SSI roadmap

As leaders in our industry, SSI members want to show the way towards a better future – for our own success and for wider society, with sustainable shipping serving a genuinely sustainable economy.

The Roadmap has been developed by the SSI members, and reviewed by panels of industry stakeholders, to show the complex pathways, through to a sustainable industry in 2040. The story begins with the analysis of the key mega-trends affecting the industry outlined in our Case for Action document. These were then projected forwards in our Vision2040 to six key defined areas which were each comprised of the evolution of one or more of the mega-trends. These six vision areas form the basis of the Roadmap which aims to help us on the journey.

It is important to note that the Roadmap is not static. Content has already changed and evolved during the development and it will need to be reviewed and updated often to maintain relevance. It is also impossible to include absolutely everything that could or should happen, but there has been some consensus on the content. It is a working document for the SSI and its members and it is hoped that the industry will also find it useful. If there are suggestions for inclusion, update or deletion of items, please contact us.

sustainable shipping initiative

Click to find out more about the Case For Action & Vision 2040

1. **Proactively contributing to the responsible governance of the oceans**

- -

2. **Earning the reputation of being a trusted and responsible partner in the communities where we live, work and operate**

- -

3. **Provide healthy, safe and secure work environments so that people want to work in shipping, where they can enjoy rewarding careers and achieve their full potential**

- -

4. **Transparency and accountability drive performance improvements and enable better, sustainable decision making**

- -

5. **Develop financial solutions that reward sustainable performance and enable large scale uptake of innovation, technology, design and operational efficiencies**

- -

6. **Change to a diverse range of energy sources, using resources more efficiently and responsibly, and dramatically reducing greenhouse gas intensity**

1 Proactively contributing to the responsible governance of the oceans

FREEDOM VS LEVEL PLAYING FIELD – GLOBAL GOVERNANCE

- Arctic sea passages 'open for business'
- Proliferation of ocean industries - deep sea mining, floating wind generation, wave power, algal biofuel etc.
- Global fleet doubles = 200,000 ships
- "sea traffic control" necessary
- Proliferation of coastal shipping around Africa and Asia puts pressure on coastal waters

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

DEMANDING HIGHER STANDARDS : SUSTAINABILITY REGULATION

- Increased transparency and visibility of shipping creates more global demand for higher standards from beyond the industry
- Reduce CO_2 to 1990 levels to prevent runaway Climate Change
- Growing (BRIC/MINT) middle class demands better social and environmental standards

VISION 2040

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

WORK WITH KEY POLICY & REGULATORY FORUMS, AND WITH RELEVANT STAKEHOLDERS TO BALANCE RIGHTS AND RESPONSIBILITIES FOR USE AND ACCESS, AND IMPROVE OCEAN GOVERNANCE

(Note: we have used marine spatial planning (MSP) as a proxy)

GOVERNANCE
Practical tools and resources are available for ocean industries to participate effectively during a MSP process (WOC goal).

IMPLEMENTATION
Pilot projects (Irish sea + Great Barrier Reef Pilots, Polar Code) have demonstrated good practice, and benefits of spatially driven legislation that brings together multiple sectors to balance rights and responsibilities of key ocean users.

IMPLEMENTATION
Agreement of standardised MSP process based on pilots (Irish sea, Polar Code, etc.)

PIRACY
Pilot studies in place to address piracy at source.

ENFORCEMENT
Audits of MSP's and their implementation becomes mandatory. Credible enforcement of existing fishing and whaling regulations is in place.

GOVERNANCE
Practical tools and resources are available for ocean industries to participate effectively during a MSP process (WOC goal).

GOVERNANCE
IMO has strengthened links with national and International governments (EU, African Union, ROCRAM, etc.), giving teeth to enforce standards and regulations.

IMPLEMENTATION
Progressive increase in performance standards required in MPAs.

IMPLEMENTATION
Programme developed for systematic role-out of Marine Spatial Plans for heavy use areas; Polar code replicated in other high risk areas.

ENFORCEMENT
Legal enforcement is effective and proven in existing MSP's and MPA's.

GOVERNANCE
Oil and gas, wind, and all other key maritime industries are represented by an international governance body, enabling formal participation in global ocean governance processes.

GOVERNANCE
Review of UNCLOS (which will be applicable to ALL countries).

IMPLEMENTATION
High seas MPA's established (in addition to coastal MPAs).

GOVERNANCE
Formalisation of inter-agency ocean governance body via UNCLOS, with buy-in from all key groups- IMO, International Seabed Authority, FAO, regional fisheries management, oil and gas (etc.).

IMPLEMENTATION
MSP's in place for all heavy use areas with legal backing and enforcement.

GOVERNANCE
Overarching governance body is formed, covering all ocean/maritime industries.

PIRACY
Piracy is eliminated/solved.

INFLUENCING FACTOR
Communication between all stakeholders.

A formal system of global ocean governance is in place, recognising the rights and responsibilities of key ocean users.

All 'heavy use areas' are managed through a system of well enforced Marine Spatial Plans

Ideally, we would measure success by the specific schedule of regulations considered by the SSI to be 'desirable by 2040'. In the absence of such a schedule, the following outcomes are proposed;

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

SUPPORT DEVELOPMENT OF COORDINATED AND PROGRESSIVE LEGISLATION AIMED AT SIGNIFICANTLY IMPROVING SOCIAL, ENVIRONMENTAL AND ECONOMIC SUSTAINABILITY ACROSS THE SHIPPING INDUSTRY.

