Environmental Challenges for the Shipping Industry

Katharine Palmer
Environmental Manager
Lloyd's Register

October 2011

Lloyd's Register
LIFE MATTERS

Strategic landscape as it relates to environment

- Increasingly demanding environmental regulations
- Political decisions not always supported by strong technical / scientific evidence
- Continued pressure on fuel price and emissions reduction
- Balancing the sustainability factors
- Range of innovative environmental solutions

Technical landscape as it relates to environment

- Air emissions
  - SOx, NOx, VOC
  - Energy Management and CO_2
- Transfer of invasive species
  - Ballast water,
  - Biofouling
- Fuel choice
  - HFO
  - MGO
  - LNG
- Waste /garbage
- New build material choices and anti fouling paint /anti corrosion paint
- Recycling issues

Drivers for change

- Corporate Social Reponsibility
- Environmental Concern
- Compliance
- Cost Efficiency

Challenges

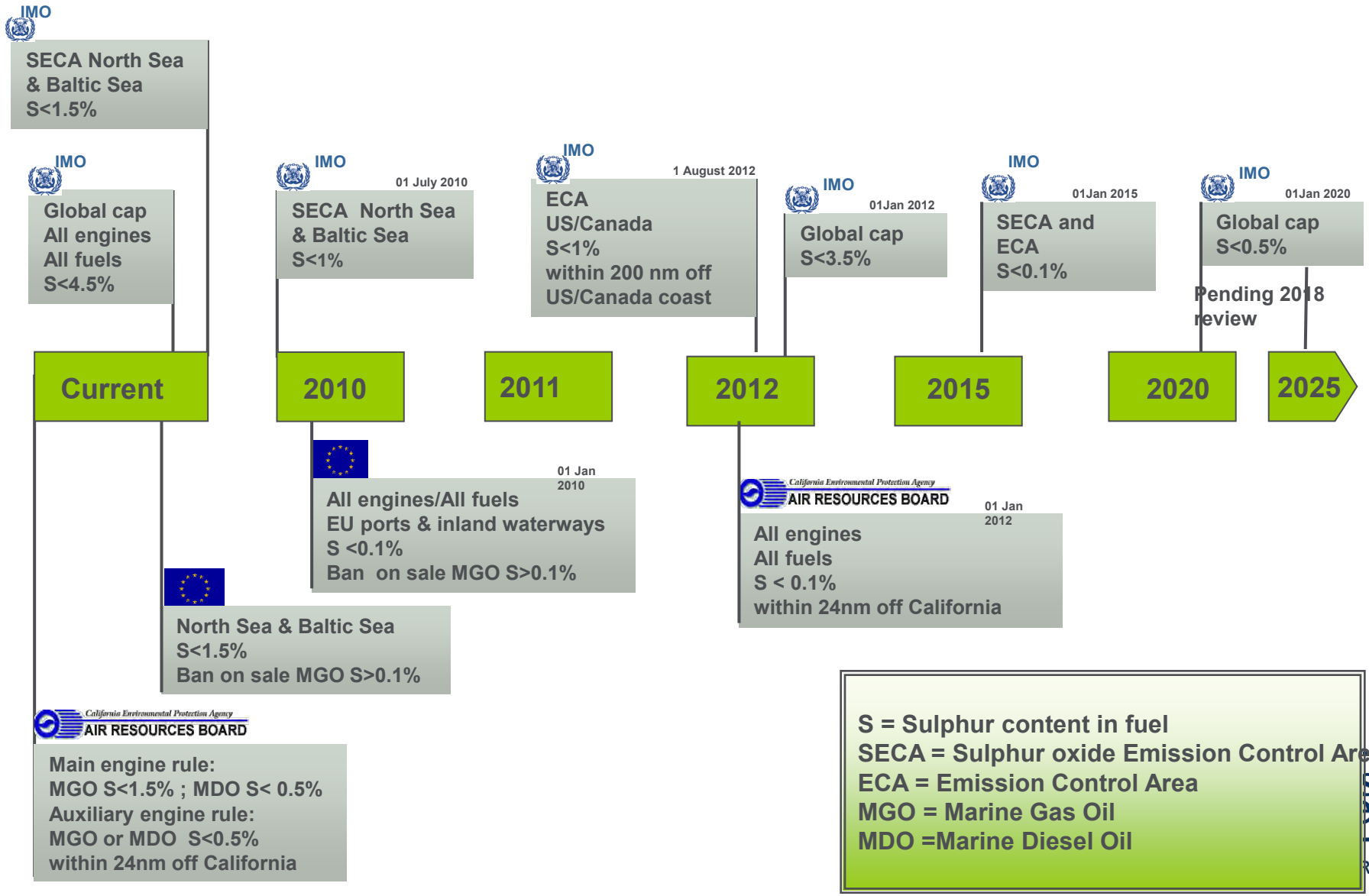
Questions:

- What requirements will be placed on new vessels?
- When?
- What about existing vessels?
- Regional versus IMO ?

