



**Arab Academy**

for Science , Technology and Maritime Transport



The International Maritime Transport  
and Logistics Conference

**“MARLOG 13”**

Towards \_\_\_\_\_  
**Smart Green Blue  
Infrastructure**

3-5 March 2024 - Alexandria, Egypt



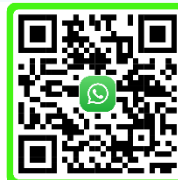


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**Professor .Adla Ragab**

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**NAVIGATING GREEN:**

**THE IMPACT OF IMO'S ENVIRONMENTAL  
POLICIES ON GLOBAL SHIPPING AND THE  
SUEZ CANAL**



SCAN For Contact

# Agenda

1. Introduction
2. Imo's Emission Reduction Targets And Policies
3. Shipping Adaptation With Imo's Regulations
4. Green Shipping And Fuel Costs
5. Impact Of Green Shipping On The Suez Canal
6. Conclusion

# 1.INTRODUCTION



## United Nation : Climate Change Actions

(COP 21)

December 2015

Paris Agreement

For climate  
change

3

KEY ELEMENTS OF THE  
**PARIS AGREEMENT**  
ON CLIMATE CHANGE

ON CLIMATE CHANGE

▶▶ 1.

▶▶ 2.

▶▶ 3.

Provide  
climate  
finance to  
developing  
countries



# 1. INTRODUCTION

## United Nations : Climate Change Actions { Latest One }



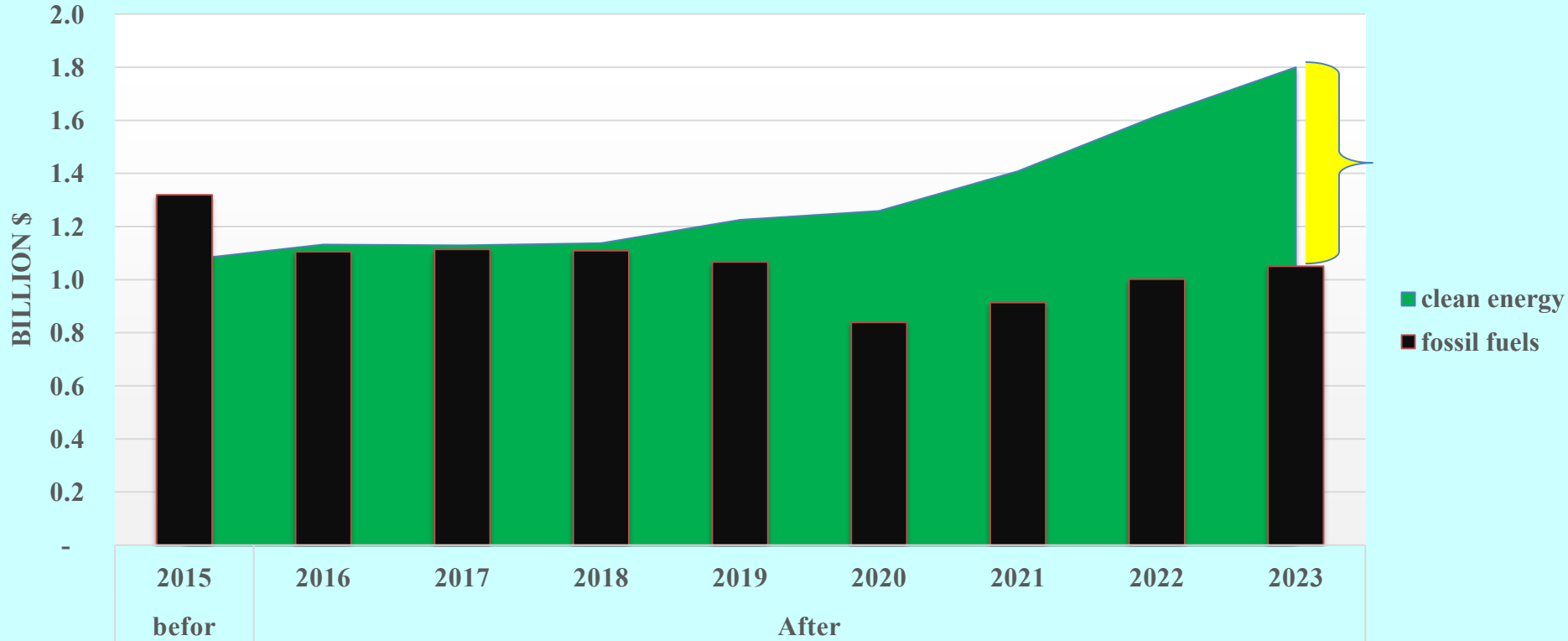
**signals  
beginning  
of the end  
of the  
fossil fuel  
era**