REGULATION
EU Marine Spatial Planning Directive.

ENFORCEMENT
Marine Spatial Planning in national waters includes all users.

REGULATION / POLICY
CBD into EBSA's
IMO into PSSA's.

ENFORCEMENT
More protected sea areas.

REGULATION
(TBC Regulation, supported/proposed by SSI,) is presented at MARPOL

REGULATION
The crime of 'Ecocide' is included in Article 5(1) under the Rome statute as the 5th crime against peace.

ENFORCEMENT
Legal enforcement of existing maritime sustainability regulation is ramped up, with significant increase in prosecutions and impacts on levels of non-compliance, with a focus on
· Anti-whaling agreements
· Prohibited fishing gear
· ECA's Operational discharges

REGULATION
Rate of ratification of regulation at IMO is increased significantly.

PROGRESSIVE VOICE
SSI produced position papers on pending regulation?

BIG DATA
Better ship tracking
Better port management.
Better route management.

PRACTICAL MEASURES
Unmanned vessels.

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

BRIC Brazil, Russia, India, China **MINT** Mexico, Indonesia, Nigeria, Turkey **MSP** Marine Spatial planning **WOC** World Ocean Council **UNCLOS** United Nations Convention on the Law of the Sea

FAO Food and Agriculture Organisation **EU** European Union **MPA** Marine Protected Area **CBD** Convention on Biological Diversity **EBSA** Ecologically or Biologically Significant Area

IMO International Maritime Organisation **ROCRAM** Red Operativa de Cooperación Regional de Autoridades Marítimas de las Americas /Operative Network for Regional Co-operation among Maritime Authorities of South America, Cuba, Mexico and Panama **PSSA** Particularly Sensitive Sea Area **ECA** Emission Control Areas

POLAR CODE IMO has adopted the International Code for Ships Operating in Polar Waters (Polar Code) and related amendments to protect the two polar regions—Arctic (north pole region) and Antarctic (south pole region)—from maritime risksand to make it mandatory under both the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL).

Earning the reputation of being a trusted and responsible partner in the communities where we live, work and operate