What can I do?

- Evaluate your ships – lifecycle costs
- Gather data to allow decisions to be made
- Focus on fuel management and plan to make it 'state of the art'
- Review management options

Regulation timeline: Sulphur in Marine Fuels



S = Sulphur content in fuel
SECA = Sulphur oxide Emission Control Area
ECA = Emission Control Area
MGO = Marine Gas Oil
MDO =Marine Diesel Oil

Regulation : NOx Emissions

IMO

Date Ship Built	Before 1990	1990 – 1st Jan 2000	2000 – 1st Jan 2011	2011 – 1st Jan 2016	From January 2016
NOx emission limits	No limits apply	Tier I globally, with exceptions	Tier I global	Tier II global	Tier II global Tier III in NOx ECAs

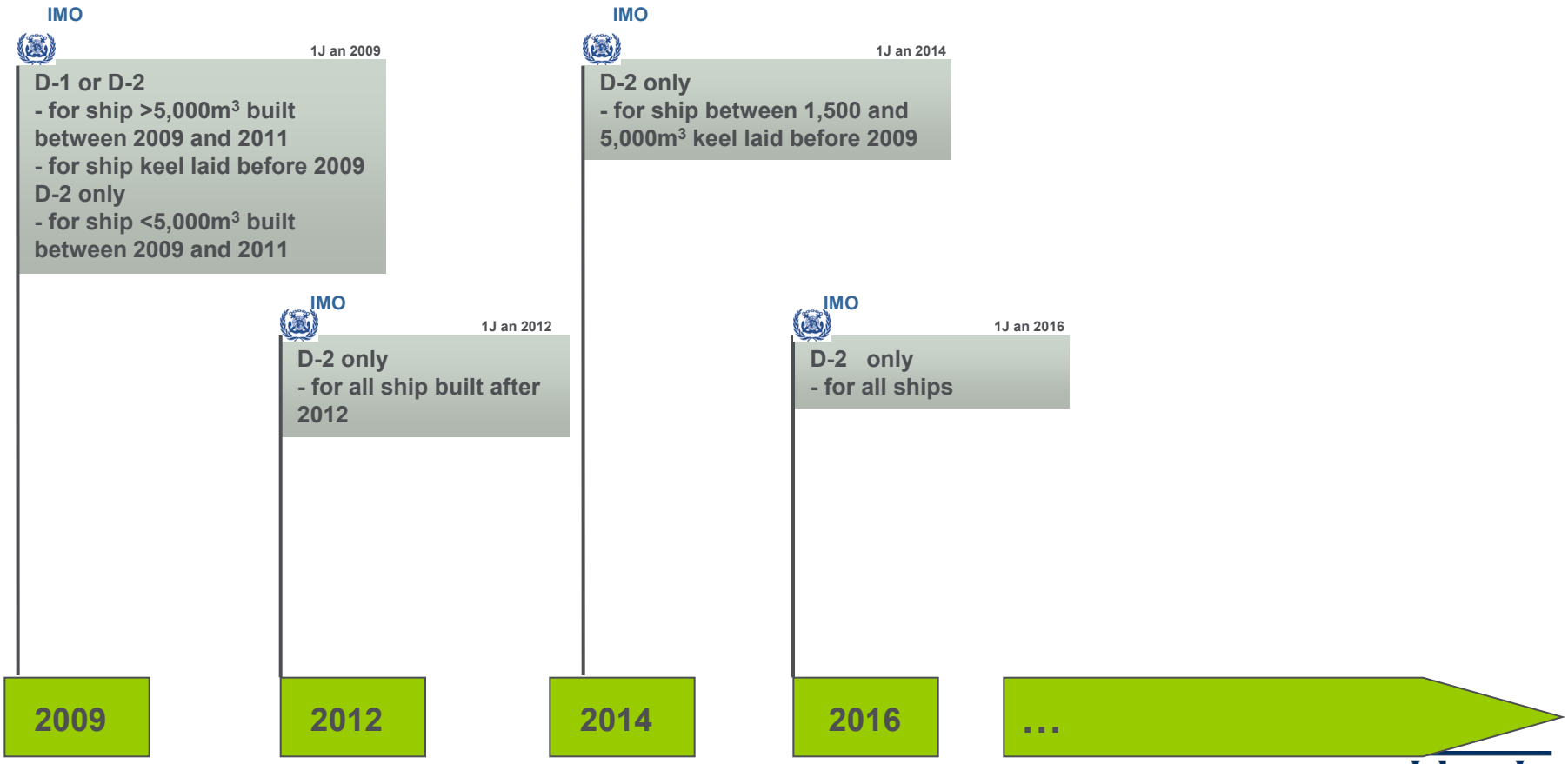
NOx emission limits	In revised Annex VI EIF 1st July 2010
Tier I	17.0 – 9.8 g/kWh
Tier II	14.4 – 7.7 g/kWh
Tier III	3.4 – 2.0 g/kWh

How to respond to the challenges ?

