



RINA

## Session 4

5th edition

**MARE FORUM  
USA - 2010**

Impact of outcome from UNFCCC COP 15 – technology to reduce carbon emissions; exhaust gas cleaning systems and other alternative technology in emission reduction; reducing emissions from existing engines; feasibility of the IMO energy efficiency design index for new ships

Maritime  
Transportation  
of Energy

# The Classification Society Perspective - Technology Solutions for Environmental Problems

## Introduction

FRIDAY  
19 FEBRUARY  
HOUSTON  
TEXAS-USA

A GOVERNMENT-INDUSTRY DIALOG

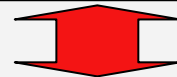
**Roberto Cazzulo**

Vice Director Marine Division  
RINA Services S.p.A.



# Energy saving

CO<sub>2</sub> emissions reduction



**Reduction of fuel consumption**

## Design

1. Hull shape and propeller optimization
2. Micro-emulsion
3. Use of silicon paints etc

## Operation

1. Cleaning of dirty surfaces
2. Speed reduction and trip optimization
3. Weather routing etc

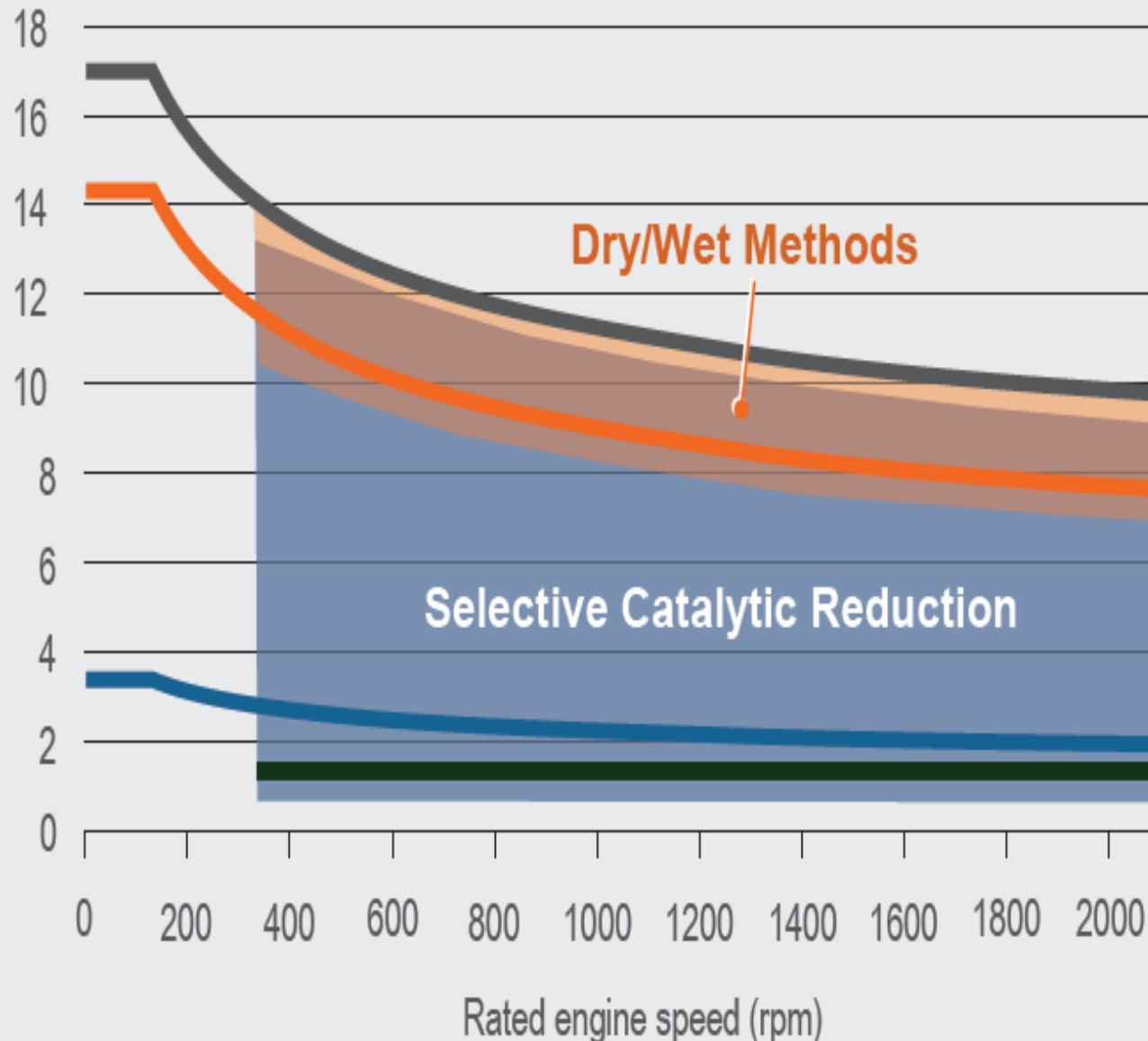
## IMO energy efficiency design index

$$\frac{\left( \prod_{j=1}^M f_j \right) \left( \sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)} \right) + (P_{AE} \cdot C_{FAE} \cdot SFC_{AE}^*) + \left( \left( \prod_{j=1}^M f_j \right) \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{nST} f_{ST(i)} \cdot P_{AE(i)} \right) C_{FAE} \cdot SFC_{AE}}{f_i \cdot Capacity \cdot V_{ref} \cdot f_w} - \left( \sum_{i=1}^{nST} f_{ST(i)} \cdot P_{AE(i)} \cdot C_{FME} \cdot SFC_{ME} \right)$$