THE GLOBAL ECONOMY – EMERGING GIANTS
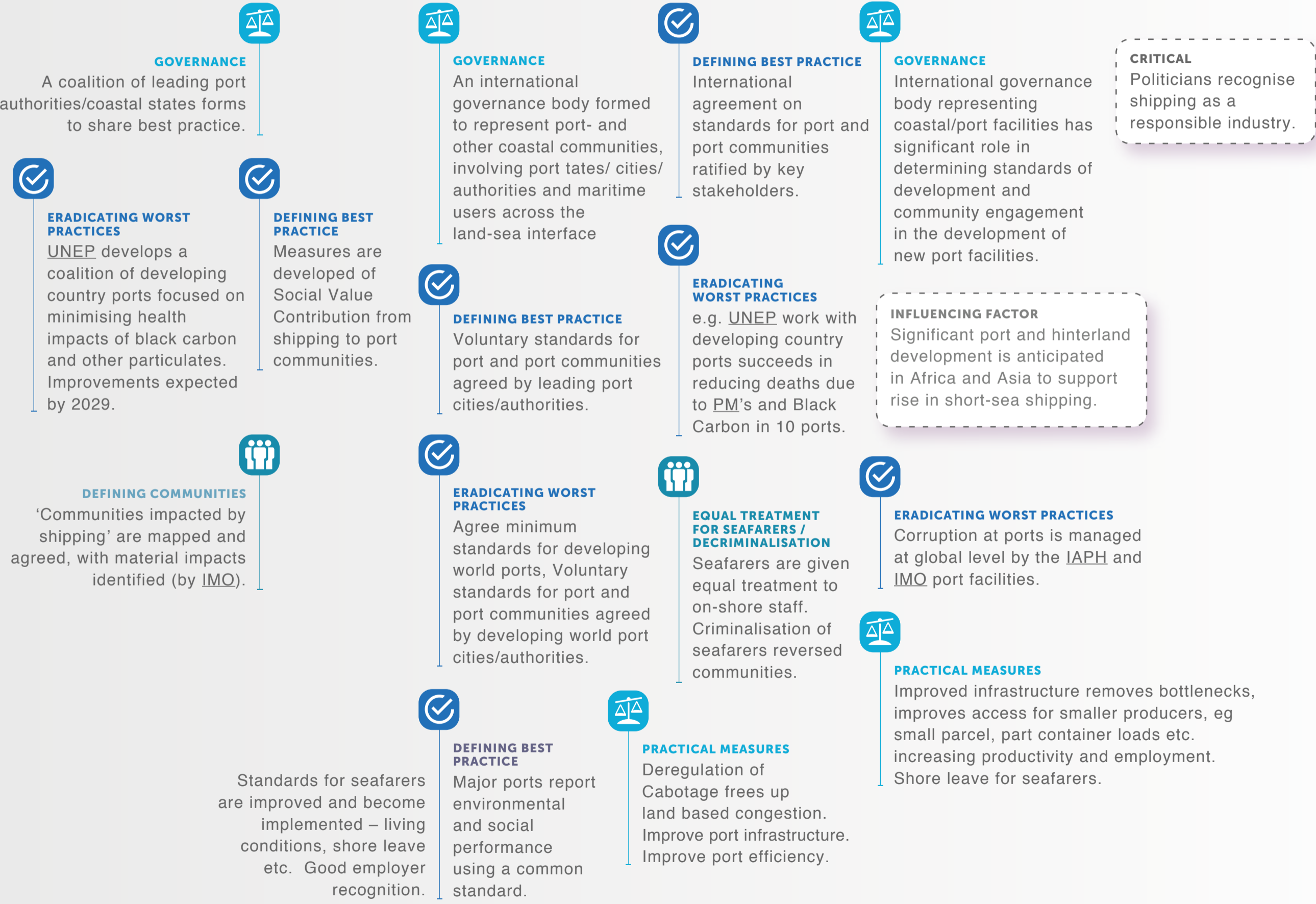
DEMANDING HIGHER STANDARDS

Increased transparency and visibility of shipping creates more global demand for higher standards from beyond the industry

Growing (BRIC/MINT) middle class demands better social and environmental standards

VISION 2040

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

DEVELOP AND FACILITATE THE IMPLEMENTATION OF ECONOMIC, SOCIAL AND GOVERNANCE BEST PRACTICES THAT BENEFIT THE KEY COMMUNITIES AFFECTED BY SHIPPING.

(Note: specifics relating to ship breaking communities are identified separately.)

GOVERNANCE
A coalition of leading port authorities/coastal states forms to share best practice.

ERADICATING WORST PRACTICES
UNEP develops a coalition of developing country ports focused on minimising health impacts of black carbon and other particulates. Improvements expected by 2029.

DEFINING BEST PRACTICE
Measures are developed of Social Value Contribution from shipping to port communities.

DEFINING COMMUNITIES
'Communities impacted by shipping' are mapped and agreed, with material impacts identified (by IMO).

GOVERNANCE
An international governance body formed to represent port- and other coastal communities, involving port tates/ cities/ authorities and maritime users across the land-sea interface

DEFINING BEST PRACTICE
Voluntary standards for port and port communities agreed by leading port cities/authorities.

ERADICATING WORST PRACTICES
Agree minimum standards for developing world ports, Voluntary standards for port and port communities agreed by developing world port cities/authorities.

DEFINING BEST PRACTICE
Major ports report environmental and social performance using a common standard.

DEFINING BEST PRACTICE
International agreement on standards for port and port communities ratified by key stakeholders.

ERADICATING WORST PRACTICES
e.g. UNEP work with developing country ports succeeds in reducing deaths due to PM's and Black Carbon in 10 ports.

EQUAL TREATMENT FOR SEAFARERS / DECRIMINALISATION
Seafarers are given equal treatment to on-shore staff. Criminalisation of seafarers reversed communities.

PRACTICAL MEASURES
Deregulation of Cabotage frees up land based congestion. Improve port infrastructure. Improve port efficiency.

INFLUENCING FACTOR
Significant port and hinterland development is anticipated in Africa and Asia to support rise in short-sea shipping.

GOVERNANCE
International governance body representing coastal/port facilities has significant role in determining standards of development and community engagement in the development of new port facilities.

ERADICATING WORST PRACTICES
Corruption at ports is managed at global level by the IAPH and IMO port facilities.

PRACTICAL MEASURES
Improved infrastructure removes bottlenecks, improves access for smaller producers, eg small parcel, part container loads etc. increasing productivity and employment. Shore leave for seafarers.

Standards for seafarers are improved and become implemented – living conditions, shore leave etc. Good employer recognition.

CRITICAL
Politicians recognise shipping as a responsible industry.

Coastal communities are effectively represented in maritime and land-based governance bodies, at a local, national and international level, with well-defined and enforced standards.

· Port communities have clean and healthy environments

· Shipping industry is seen as an enabler to trade and development

· Corruption is eradicated

· IAPH drives improvements through globally recognised standards and reporting requirements

· There is harmony between ships, ports and port communities in terms of jobs, conditions and technology

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IMO International Maritime Organisation   UNEP United Nations Environment Programme   PM Particulate Matter   IAPH International Association of Ports and Harbors

PREVIOUS ROADMAP   NEXT ROADMAP

THE CASE FOR ACTION

NO SECRETS – DEMAND FOR TRANSPARENCY

- Increased transparency and visibility of shipping creates more demand for higher standards from beyond the industry
- Low cost personal satellite / internet technology empowers seafarers to expose poor conditions
- Technology enabling real-time monitoring of activity on ships is required by key customers to monitor standards

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

DEMANDING HIGHER STANDARDS – SUSTAINABILITY REGULATION

- Ongoing difficulty in recruiting Officer level seafarers puts pressure on the industry
- Branded shipping customers seek to eradicate 'sweatshop ships' - the final frontier of supply chain management
- Growing BRIC middle class demands better social standards

VISION 2040

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

ADOPT LABOUR STANDARDS ACROSS THE SHIPPING INDUSTRY TO IMPROVE SAFETY, SECURITY, LIVING CONDITIONS, WAGES AND REWARD FOR WORKERS

LEGAL STANDARDS
Ratification of the MLC by 95% of member states.

LEGAL STANDARDS
Ratification of the MLC by 100% of member states with clear evidence of enforcement.

LEGAL STANDARDS
Existing standards are robustly enforced by PSC – eliminating non-compliance / 'sweat shop' ships.