Many different solutions available
No single solution is suitable for all ships

1. Identify technically compatible solutions
2. Fuel cost scenario planning
3. Review commercial implications

Regulation timeline: Ballast Water Convention



D-1: must comply with ballast water **exchange** standard
D-2: must comply with ballast water **treatment** standard

Design/Installation Considerations

Items to consider when selecting a ballast water treatment system include:

- **Ship type**
- **Ballast capacity**
- **Trading Pattern**
- **Space required (foot print and volume)**
- **Flexibility of location of system components**
- **Integration with existing systems**
- **Intrinsically safe / Ex proof**
- **Power balance**
- **Health and Safety**
- **Effects on tank structure/coatings**
- **Availability of consumables, spares and support (servicing)**
- **Additional crew workload**
- **Crew training**
- **Capital and Operating Cost**
- **System availability – delivery time**

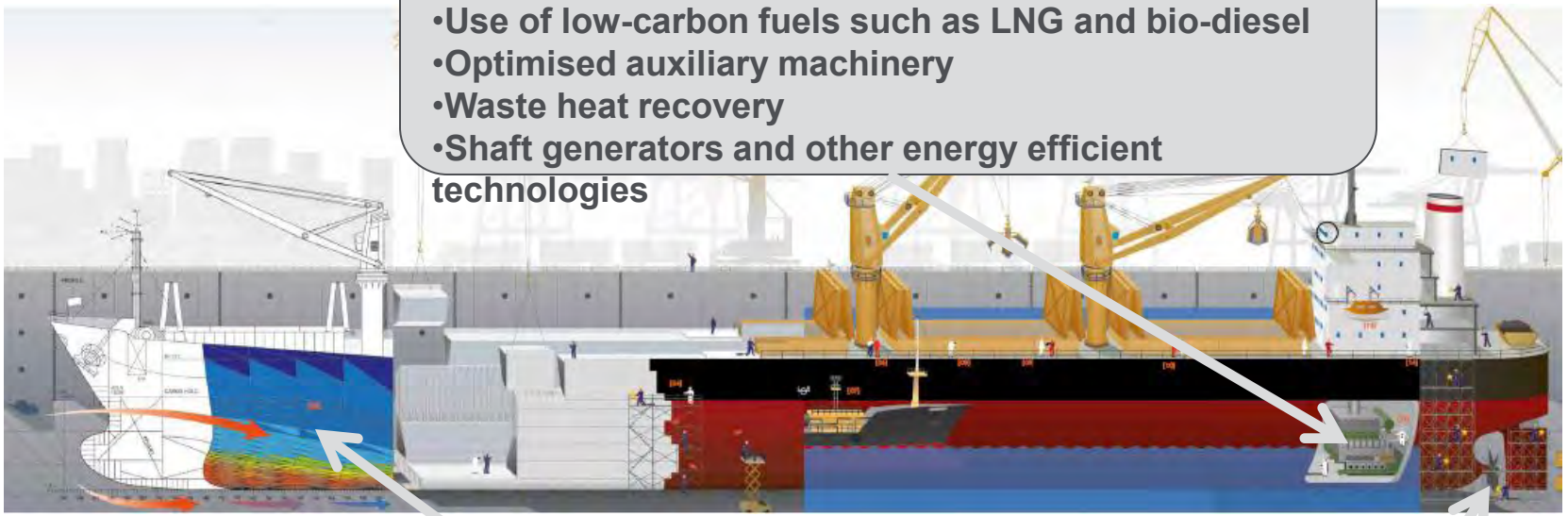
Potential Regulatory Environment for CO2 Emissions

- Mandatory Operational and Technical Measures
  - Energy Efficiency Design Index (EEDI)
  - Shipboard Energy Efficiency Management Plan (SEEMP)

  - Market based measures are still under debate

What is the EEDI?

Machinery
- More efficient engines (ME/AE)
- Use of low-carbon fuels such as LNG and bio-diesel
- Optimised auxiliary machinery
- Waste heat recovery
- Shaft generators and other energy efficient technologies



Hull
- Optimised hull form for reduced resistance
- Appendages optimisation
- Advanced hull coatings
- Increased capacity?
- Reduced lightweight?

Propulsion
- Propeller optimisation
- Variable speed drives
- Electric propulsion
- Podded propulsion
- Boss cap fins

Lloyd's Register
LIFE MATTERS

EEDI implementation

Current Regulatory Text:

- Phase 0 0% 2013 –
- Phase 1 10% 2015 –
- Phase 2 20% 2020 –
- Phase 3 30% 2025 –

Ships to be regulated in Phase 0

- Bulk carriers;
- Tankers;
- Gas tankers;
- Container ships;
- General cargo ships;
- Refrigerated cargo ships;
- Combination carriers..