# NO<sub>x</sub>

Specific NO<sub>x</sub> emissions (g/kWh)



## Tier I (present)

Ships built 2000 onwards  
Engines > 130 kW

Retrofit: Ships built  
1990 – 2000

Engines > 90 litres/cylinder  
and > 5000 kW

## Tier II (global 2011)

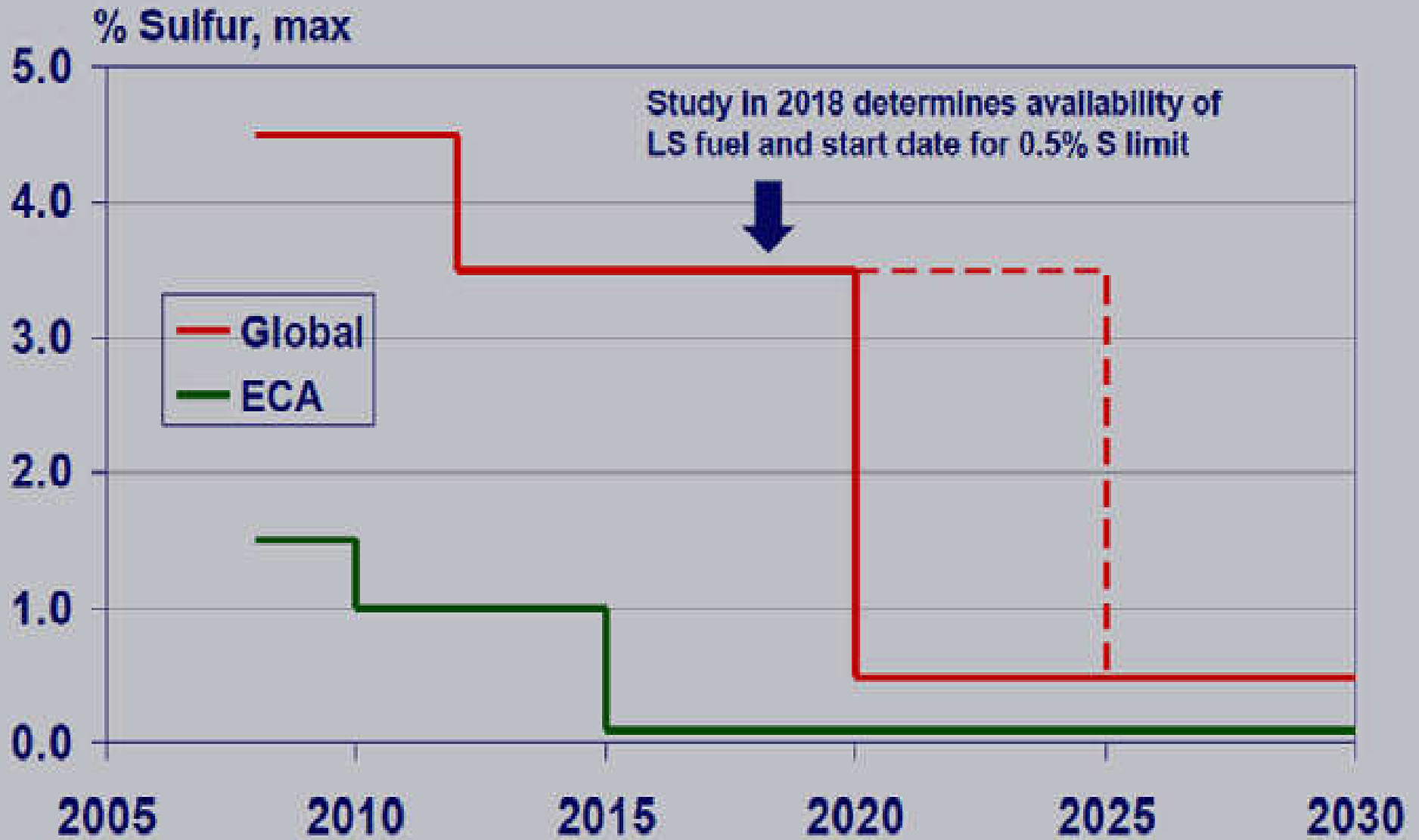
Ships built 2011 onwards  
Engines > 130 kW

## Tier III (ECAs 2016)

Ships in designated  
areas, 2016 onwards  
Engines > 130 kW



# SOx





## **European Community Ports**

European Union Council Directive 2005/33/EC dated 6 July 2005,  
from 1 January 2010, sulphur in fuels not greater than 0.1%  
all type of ships, at berth in European Community ports