SAFETY
Shipping sectors LTI rates reducing by 10% pa from 2012 baseline. Zero fatalities.

SAFETY
Globally agreed accident and near miss reporting formats developed, and used by critical mass of industry leaders.

SAFETY
Global standards for accident and near miss reporting are enshrined in regulation.

SHIP RECYCLING
Industry and regulators apply strong financial, legal and regulatory pressure to ship recyclers to significantly improve 'worst case' performance.

SAFETY
Structures in place for systematic reporting and sharing of accident & near miss data across the industry, to enable better identification of patterns, and design of safe processes and vessels, with >50% participation.

TRAINING
Agreed global minimum standards of training for mariners, ratified by 95% of IMO member states.

> **Zero Accidents.**
>
> (Accident rates in shipping achieve parity with those of land-based industries). The shipping sector's fatality rates are reduced by 90% (over x baseline).

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

EMPLOY BEST PRACTICE IN LEADERSHIP AND EMPLOYEE DEVELOPMENT TO ATTRACT PEOPLE TO SHIPPING CAREERS

EQUALITY
Women represent 2% of the maritime workforce (CURRENT).

TRAINING
Cultural / language support Eco / tech training awareness.

REPRESENTATION
All mariners have access to union representation

EQUALITY
Women represent 30% of the maritime workforce.

LABOUR CONDITIONS
Bullying, harrassment and discrimination are eliminated / managed through actively enforced company policies, with minimum standards set and enforced by the IMO.

LABOUR CONDITIONS
Shipping careers rank equally or higher with shore based industries in terms of
· Satisfaction
· Technology*
· Impact on relationships

TRAINING
High quality training facilities in all areas associated with poor standards of mariner training. 80% of mariners have access to "high quality" training.

TRAINING
Globally recognised competence standards, qualifications and career development paths are adopted by IMO, with minimum standards required across the industry.

LABOUR CONDITIONS
There is equality of opportunity for people wishing to enter the shipping industry, regardless of race, gender, religion etc.

LABOUR CONDITIONS
Greater education of shipping as a career option.

LABOUR CONDITIONS
Mariners pay, benefits and recognition are, as a minimum, equal to those of shore staff.

> Shipping is a recognised career sector and features in rankings of sought-after careers.
>
> Labour conditions are assessed on a level playing field across all segments of the industry (short sea, coastal, deep sea etc.) – no 'hidden horrors'.

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

4 Transparency and accountability drive performance improvements and enable better, sustainable decision making

Increased transparency and visibility of shipping creates more demand for higher standards from beyond the industry

Campaign groups use Google satellite data to prosecute ship operators following pollution incidents

Low cost personal satellite /internet technology empowers mariners with social media 'voice'

Technology enables real time, remote monitoring of almost every aspect of ship performance, crew activity, efficiency, emissions etc

INCREASED SCRUTINY, HIGHER EXPECTATIONS

LATE 2010's   2020's   2030's   OUTCOME 2040's

Asda uses webcams to provide real-time monitoring of conditions in supplier factories. Will this extend to shipping in future?
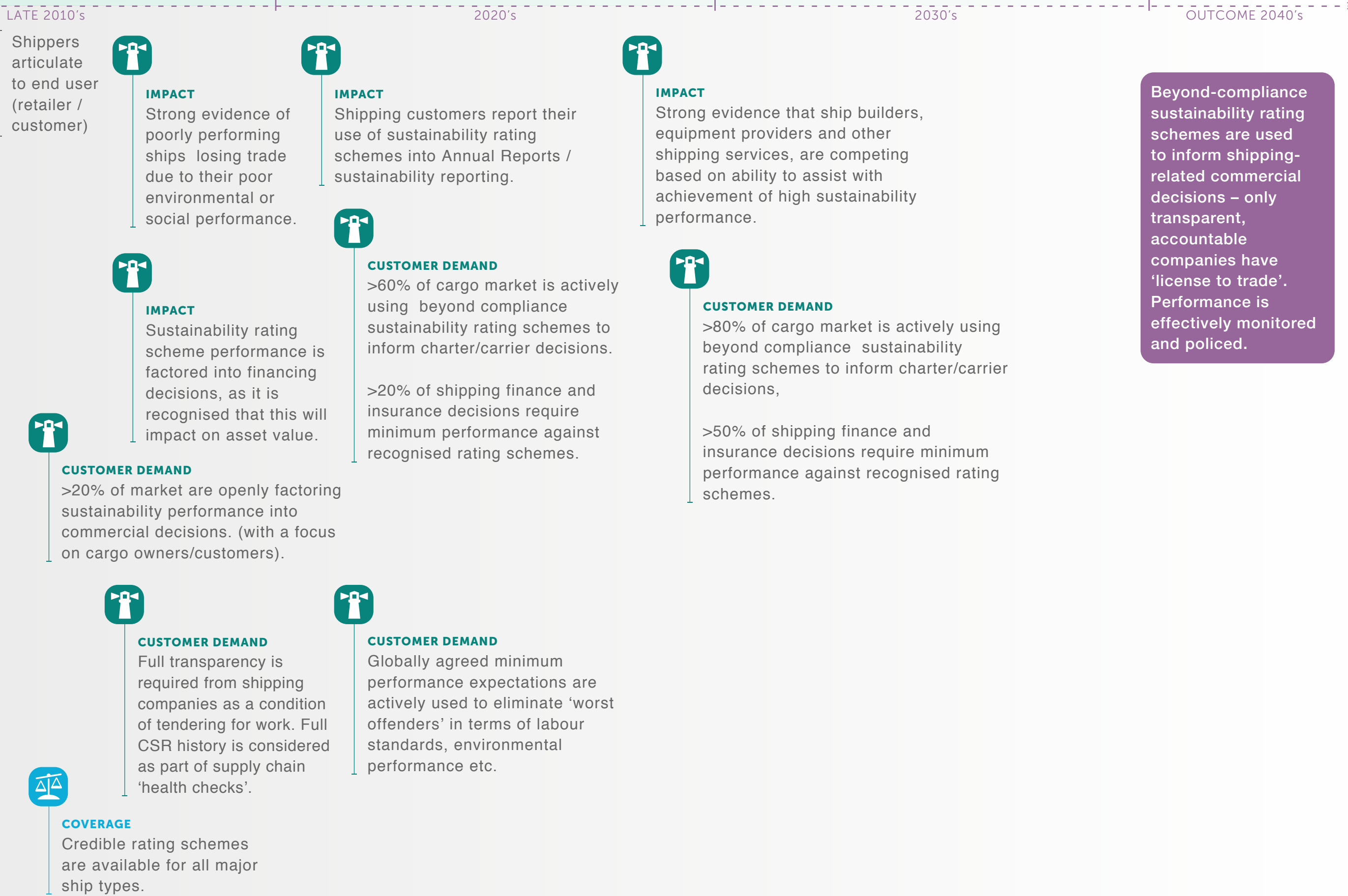
Branded shipping customers begin to focus on Shipping - the final frontier of supply chain management