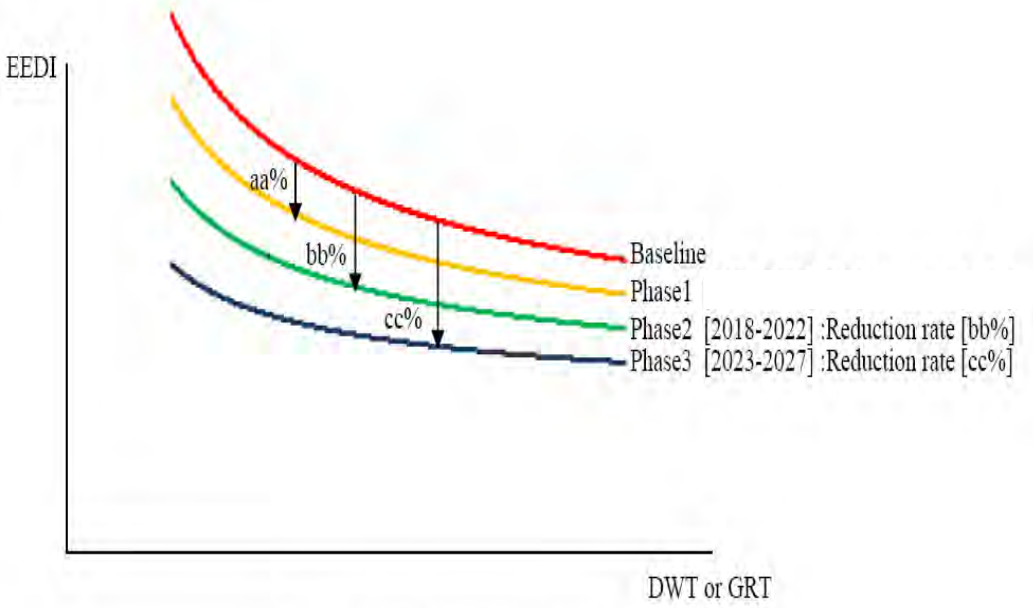
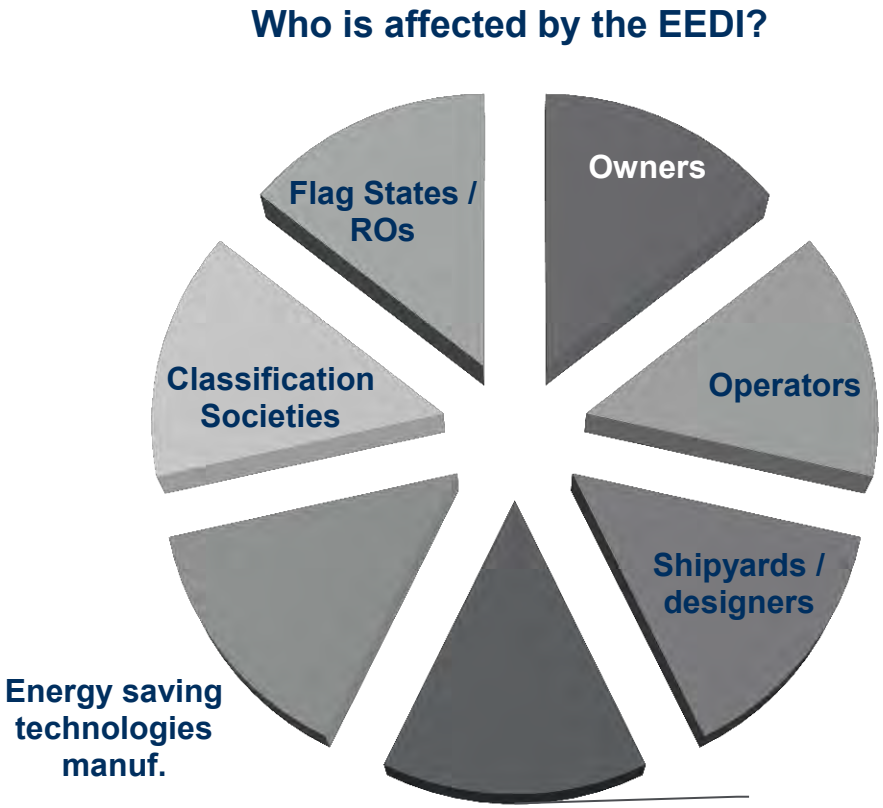