# 1.INTRODUCTION



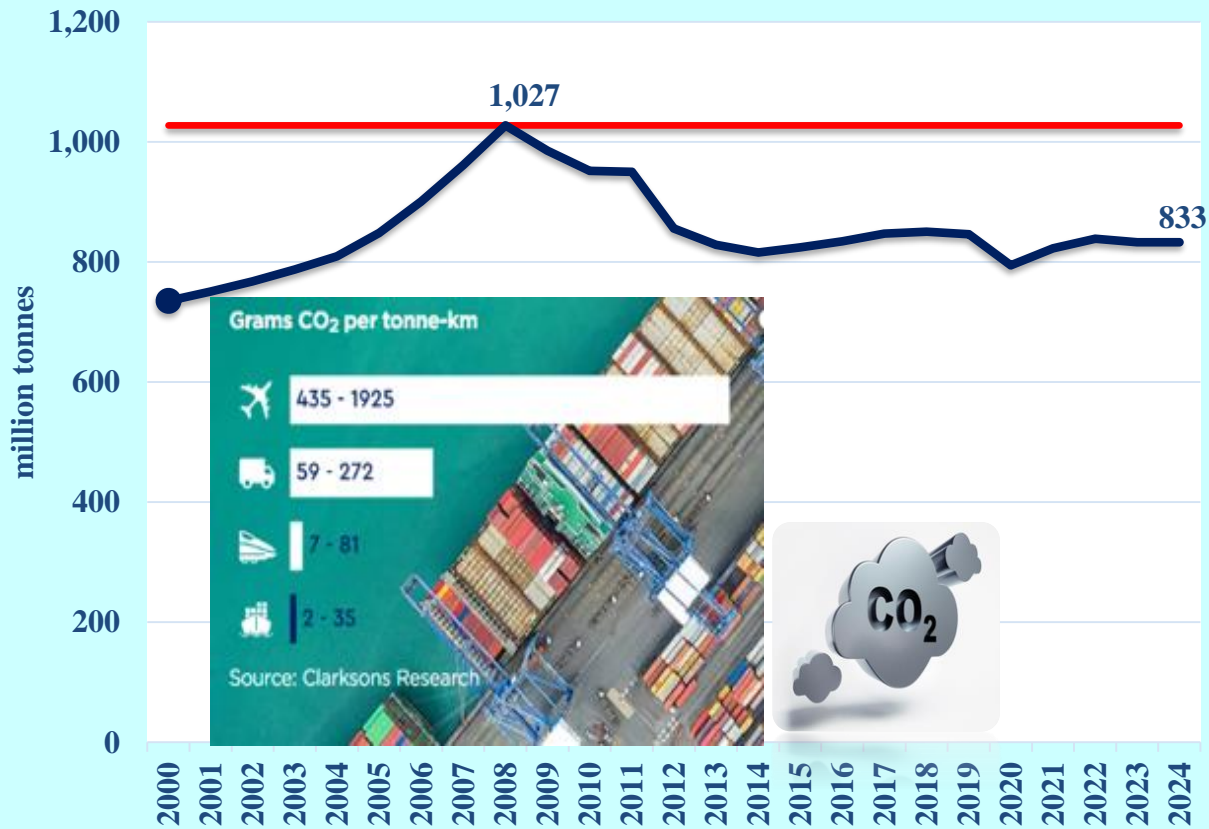
## Annual investment in energy



# 1.INTRODUCTION

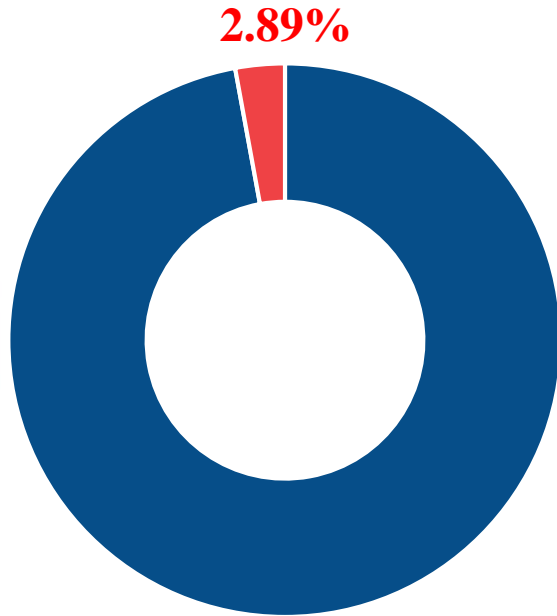


## Shipping Emissions

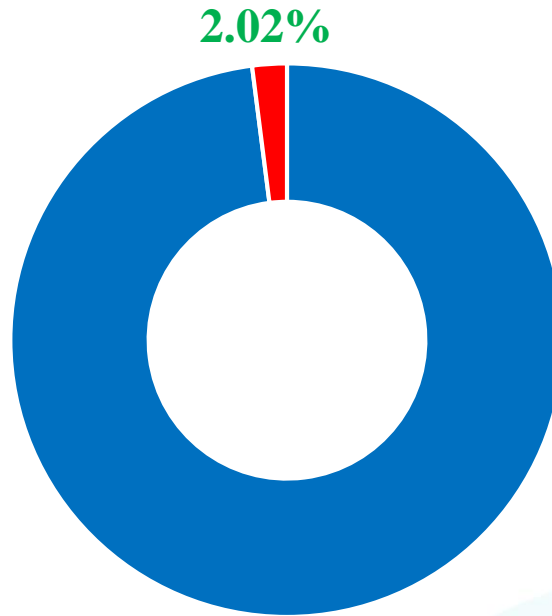


# 1. INTRODUCTION

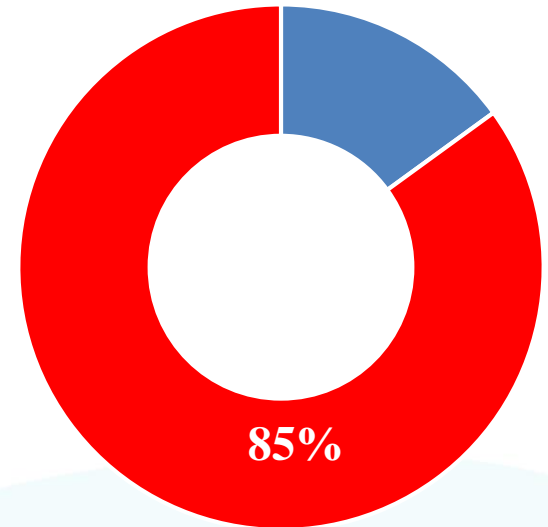
## Share of Shipping from Emissions & World Trade



■ Total shipping



■ International shipping



■ world seatriade (Volume)



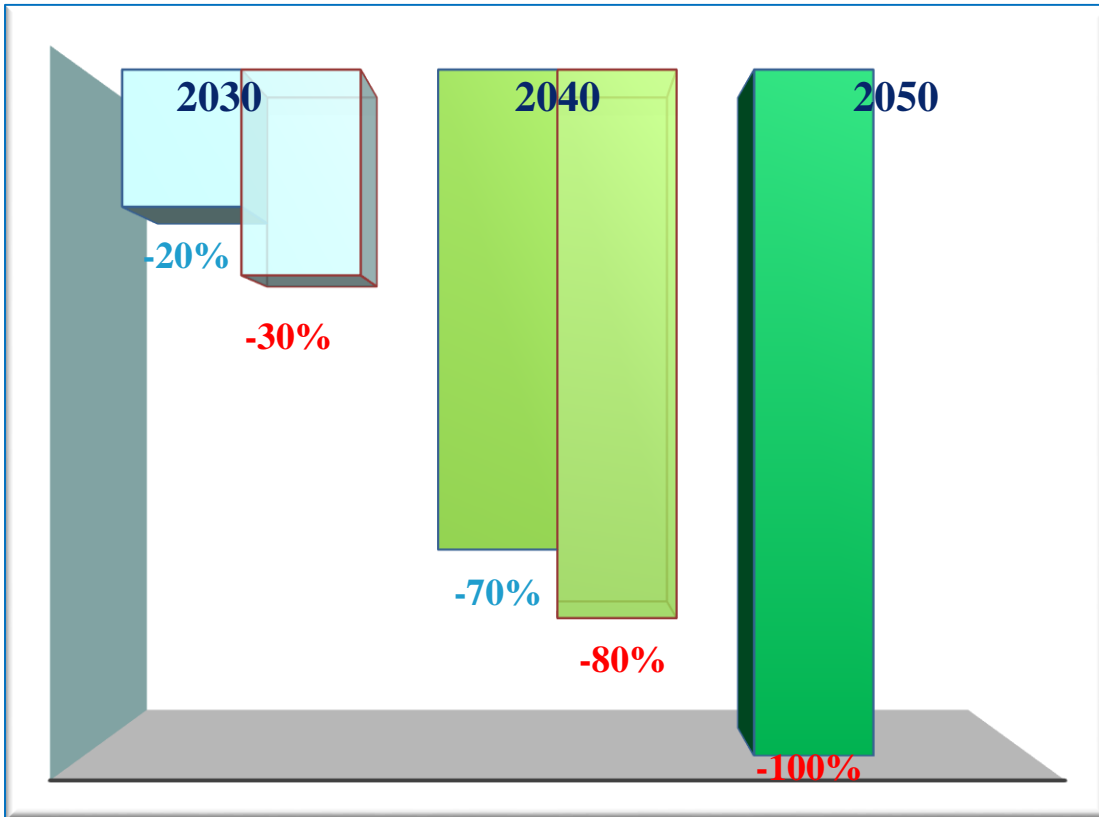
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## 2. IMO'S EMISSION REDUCTION TARGETS AND POLICIES



### IMO : G H G S T R A T E G Y 2 0 2 3



## 2. IMO'S EMISSION REDUCTION TARGETS AND POLICIES



### IMO : Summary for Policies

TIMELINES	SHORT-TERM (2013 - 2023)	MIDUM-TERM (2023 - 2030)	LONG-TERM (2030-2050)
	<b>SEEMP- EEDI DCS -EEXI –CII (Sox –Nox )</b>	<b>Alternative fuel Levy tax</b>	<b>Will Discuss at the 2028 IMO GHG Strategy Review</b>
<b>Main target</b>	<b><u>Efficiency</u></b>	<b><u>Toward Green</u></b>	<b><u>Green fuel</u></b>