Growing BRIC/MINT middle class demands better social standards
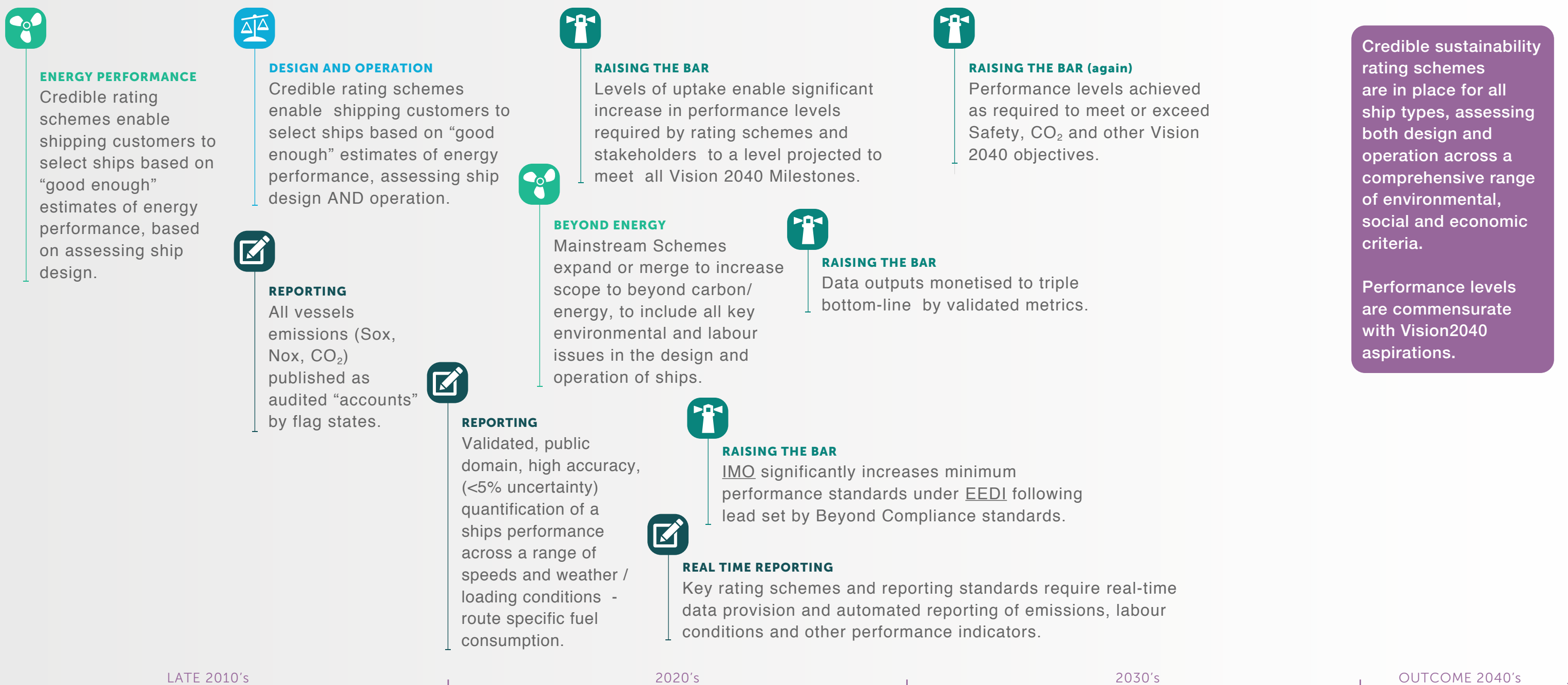
VISION 2040

ENCOURAGE SHIPPING CUSTOMERS TO MAKE SD PERFORMANCE KEY IN SERVICE SELECTION AND AGREED SET OF PERFORMANCE STANDARDS

LATE 2010's   2020's   2030's   OUTCOME 2040's

Shippers articulate to end user (retailer / customer)

IMPACT
Strong evidence of poorly performing ships losing trade due to their poor environmental or social performance.