Figure 1: Phased approach to set the EEDI requirements

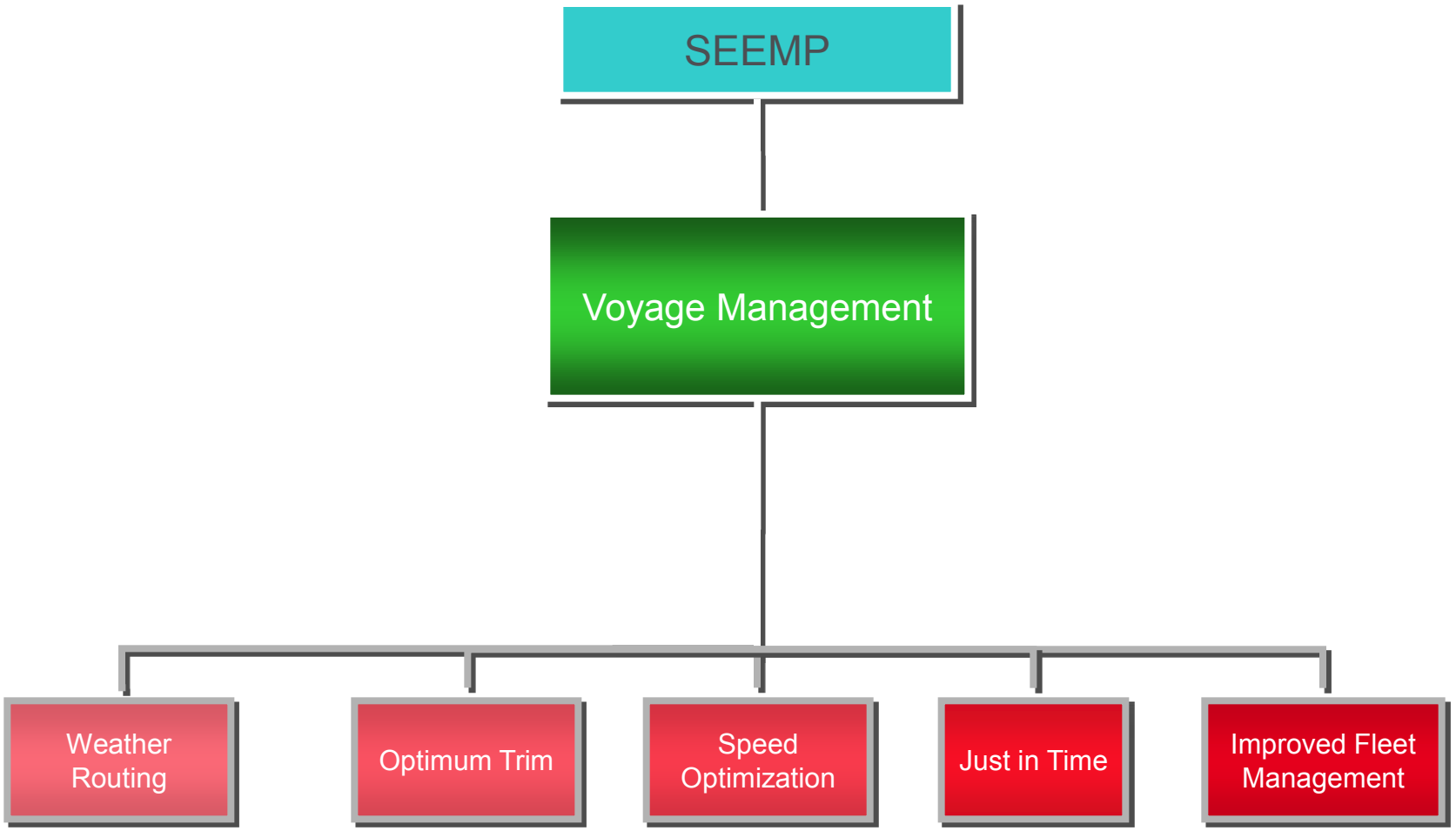
MEPC 60/4/33

Lloyd's Register
LIFE MATTERS

Commercial impact of the EEDI

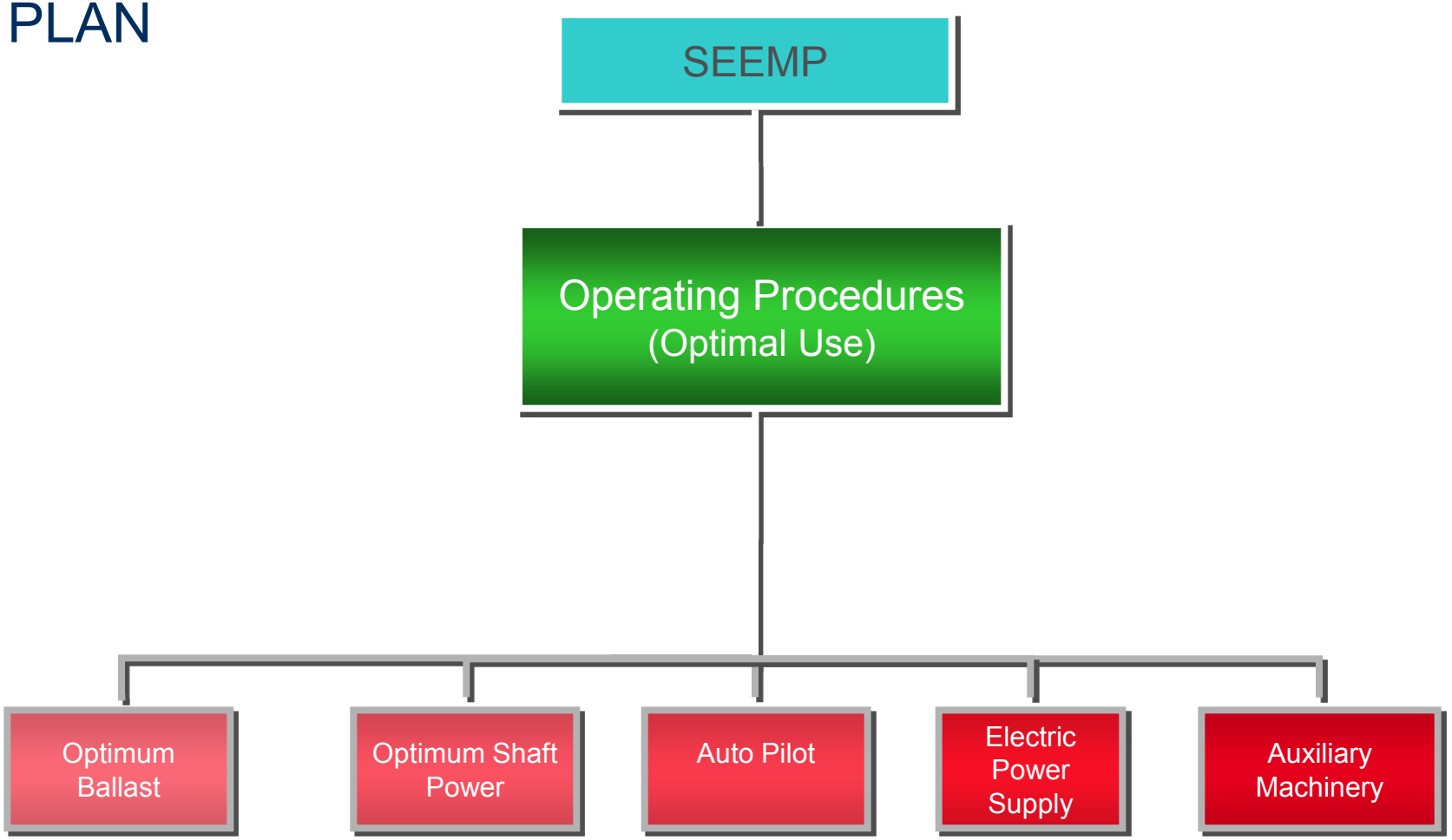


SEEMP – SHIP ENERGY EFFICIENCY MANAGEMENT PLAN

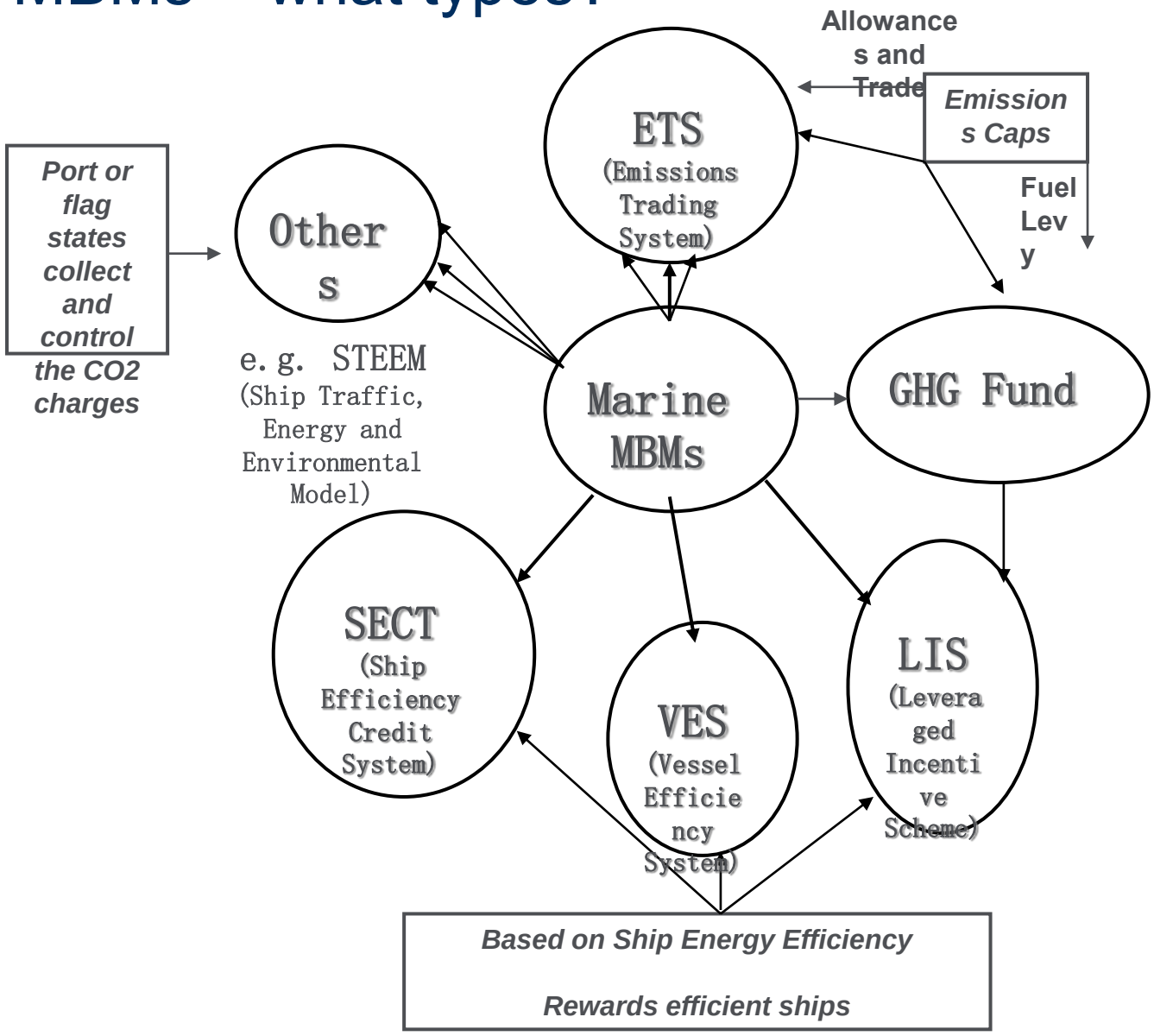


Lloyd's Register
LIFE MATTERS

SEEMP – SHIP ENERGY EFFICIENCY MANAGEMENT PLAN