# Agenda

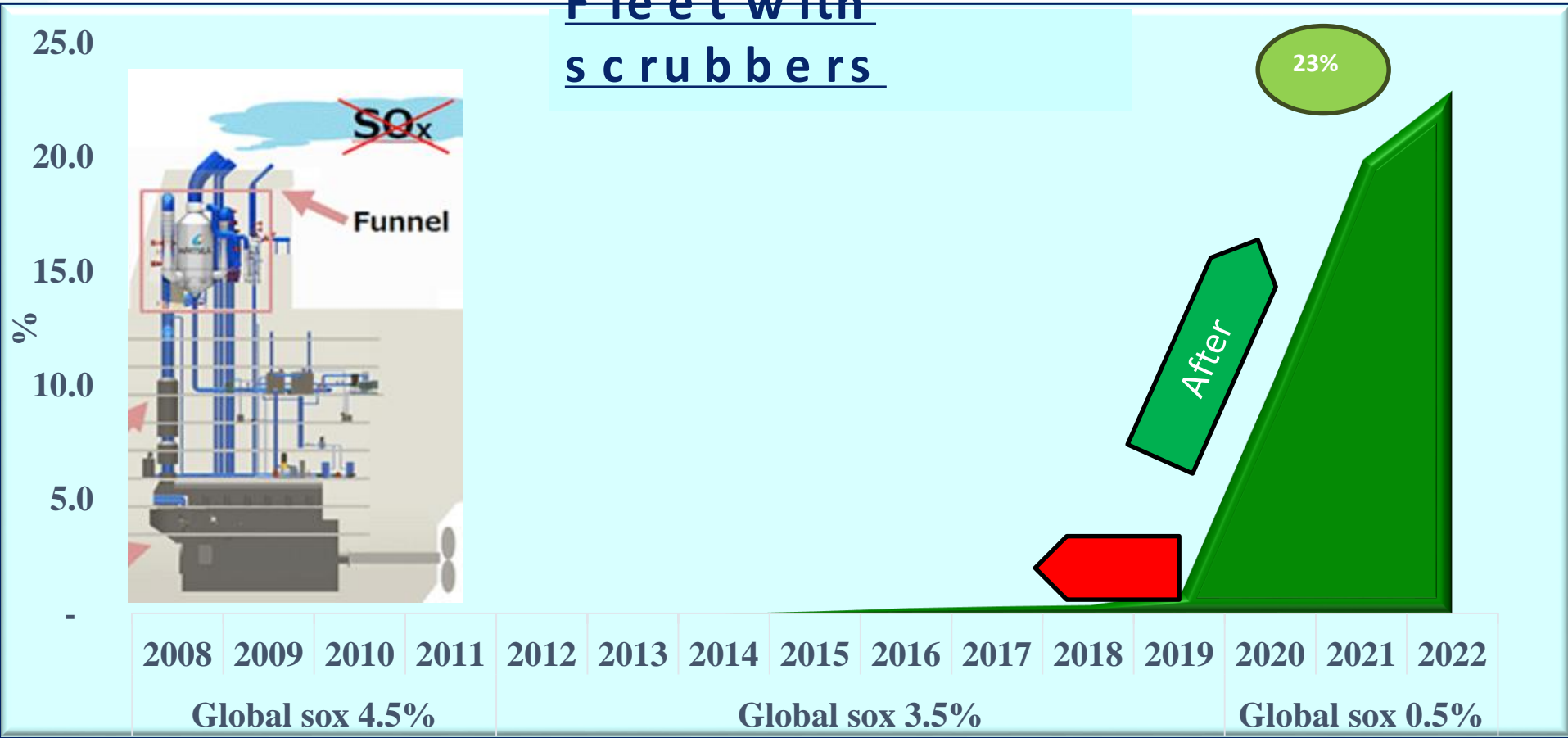
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# 3.SHIPPING ADAPTATION WITH IMO'S REGULATIONS