IMPACT
Shipping customers report their use of sustainability rating schemes into Annual Reports / sustainability reporting.

IMPACT
Strong evidence that ship builders, equipment providers and other shipping services, are competing based on ability to assist with achievement of high sustainability performance.

Beyond-compliance sustainability rating schemes are used to inform shipping-related commercial decisions – only transparent, accountable companies have 'license to trade'. Performance is effectively monitored and policed.

IMPACT
Sustainability rating scheme performance is factored into financing decisions, as it is recognised that this will impact on asset value.

CUSTOMER DEMAND
>60% of cargo market is actively using beyond compliance sustainability rating schemes to inform charter/carrier decisions.

>20% of shipping finance and insurance decisions require minimum performance against recognised rating schemes.

CUSTOMER DEMAND
>80% of cargo market is actively using beyond compliance sustainability rating schemes to inform charter/carrier decisions,

>50% of shipping finance and insurance decisions require minimum performance against recognised rating schemes.

CUSTOMER DEMAND
>20% of market are openly factoring sustainability performance into commercial decisions. (with a focus on cargo owners/customers).

CUSTOMER DEMAND
Full transparency is required from shipping companies as a condition of tendering for work. Full CSR history is considered as part of supply chain 'health checks'.

CUSTOMER DEMAND
Globally agreed minimum performance expectations are actively used to eliminate 'worst offenders' in terms of labour standards, environmental performance etc.

COVERAGE
Credible rating schemes are available for all major ship types.

LATE 2010's   2020's   2030's   OUTCOME 2040's

PIONEER METHODS FOR SHIPPING'S STAKEHOLDERS TO COMPARE SUSTAINABILITY PERFORMANCE & DRIVE IMPROVEMENT

ENERGY PERFORMANCE
Credible rating schemes enable shipping customers to select ships based on "good enough" estimates of energy performance, based on assessing ship design.

DESIGN AND OPERATION
Credible rating schemes enable shipping customers to select ships based on "good enough" estimates of energy performance, assessing ship design AND operation.

RAISING THE BAR
Levels of uptake enable significant increase in performance levels required by rating schemes and stakeholders to a level projected to meet all Vision 2040 Milestones.

RAISING THE BAR (again)
Performance levels achieved as required to meet or exceed Safety, CO$_2$ and other Vision 2040 objectives.

Credible sustainability rating schemes are in place for all ship types, assessing both design and operation across a comprehensive range of environmental, social and economic criteria.

Performance levels are commensurate with Vision2040 aspirations.

BEYOND ENERGY
Mainstream Schemes expand or merge to increase scope to beyond carbon/energy, to include all key environmental and labour issues in the design and operation of ships.

RAISING THE BAR
Data outputs monetised to triple bottom-line by validated metrics.

REPORTING
All vessels emissions (Sox, Nox, CO$_2$) published as audited "accounts" by flag states.

REPORTING
Validated, public domain, high accuracy, (<5% uncertainty) quantification of a ships performance across a range of speeds and weather / loading conditions - route specific fuel consumption.

RAISING THE BAR
IMO significantly increases minimum performance standards under EEDI following lead set by Beyond Compliance standards.

REAL TIME REPORTING
Key rating schemes and reporting standards require real-time data provision and automated reporting of emissions, labour conditions and other performance indicators.

LATE 2010's   2020's   2030's   OUTCOME 2040's

BRIC Brazil, Russia, India, China   **MINT** Mexico, Indonesia, Nigeria, Turkey   **IMO** International Maritime Organisation   **EEDI** Energy Efficiency Design Index

THE CASE FOR ACTION

FREEDOM VS LEVEL PLAYING FIELD – OCEAN GOVERNANCE

Investments in double hull required as 'license to operate' for tankers

ECA Compliance requires investment in NOx and SOx reduction

LATE 2010's · 2020's · 2030's · OUTCOME 2040's

ADVANCING TECHNOLOGY – MAKING IT PAY

New ownership models emerge
· ownership of the vessel and all technical installations
· owner buys and supplies to yard (owner supply)
· ESCO models (energy service company) with suppliers retaining ownership of equipment and guaranteeing lifecycle cost OR performance on spot-test

VISION 2040

LATE 2010's · 2020's · 2030's · OUTCOME 2040's

EXPLORE WAYS TO PUT A FINANCIAL VALUE ON ECOSYSTEM GOODS AND SERVICES AND ENSURE RESPONSIBLE USE AND REDUCE ECOSYSTEM IMPACT

VALUATION TECHNIQUES
Pilot methodologies demonstrate the monetary value (as well as other values) of the services produced by marine ecosystems within a pilot area.

PRACTICAL APPLICATION
Public and political awareness and support is strong due to investment in education, lobbying and capacity-building activities.

GOVERNANCE
Global governance body established for overseeing ecosystem goods and service valuation. (Also see Milestone 2020's in Key Area for Action 1 (governance of the oceans).