## **California Waters and Ports**

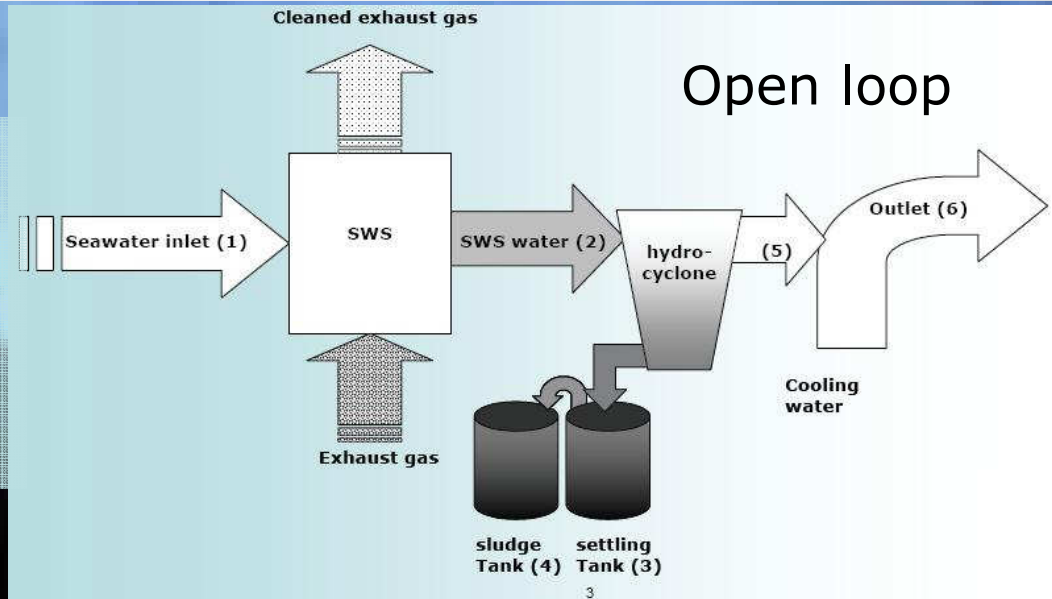
California Code of Regulations (CCR),  
from 1 January 2012, sulphur in fuels not greater than 0.1%  
all type of ships, operating in the Regulated California Waters



# Particulate

in

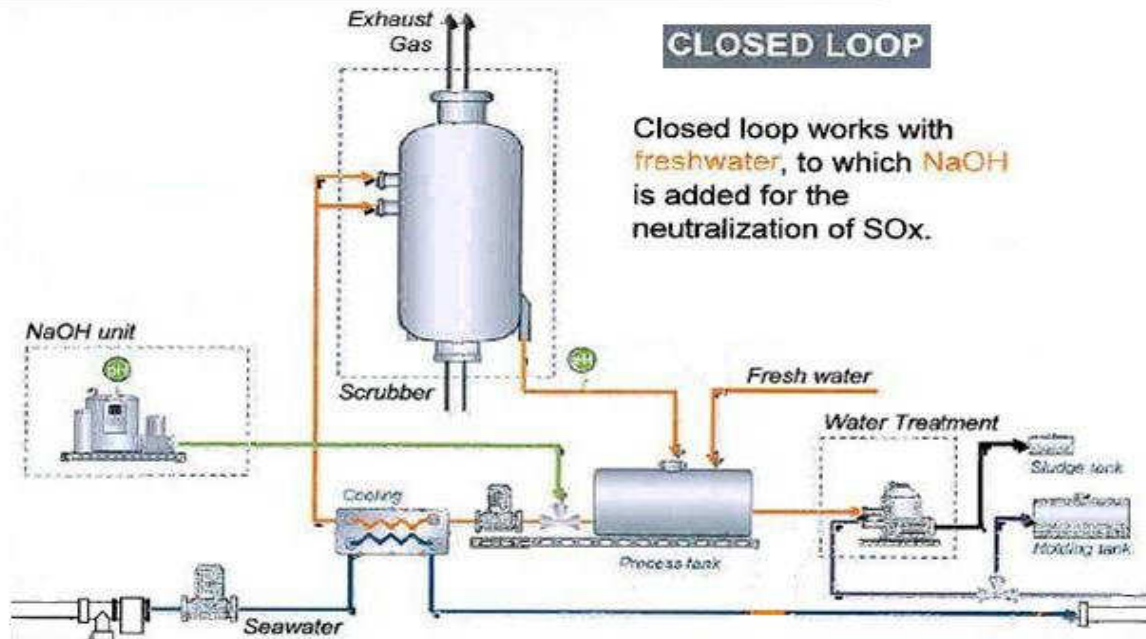
- Fuel types
- Fuel micro-emulsions
- ...



3

out

- Filters
- Scrubbers
- ...



## CLOSED LOOP

Closed loop works with **freshwater**, to which **NaOH** is added for the neutralization of SOx.