## Shipping New Trend

### Fleet with scrubbers

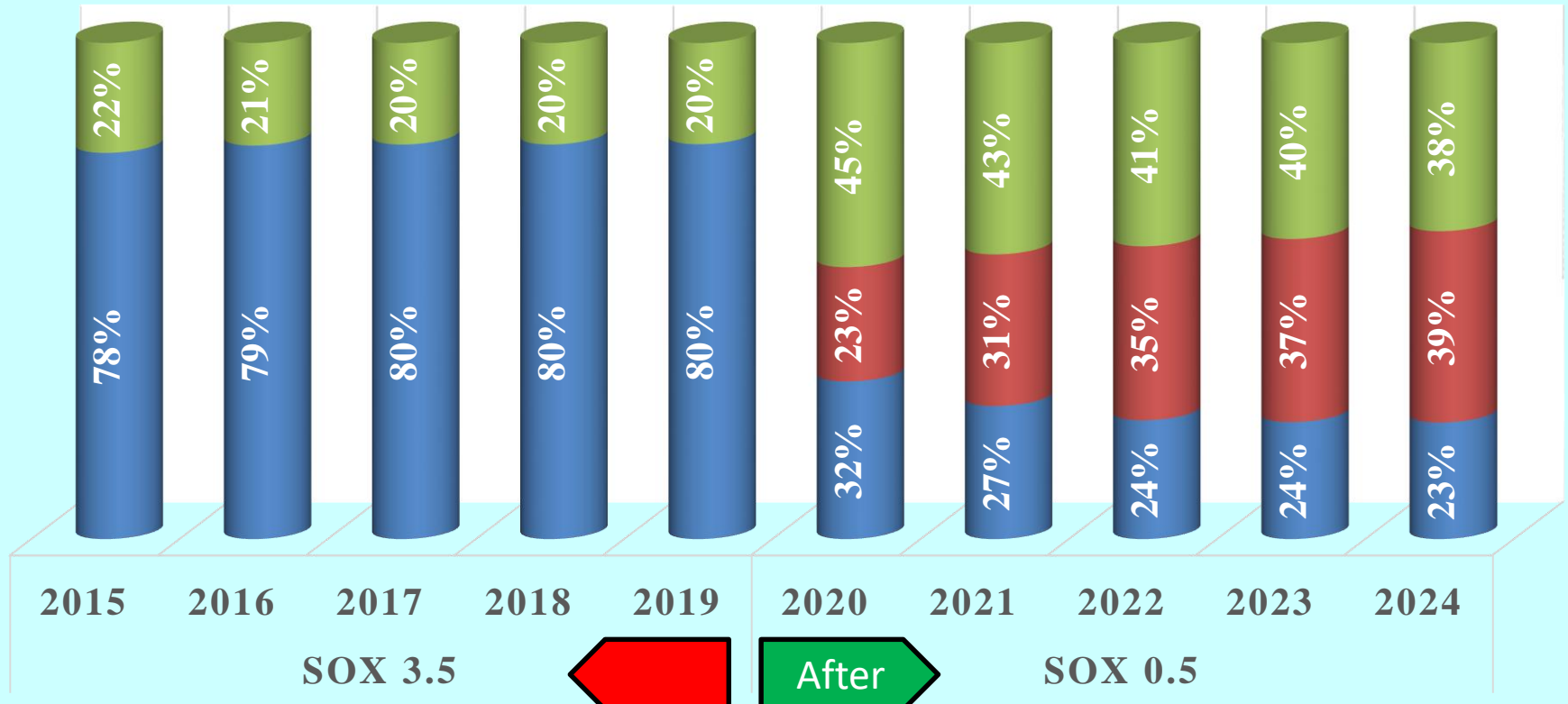


# 3.SHIPPING ADAPTATION WITH IMO'S REGULATIONS



## Bunkering Structure “DEMAND”

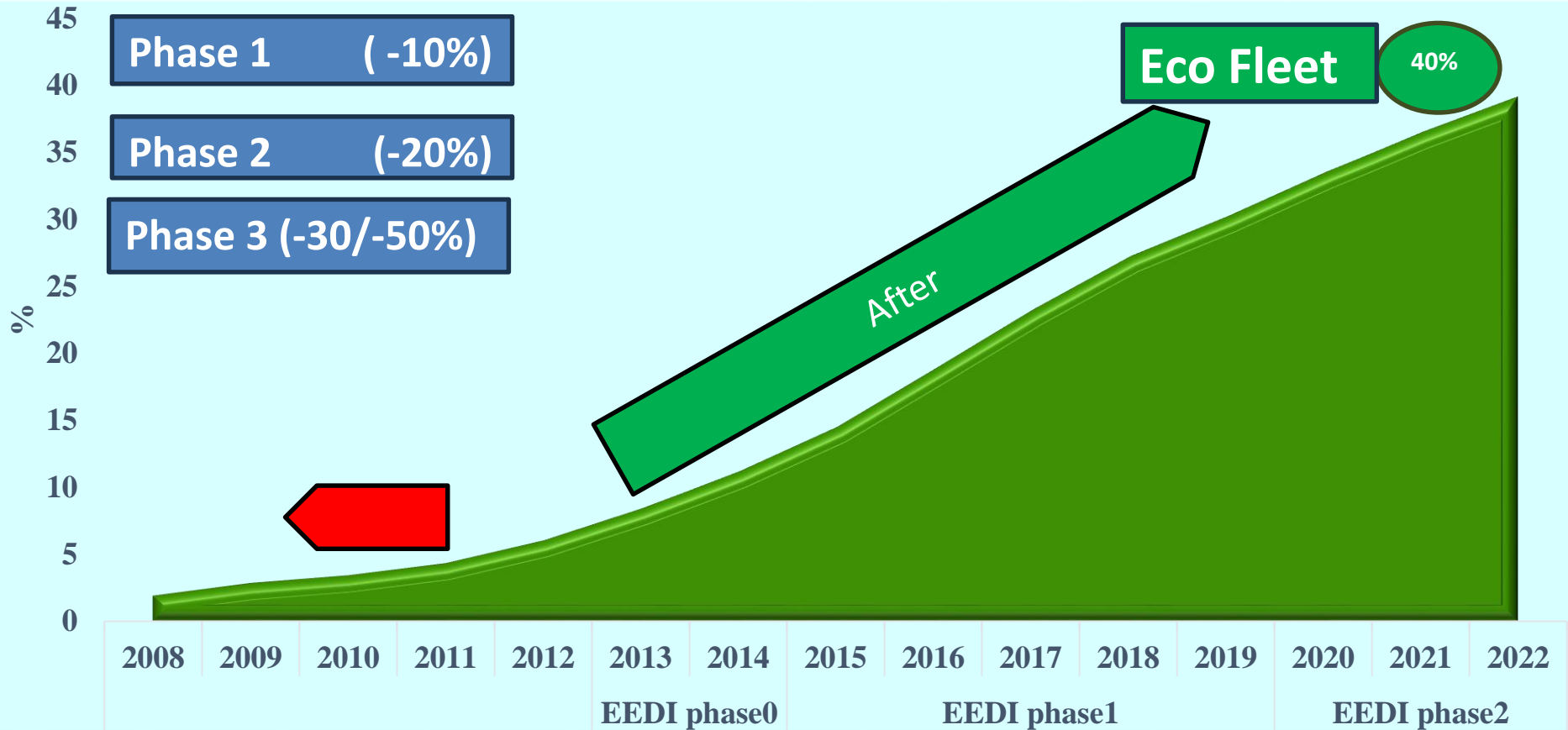
■ HSFO ■ VLSFO ■ MGO



# 3.SHIPPING ADAPTATION WITH IMO'S REGULATIONS



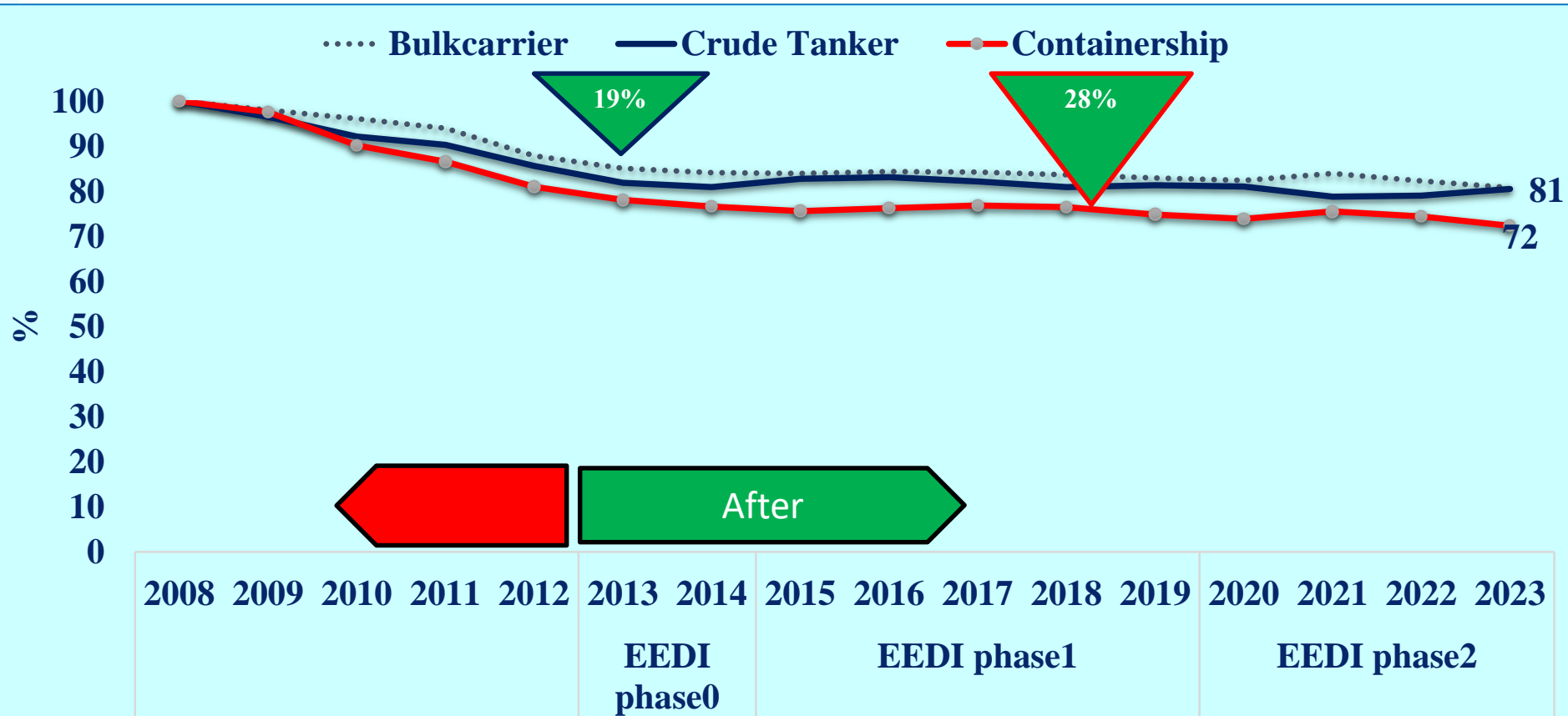