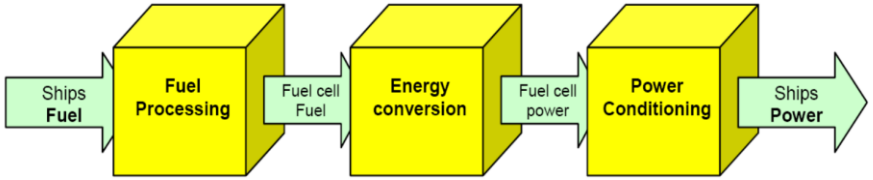
MBMs – what types?



Lloyd's Register
LIFE MATTERS

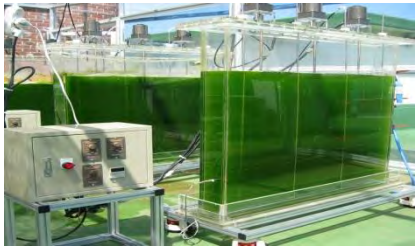
Emerging Technologies

- Alternative technologies: fuel cell.
- Alternative fuel: biofuels, LNG, nuclear.
- Renewable energy: wind, solar.



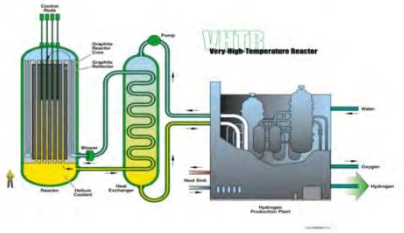
Wind

Bio Mass



Solar Power