VALUATION TECHNIQUES
Agreed global methodology for ecosystem valuation adopted by global governance body.

PRACTICAL APPLICATION
Ecosystem valuations are factored into major MSP negotiations and IMO decisions.

PRACTICAL APPLICATION
Pilot studies identify how the notional "Value" of ecosystems can be incorporated into marine governance systems and real decision making – eg calculation of license fees that reflect the impact a given economic activity has on the marine environment.

GOVERNANCE
Establishment of a credible, global coalition of institutions and organisations to advance natural capital accounting & adoption by IMO.
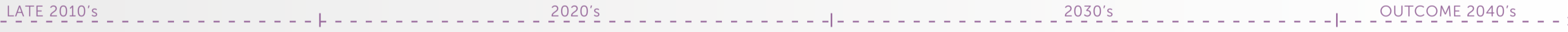
PRACTICAL APPLICATION
Legislative requirement for natural capital valuations to be included in sales price of goods and services.

PRACTICAL APPLICATION
IMO trials the use of Ecosystem valuations in development of regulations.

PRACTICAL APPLICATION
Ecosystem valuation integration into financial contracts.

PRACTICAL APPLICATION
Establish methodology for costing performance of vessels.

Ecosystem valuations are routinely used by key global institutions in decisions affecting maritime regulation and ocean planning (MSP). There is clear evidence that ecosystem valuations have a material impact on decisions.

LATE 2010's · 2020's · 2030's · OUTCOME 2040's

DEVELOP PREFERENTIAL ACCESS TO CAPITAL AND INSURANCE THAT REWARDS HIGH SUSTAINABILITY PERFORMANCE

FEEDBACK
Lessons learned from ecosystem valuation are fed back into the design process to minimise ecosystem costs.

SPLIT INCENTIVES
Financial models such as SAYS overcome the main Split Incentives that prevent investment in energy saving technology.

Better data → better valuation → financial rewards for eco performance

RATING SCHEMES - MAINSTREAMING
Sustainability rating scheme performance (is factored into financing decisions for >20% of new and used ship purchases.

Flag registries (eg: Liberia) move / play a role in finance to exploit their interest / need for quality tonnage

RATING SCHEMES - TRIALS
Pioneering banks are factoring Sustainability Rating Scheme performance (eg under EEDI, Rightship, Green Award etc) is factored into financing decisions, as it is recognised that this will impact on asset value (see 'Transparency and Accountability Drive Performance' Key Area for Action).

Adoption of a voluntary pricing scheme – eg: Gold Standard.

LATE 2010's · 2020's · 2030's · OUTCOME 2040's

6 Change to a diverse range of energy sources, using resources more efficiently and responsibly, and dramatically reducing greenhouse gas intensity

ADAPTING TO CLIMATE CHANGE

Reduce CO$_2$ to 1990 levels to prevent runaway Climate Change

Arctic sea passages 'open for business'

IPCC predict significant increase in extreme weather

IPCC predict significant impact on coastal infrastructure due to CC.

2050 Arctic completely ice free during the summer

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

MOVING ON FROM OIL – THE FUTURE OF ENERGY

Oil price spike + downturn hits shipping.

Increasing reliance on 'hard to reach' oil reserves and shale gas.

Likely date of 3rd generation biofuel wide availability to shipping.

Predicted date of depletion of US shale gas reserves.

80% reduction in CO$_2$ emissions required (by 2050) to prevent runaway climate change.

VISION 2040

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

PIONEER / IMPLEMENT AGGRESSIVE IMPROVEMENTS IN ENERGY EFFICIENCY IN NEW SHIP DESIGNS, RETROFITS AND OPERATIONS.

REGULATORY MILESTONE
IMO implements CO$_2$ reduction plan towards UNFCCC warming target.

OPERATIONAL MILESTONE
Coalition of global ports adopt Virtual Arrival-type arrangements.

OPERATIONAL MILESTONE
Slow steaming, weather routing and other key operational practices are used on majority of voyages.

INDUSTRY MILESTONE
Sustained 20% reduction in CO$_2$ per tonne/mile from 2012 levels.

INDUSTRY MILESTONE
Cold ironing for new vessels 2025.

OPERATIONAL MILESTONE
Cold Ironing and virtual arrival used in all major ports.

INDUSTRY MILESTONE
Average 50-70% reduction in CO$_2$ per tonne/mile from 2012 levels.

OPERATIONAL MILESTONE
Un/Low-manned vessels focus on operational efficiency.

Global shipping fleet achieves 80-90% CO$_2$ per tonne/mile from 2012 levels.
(UCL)

OPERATIONAL MILESTONE
Digital monitoring and advanced power management; used as standard in all new ships?

INFLUENCING FACTOR
Panama canal extension enables more efficient, larger shipments on new routes.

INFLUENCING FACTOR
IMO requires 10% improvement in EEDI – this is insufficient.

INFLUENCING FACTOR
2025: 90% of pre 2010 ships have been decommissioned.

INFLUENCING FACTOR
Rapid Prototyping (advanced CFD and Model Based Systems engineering) enables development of new technologies at lower cost and greater certainty, significantly advancing progress of prototypes to sea trial, through 2020, to full maturity in 2030

INFLUENCING FACTOR
New ship building materials/composites dramatically reduce weight and ballast requirements – up to 20% reduction in fuel use.