## S h i p p i n g N e w T r e n d



# 3.SHIPPING ADAPTATION WITH IMO'S REGULATIONS



## Shipping And Speed

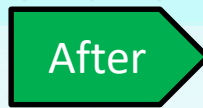
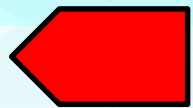
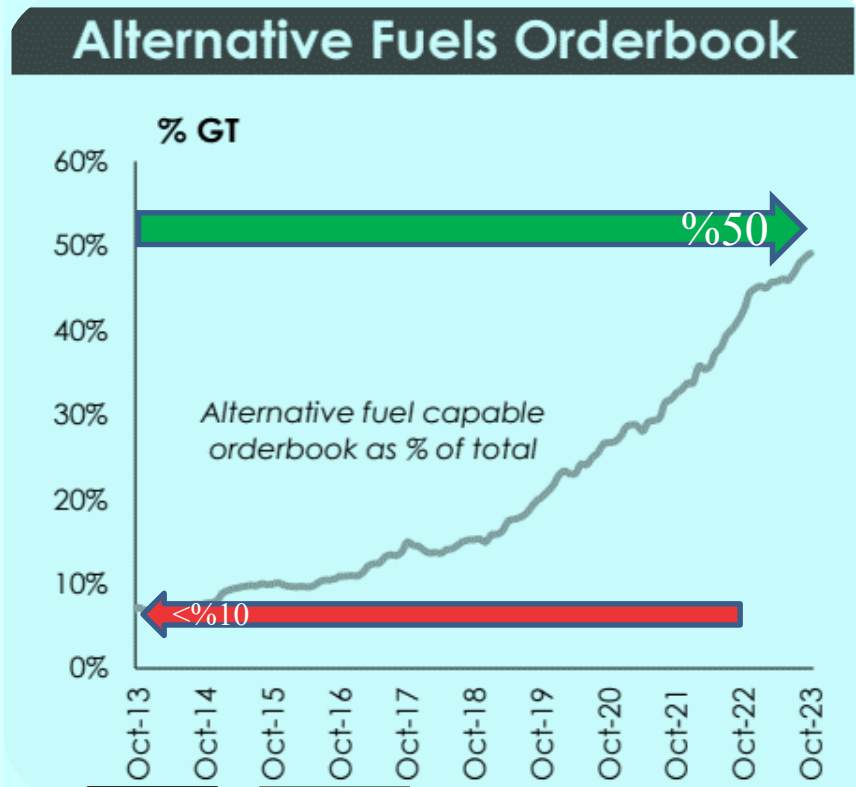
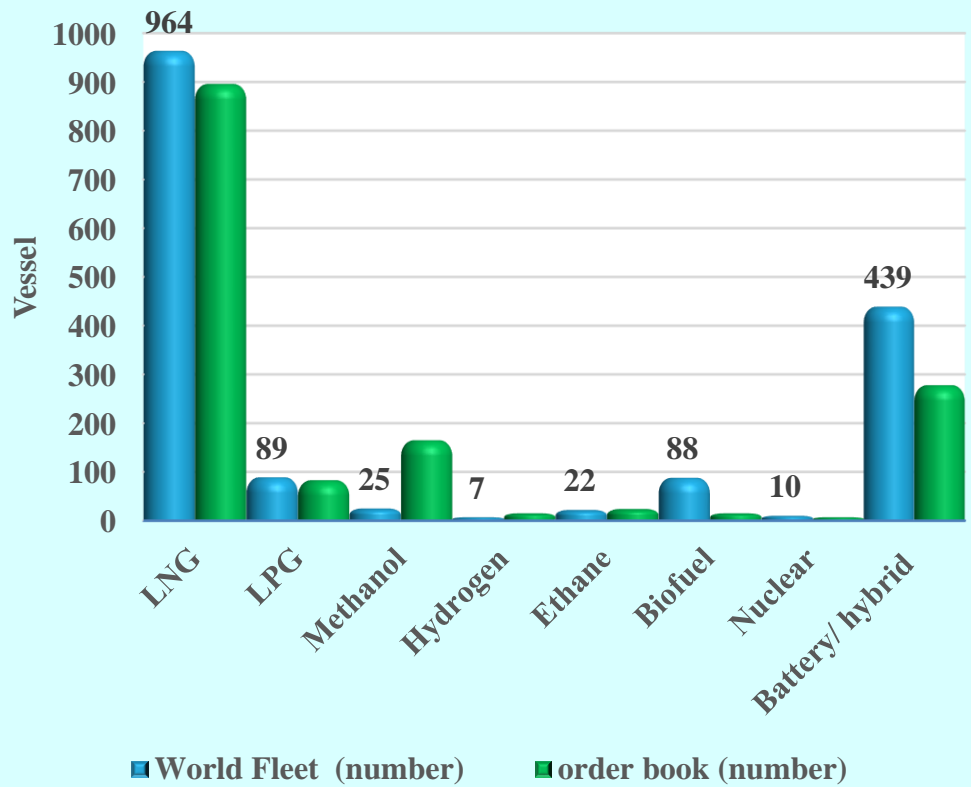




