%	37%

## EEDI Level : Container Vessels



	1st STX GD-ECO CV Average	2nd STX GD-ECO CV Average
CO2 Reduction	31%	54%
Efficiency Upgrade	28%	50%



# ❖ Milestone of STX GD-ECO Ship

2010

2014

2018

2022

## 1<sup>st</sup> Generation GD-ECO Ship

- **Main Power**  
Engine (HFO)+ WHRS
- **Auxiliary Power**  
Generator(MDO) + WHRS
- **Emission Control**  
EGR + SCR +VOCs
- **Energy Saving Devices**  
Rudder Bulb + MEWIS Duct  
+ LFC + 3 Blades WCT Propeller

## 2<sup>nd</sup> Generation GD-ECO Ship

- **Main Power**  
Engine (LNG) + WHRS
- **Auxiliary Power**  
Generator(MDO) + WHRS
- **Emission Control**  
EGR + VOCs
- **Energy Saving Devices**  
STWS + CJ-HL Rudder  
+ Air Lubrication Technology  
+ LFC+ Contra Rotating Propeller

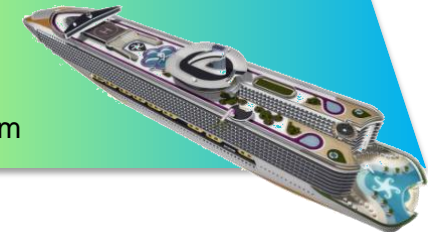
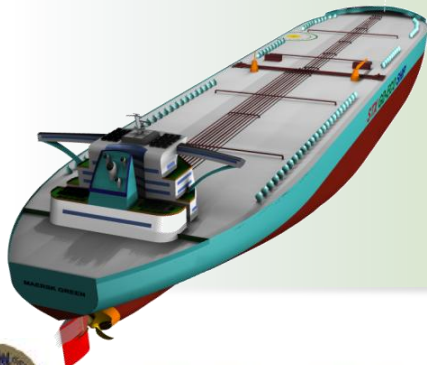
## 3<sup>rd</sup> Generation GD-ECO Ship

- **Main Power**  
Generator (LNG)  
+ Electronic Motor + WHRS
- **Auxiliary Power**  
Generator (LNG)  
+ Renewable Energy
- **Emission Control**  
VOCs
- **Energy Saving Devices**  
STWS + CJ-HL Rudder  
+ Air Lubrication Technology  
+ LFC + Contra Rotating Propeller

### ▪ Common Items

#### Integrated Water & Waste Treatment System

- Black & Gray Water, Oily Water,
- Sewage Treatment Systems
- Ballast Water Treatment System or Non-Ballast System





*Thank you  
for Your Attention*

*STX,*

*your partner*

*with dream and future*

**stx** Offshore & Shipbuilding