Nuclear



Concept Demonstrators

Lloyd's Register
LIFE MATTERS

Sustainability - what is it?

Sustainability refers to way companies *integrate economic, social and environmental concerns* in their business operations.

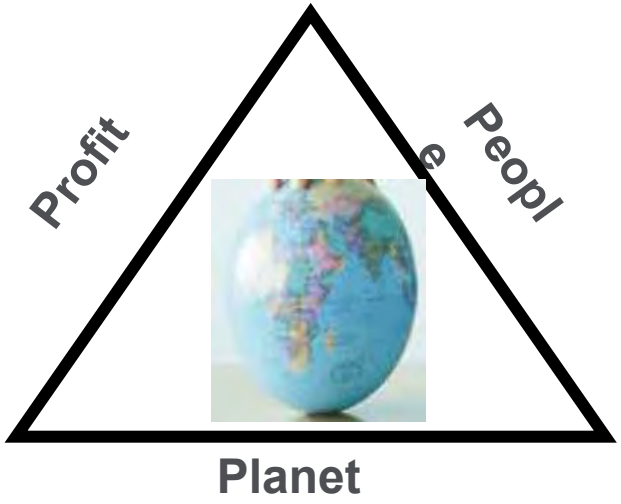
Sustainability relates to the idea whereby a business addresses and balances the needs of *stakeholders.*