# 3.SHIPPING ADAPTATION WITH IMO'S REGULATIONS



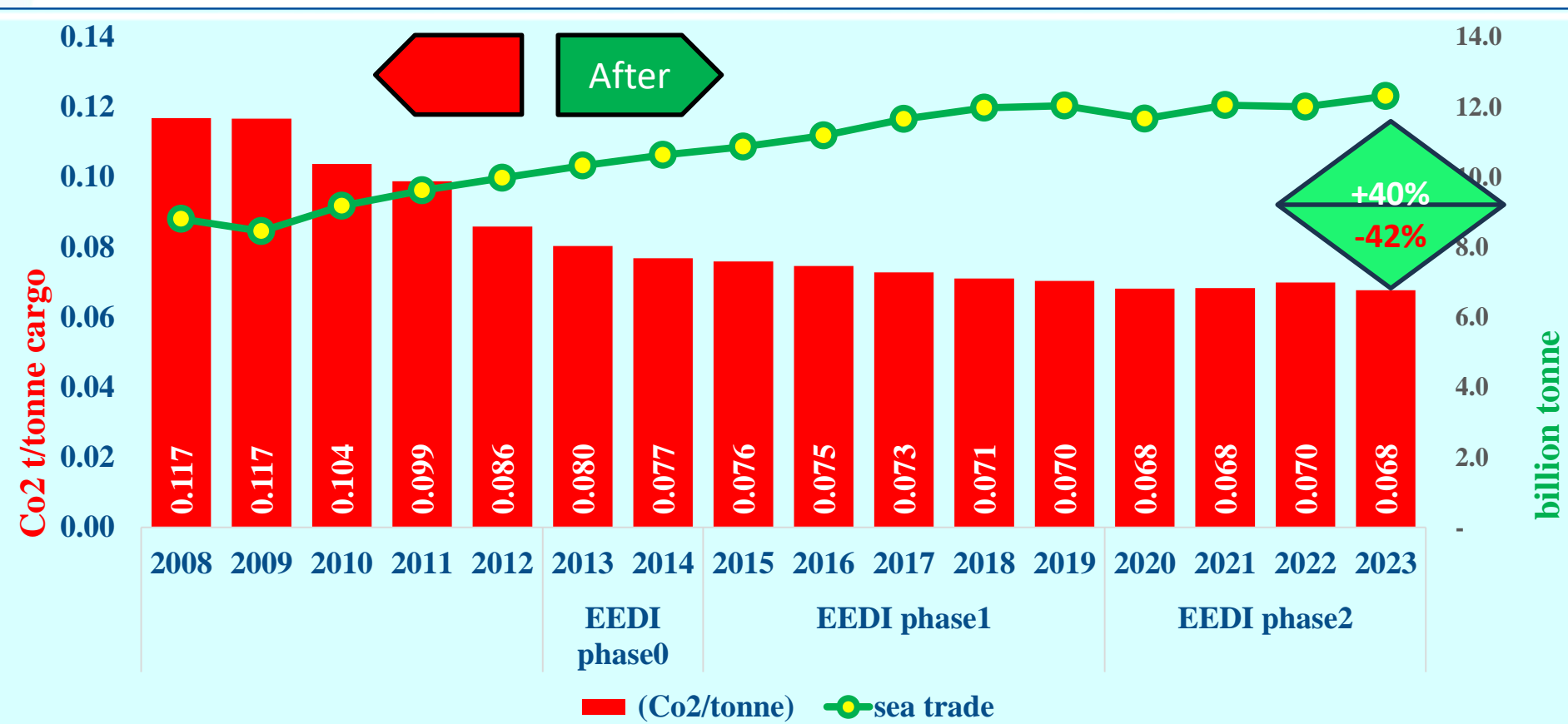
## Alternative Fuel



### 3.SHIPPING ADAPTATION WITH IMO'S REGULATIONS



## World Seaborn Trade & Carbon Footprint per tonne



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# 4.GREEN SHIPPING AND FUEL COSTS



## Bunker Cost



sox 3.5%

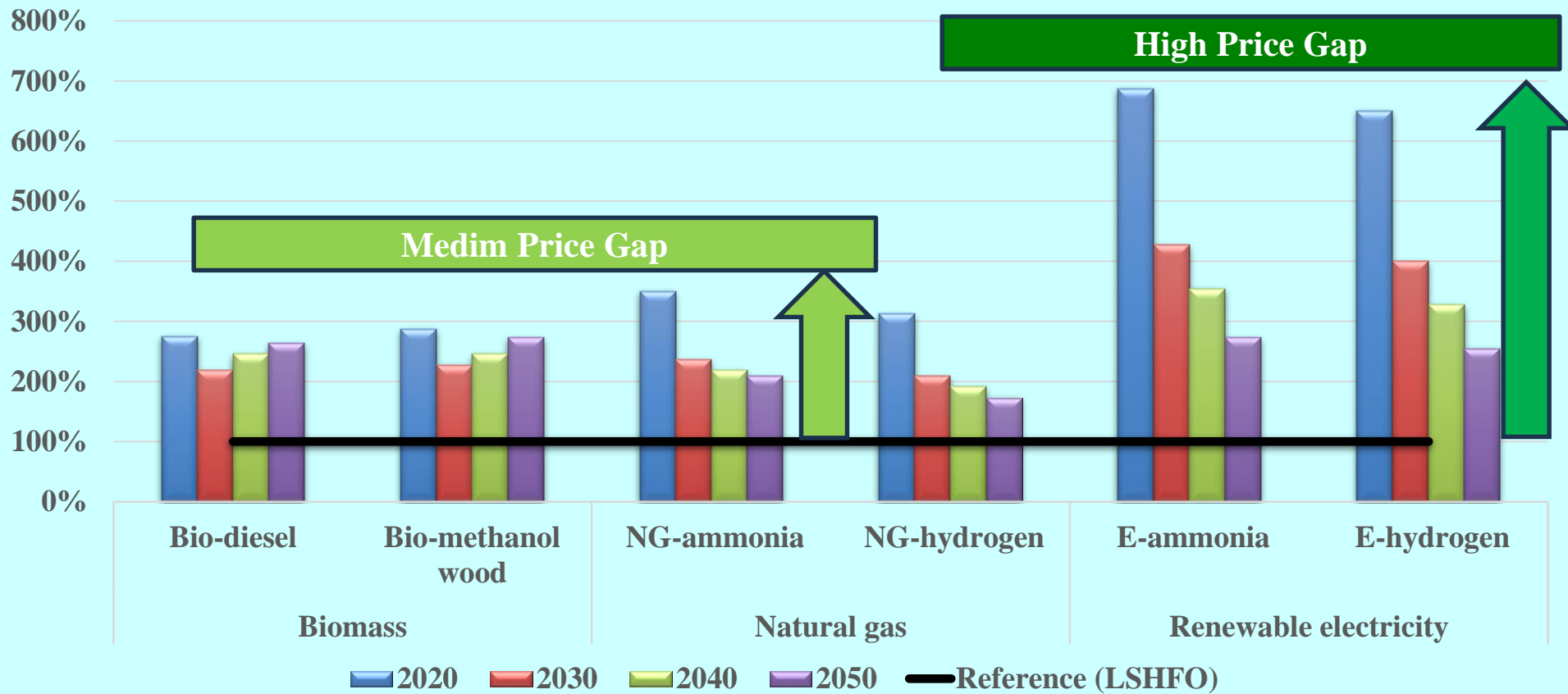
sox 0.5%



# 4.GREEN SHIPPING AND FUEL COSTS



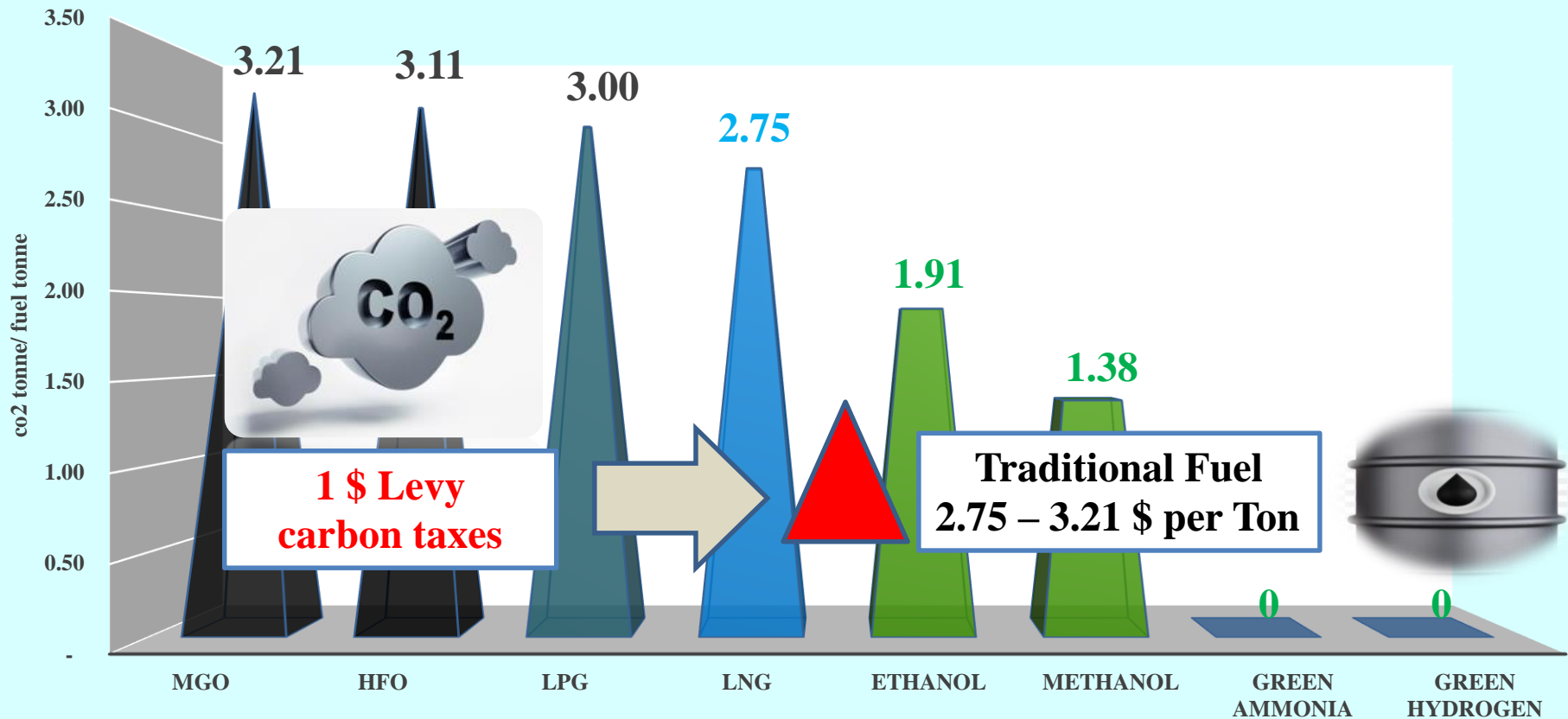
## Future price gap between alternative fuels and HFO