INFLUENCING FACTOR
Polar ice cap melting has resulted in shorter transport routes between Europe and Asia.

Unified regulation, ONE voice (EU/IMO/ Global).

INDUSTRY MILESTONE
The '80% ship' is launched.

INFLUENCING FACTOR
Global fleet doubles to 200,000 ships.

TECHNOLOGY
New materials means ships are 50% lighter weight than in 2010, improving efficiency by 5% per tonne/km of cargo. Options of power/assist modules.

TECHNOLOGY
New build ships 100% recyclable.

INFLUENCING FACTOR
New technologies currently take around 10-15yrs to achieve market penetration. Average rate of improvement in energy efficiency of new ships is <10% per decade.

AVERAGE 25-30% REDUCTION IN CO2 EMISSIONS PER TONNE/KM REQUIRED, EVERY DECADE TO 2040

ACTIVELY SEEK RENEWABLE AND OTHER ENERGY SOURCES TO ENCOURAGE A STEP-CHANGE IN ENERGY PORTFOLIO TO ACHIEVE SIGNIFICANTLY REDUCED CO$_2$ INTENSITY.

(WORK IN PARTNERSHIP TO SHARE RISKS AND BENEFITS OF SUSTAINABLE INNOVATION AND TECHNOLOGY).

BIOFUEL
IMO produces guidelines for biofuel.

INDUSTRY MILESTONE
MARPOL low sulphur regulation and SECAs promote fuel switch (rather than scrubbers).

BATTERIES/ELECTRIC
Electric hybrid propulsion for large ships enabled by 50% drop in battery cost (per kWh) by 2025. Enables on-shore charging, and energy harvesting and recovery, estimated 8-15% efficiency gain.

FUEL CELLS
Piloting of fuel cells running on hydrogen, providing auxiliary power (hydrogen produced on land – or by offshore wind - using renewable electricity).

NUCLEAR?
Nuclear is an unlikely solution before 2040 due to lack of public acceptance. Thorium based systems may emerge, elliminating waste problems?

Shipping is becoming de-carbonised and uses a diverse range of fuels including renewables and possibly nuclear.

BIOFUEL TRANSITION
Transition plan in place to enable transition from methanol/ethanol from coal/natural gas, to bio-methanol and bio-ethanol.

LNG
LNG use in deep sea ships well established.

ALT FUEL TRIALS
Many experimental projects for ship propulsion have materialized by 2030, using wind /solar / wave energy.

BIOFUEL
Commercial pilots of biodiesel, methanol, ethanol, DME and biogas by a number of operators.

BIOFUEL
Sustainable biofuel used for marine engines + fuel cells on gas/methanol begin to be used for auxiliary engines.

BIOFUEL
Biofuel widely available and used in deep sea sector.

WASTE TO ENERGY
Waste heat and waste materials are all recycled as energy on-ship.

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

ENGAGE OUR PARTNERS TO ACHIEVE MAJOR SUPPLY CHAIN EFFICIENCY GAINS

PERVERSE TRADING
Key mechanisms of 'perverse trading' (eg when commodities are shipped in opposing directions) are mapped and cost to the global economy is understood.

TRANSPARENCY
Carbon pricing is used to inform procurement processes and logistics design.

INDUSTRY MILESTONE
The practice of ships / containers returning empty from a voyage is phased out (WBCSD).

INDUSTRY MILESTONE
Elimination of "in ballast" phase. More efficient positioning of cargo / ship (DHL model).

Large, super-efficient, fully integrated supply chains are operating throughout the industry, supported by widespread sharing of resources and information.

COLLABORATION
Multi-modal collaboration is optimised

WHOLE SYSTEM APPROACH TO LOGISTICS
Finished goods are consumed primarily by domestic market – facilitate by 3rd party licenses for manufacture reducing import/export cross over.

TRANSPARENCY AND COLLABORATION
Multi-modal reporting processes are in place and used by leading organisations, enabling transparency through the supply chain.

WHOLE SYSTEM APPROACH TO LOGISTICS
Modal shift from air to sea transport as cargo owners seek dramatic CO$_2$ reduction.

AUTOMATION
New terminal facilities applying automated cargo handling and terminal equipment.

TRANSPARENCY
Mainstream use of sustainability Rating schemes in procurement processes.

TRANSPARENCY AND COLLABORATION
Optimisation of supply chain and 3rd party supplier licensing.

PERVERSE TRADING
Business/trading models to avoid 'perverse trading' are developed and trialled.

PERVERSE TRADING
Business/trading models to avoid 'perverse trading' are used as standard.

TRANSPARENCY AND COLLABORATION
"Big Data" is used to optimise supply chains including reverse-logistics.

WHOLE SYSTEM APPROACH TO LOGISTICS
Metal ores and other high-waste content commodities are increasingly processed at source to reduce transport of 'waste' material.

Shipping – Adoption of carbon markets? Factored into all decision making – carbon accounting. Systematic / voluntary / throughout logistics chain.

LATE 2010's | 2020's | 2030's | OUTCOME 2040's

IPCC Intergovernmental Panel on Climate Change **CC** Climate Change **EEDI** Energy Efficiency Design Index **SEEMP** Ship Energy Efficiency Management Plan
SECA Sulphur Emission Control Area **DME** DiMethyl Ether **IMO** International Maritime Organisation **EU** European Union
WBCSD World Business Council for Sustainable Development