PEOPLE, PLANET & PROFIT

Sustainability Triangle

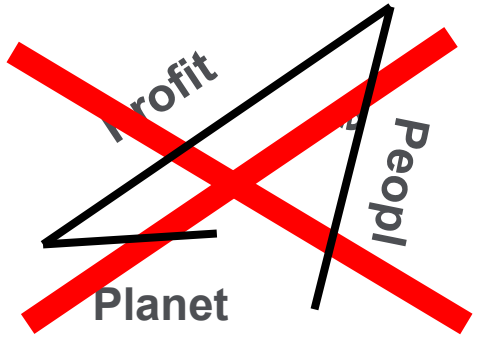
3 Pillars of sustainability

- Economic
- Social
- Environmental



Note - Sustainability cannot exist without balance between all elements

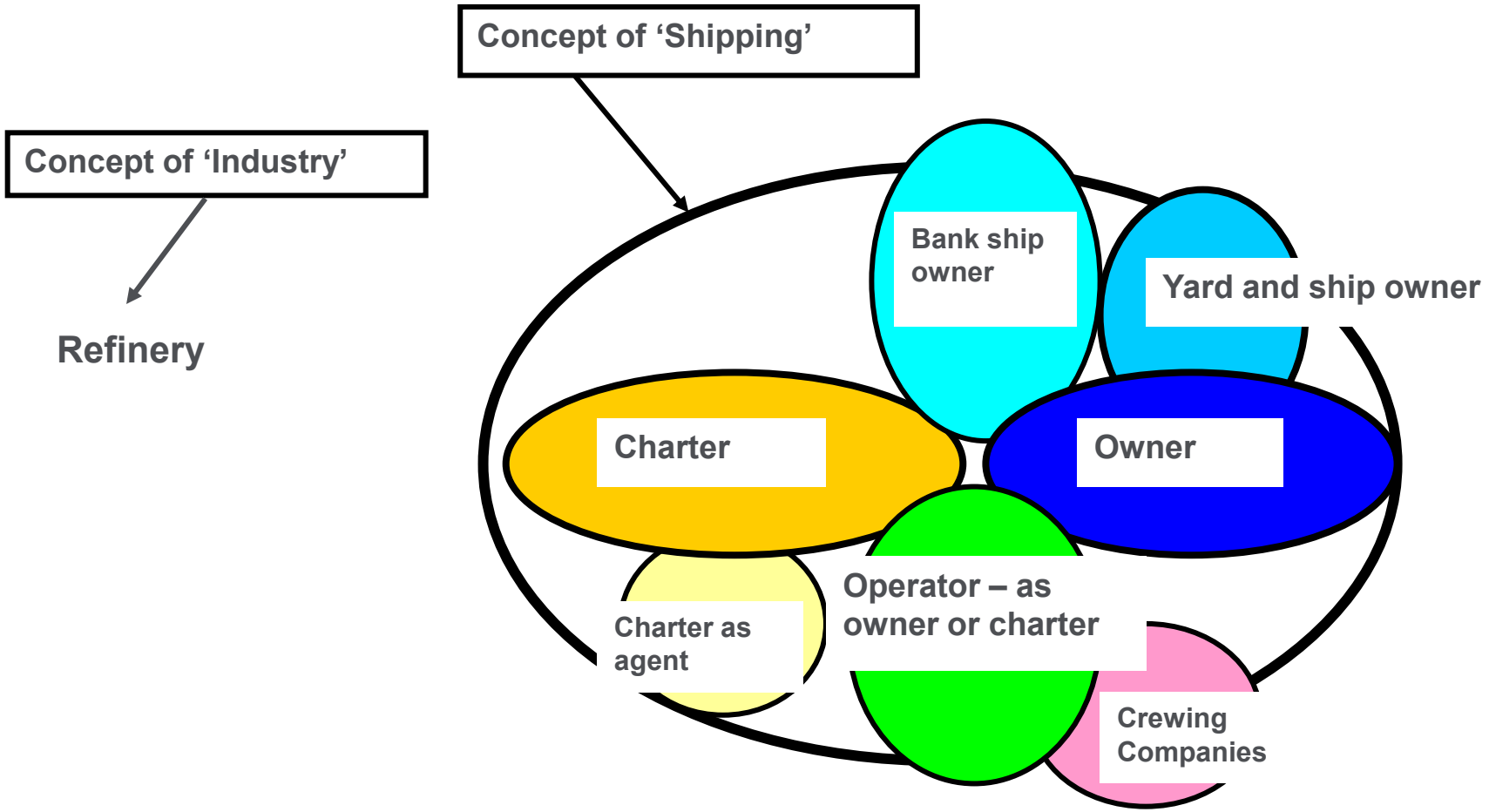
Too much focus on any area and model collapses



Marine Stakeholder

Lloyd's Register
LIFE MATTERS

Areas of responsibility - challenge



Sustainable Shipping

The truly sustainable shipping company...

- **Is committed to maintaining & enhancing all five stocks of capital**
- **Is committed to operating within environmental limits, and has agreed with stakeholders what the limits are**
- **Has a robust strategy in place to deliver on these commitments**
- **Has integrated proactive sustainability thinking into management decision-making**
- **Is innovative in cutting carbon intensity:**
  - **new propulsion methods, fuels, ship designs**
  - **voluntary emissions trading**
  - **cargo types, volumes and value**
- **Has 'future-proofed' its business against radical discontinuities**

Jonathan Porritt

Success criteria

- Balance '*planet, people and profit*'
- Life cycle thinking
- Climate adaptation and resource issues
- Safe operation and crew
- Feasible technically (accepting we do not know future developments)
- Cost effective / commercial investment
- Complex
- Future proof