## 4.GREEN SHIPPING AND FUEL COSTS



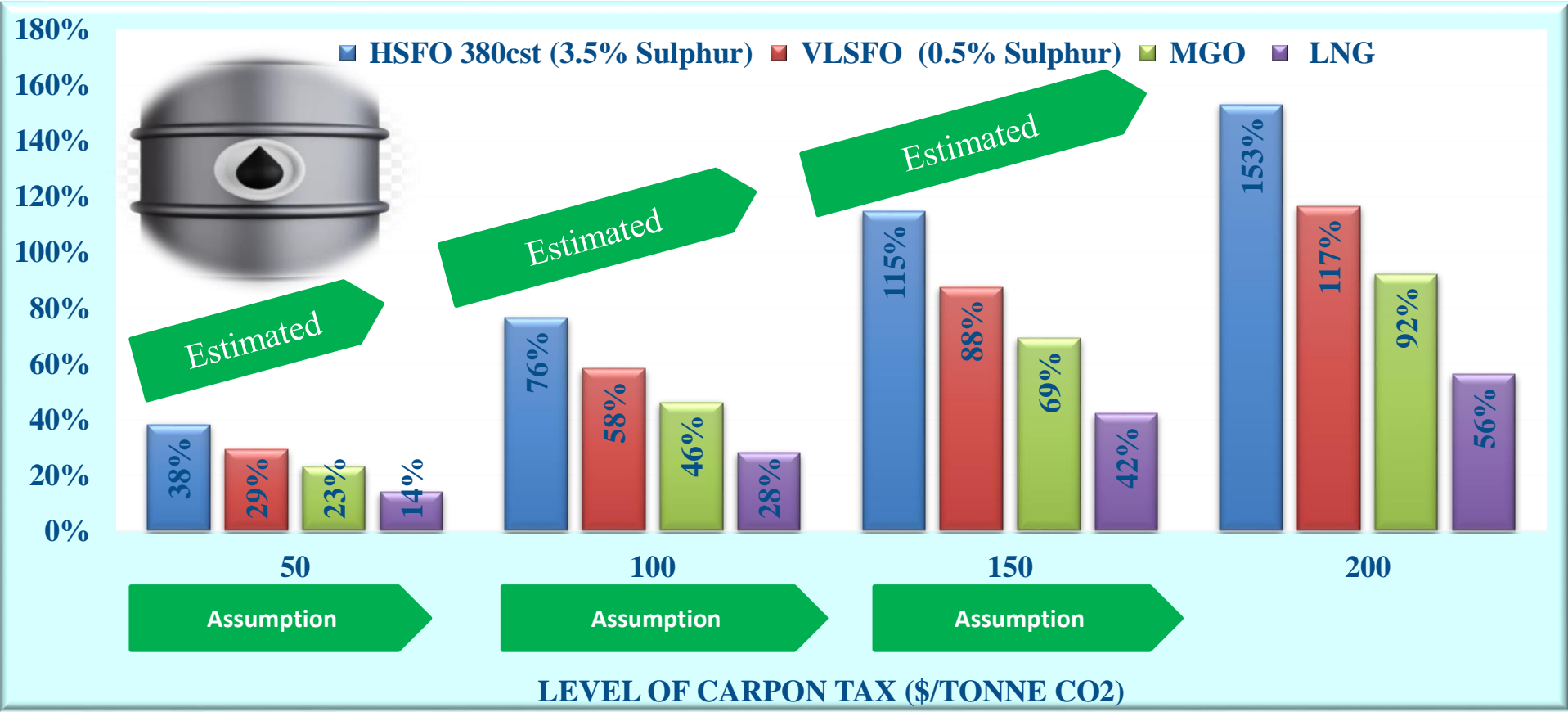
### Emission Factor from fuel type (Co2 /tonne)



# 4.GREEN SHIPPING AND FUEL COSTS



## Carbon Tax and traditional bunker cost (2020-2023)



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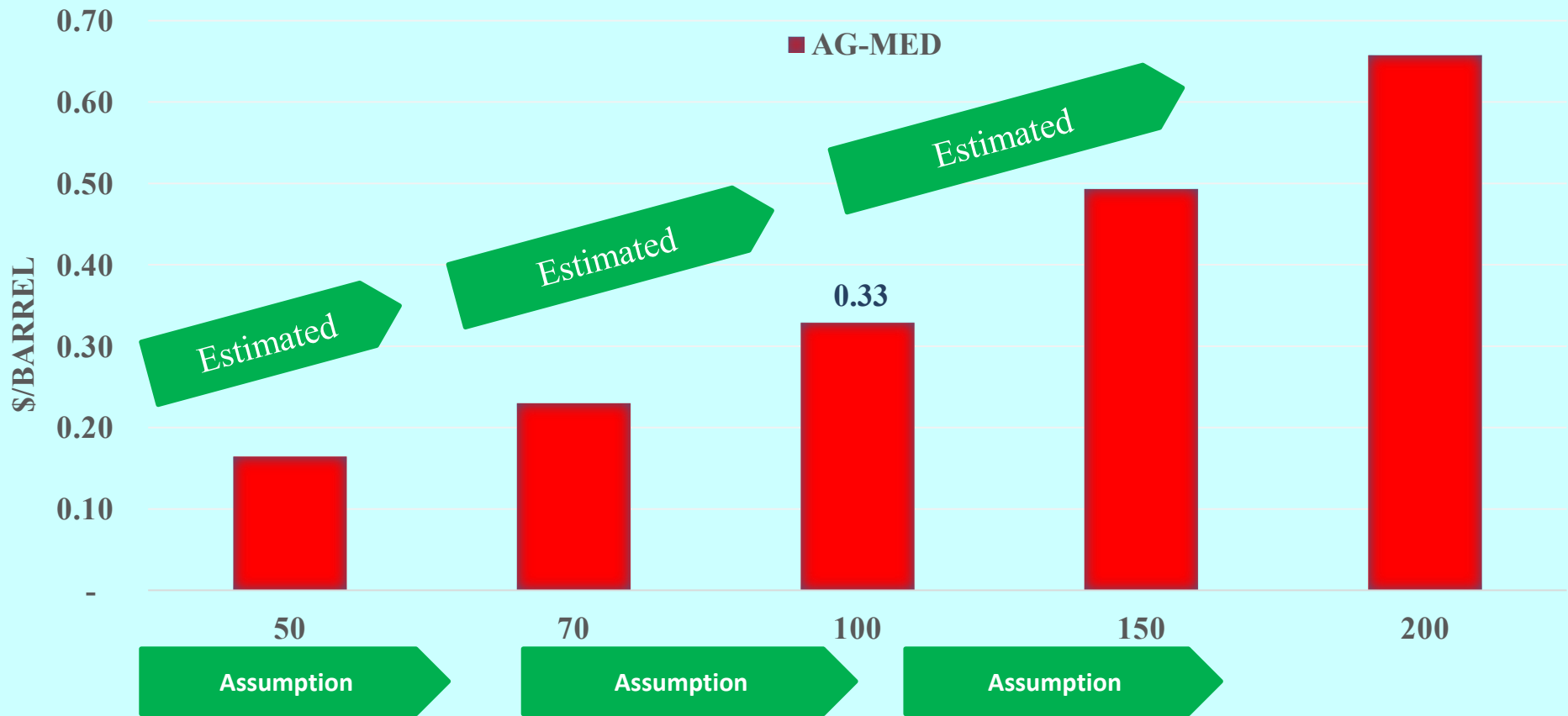


# SC And Emission Reduction





# Carbon tax and oil trade “CASE STUDY”





# Estimate the Effect of WST – Shipping Emissions on SC

## **The ARDL (Autoregressive Distributed Lag) model**

- 1. Specification of the Model**
- 2. Testing for Stationarity**
- 3. Estimating the ARDL Model**
- 4. Bounds Testing for Cointegration**
- 5. Estimating Long-run and Short-run Coefficients**
- 6. Diagnostic Checking**





# 1. Specification of the Model

$$\ln SCT_t = \beta_0 + \beta_1 WST_t + \beta_2 SCo2_t + \varepsilon_t \text{ (eq1)}$$

# 2. Testing for Stationarity

Time series	Prob	levels			1 <sup>st</sup> differences		
		ADF	PP	unit root*	ADF	PP	unit root*
Ln SCT	p-value	<b>0.9990</b>	<b>0.9996</b>	YES/YES	<b>0.0001</b>	<b>0.0001</b>	No/No
Ln WST	p-value	<b>0.4104</b>	<b>0.9928</b>	YES/ YES	<b>0.0002</b>	<b>0.0002</b>	No/No
Ln SCo <sub>2</sub>	p-value	<b>0.4805</b>	<b>0.8499</b>	YES/ YES	<b>0.0010</b>	<b>0.0008</b>	No/No



### 3. Estimating the ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Ln SCT <sub>(t-1)</sub>	0.852301	0.077225	11.03655	0.0000
Ln WST <sub>(t)</sub>	2.929444	0.493453	5.936622	0.0000
Ln WST <sub>(t-1)</sub>	-2.491214	0.503545	-4.947346	0.0001
Ln C <sub>O2(t)</sub>	0.117780	0.315352	0.373489	0.7125
Ln C <sub>O2(t-1)</sub>	-0.005697	0.553607	-0.010291	0.9919
Ln C <sub>O2(t-2)</sub>	-0.804150	0.504903	-1.592682	0.1262
Ln C <sub>O2(t-3)</sub>	1.162099	0.512244	2.268645	0.0340
Ln C <sub>O2(t-4)</sub>	-0.815042	0.322750	-2.525304	0.0197

**ARDL (1, 1, 4)**  
selected based  
on Akaike info  
criterion (AIC)

R-squared	0.991646
Adjusted R-squared	0.988861
S.E. of regression	0.049600
S.D. dependent var	0.469951
Durbin-Watson stat	1.848092



## 4. Bounds Testing for Cointegration

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I (0)	I (1)
F-statistic	6.286861	10%	2.17	3.19
k	2	5%	2.72	+3.83
		2.5%	3.22	4.5
		1%	3.88	5.3
t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I (0)	I (1)
t-statistic	-4.544979	10%	-1.62	-2.68
		5%	-1.95	-3.02
		2.5%	-2.24	-3.31
		1%	-2.58	-3.66





## 5. Estimating Long-run and Short-run Coefficients

ARDL (1, 1, 4) Error Correction model ECM “short run”

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (Ln WST)	2.929444	0.364885	8.028402	0.0000
D (LN SCo <sub>2</sub> )	0.117780	0.296171	0.397677	0.6949
D (LN SCo <sub>2</sub> (-1))	0.457093	0.325402	1.404705	0.1747
D (LN SCo <sub>2</sub> (-2))	-0.347057	0.295393	-1.174897	0.2532
D (LN SCo <sub>2</sub> (-3))	0.815042	0.304269	2.678686	0.0141
ECM (-1)	-0.147699	0.032497	-4.544979	0.0002

The ECM equation is given as  $ECM = LN SCT - (2.9670 * LN WST - 2.3359 * LN Co_2)$





## 5. Estimating Long-run and Short-run Coefficients

ARDL (1, 1, 4) Model Long Run results dependent variable ln (SCT)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNWST	2.967045	0.758730	3.910540	0.0008
LN <sub>SC</sub> CO <sub>2</sub>	-2.335895	0.853291	-2.737515	0.0123







## 6. Diagnostic Checking

Heteroskedasticity Test: Breusch-Pagan-Godfrey results

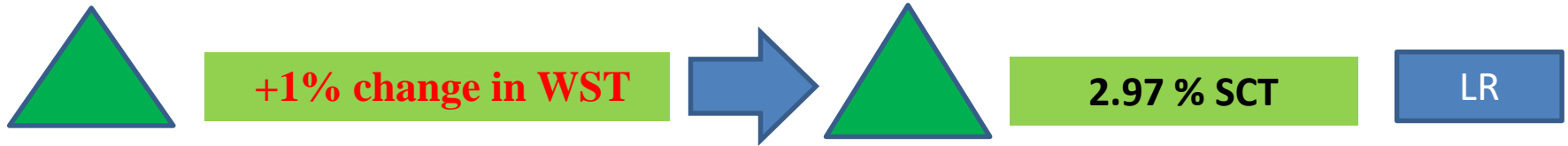
Null hypothesis: Homoskedasticity			
F-statistic	0.346472	Prob. F (8,20)	0.9364
Obs*R-squared	3.529877	Prob. Chi-Square (8)	0.8969
Scaled explained SS	1.536020	Prob. Chi-Square (8)	0.9921

Breusch-Godfrey Serial Correlation LM Test results

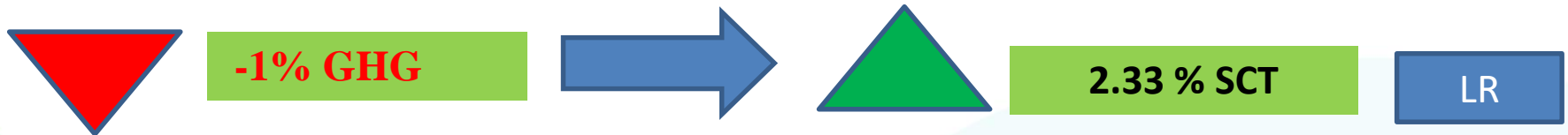
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.060198	Prob. F(2,19)	0.9418
Obs*R-squared	0.182604	Prob. Chi-Square (2)	0.9127

# Final Results

## □ SCT and WST



## □ SCT And GHG emissions



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# CONCLUSION

- ❑ The IMO's short-term policies: have pushed maritime Sector towards the first stage of transition : "Efficiency" by (Eco-ships, Scrubbers, and Alternative fuels).



- Carbon footprint per tonne %42

- ❑ The IMO's medium-term policies: Will Focus on the Second stage of transition : "Start up Towards Green Shipping" .



+ Green Fuel



+ Shipping Cost



- WST

- ❑ SC: will be very important for the shipping transition towards green navigation.

"Green navigation: will be costly, but through technology, innovation, and cooperation, we can decrease these costs"



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*Thank You*

