PIANC
The World Association for Waterborne Transport Infrastructure

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

MARINA ADAPTATIONS TO NEW PROPULSION SYSTEMS

PIANC DESIGN GUIDELINES AND APPROACH TO CLIMATE MITIGATION AND ADAPTATION

Prepared by
Esteban L. Biondi
Chairman of PIANC Recreational Navigation Commission
Principal, Applied Technology & Management / Geosyntec Consultants, Inc.

Presented by

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

Contents

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

Working Group 217

Ian Dobson, Chairman

MARINA DESIGN GUIDELINES FOR NEW VESSEL PROPULSION SYSTEMS

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

Recreational Vessel New Propulsion Fuel Trends

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

Drop-in Fuels

- Replace fossil fuels in existing internal combustion engines
- Emission performance highly dependent on source
- Transitional solution
- Efficient carbon reduction when used for hybrid vessels
- For all traditional boats

Electric – Liquid Fuel Hybrid

- Dual energy source
- Optimized performance and autonomy compared to full-electric
- Battery charging installations and liquid fuel supply facilities
- Available design solutions for vessels 10 to 24m in the market today

Electric Propulsion

- Full electric engine systems are available in the market
- Battery technology restricts autonomy and performance
- Battery charging facilities increase marina power demand
- Slow and fast-charging strategies
- Practical solutions available for small boats (under 11m)

Hydrogen

- Internal combustion and fuel cell engine solutions
- Safety and supply installation challenges
- Emission performance highly dependent on source
- Advanced R&D for superyacht propulsion
- No commercial systems available for recreational vessels*

Methanol

- Replace fossil fuels with reduced engine and storage adaptations
- Liquid with safe and convenient handing requirements
- Emission performance highly dependent on source
- Potential superyacht propulsion*

Available Short-Term Solutions Design Conditions

Future-proofing considerations

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

Preliminary Approach to Future Proofing Marinas

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

A decarbonized recreational boating future will evolve from a set of technologies and fuels already available.

Some technologies are more adequate for some vessel sizes, uses, ambient conditions, etc. in the short and long-term.

A mix of propulsion systems is envisioned, so flexibility for marina facilities is required.

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

Potential Path Forward for Marinas

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

Drop-in Fuels

- Replace fossil fuel diesel by low- or no-emission alternative liquid fuels.
- Big variation in GHG performance!
- Fuel standards / certification of engine compatibility.

Electric – Liquid Fuel Hybrid

- Vessels between 12m and 30m can be efficiently powered by hybrid plug-in technology.
- Use no emission drop-in fuels in Hybrid systems to minimize GHG emissions.

Electric Propulsion

- Most vessels 12m or under could be fully electric.
- Full electric technology still has some limitations on autonomy and performance.

Hydrogen

- Hydrogen powered vessels (superyachts) are presently rare and evolution is uncertain.

Methanol

- Methanol powered yachts are in research and development stages, but there is progress in non-recreational marine uses.

Marinas should start adapting now to serve these vessels

Future adaptations should be considered

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

New Marina Utilities Design Approaches

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

Conventional Fossil Fuels

- Fuel storage demand calculation assumed that all vessels consume fossil fuel (petrol and diesel).
- Fuel demand based on use patterns, marina capacity, expected refill in high-season, etc.
- Conventional calculation may result in a baseline estimate for fuel installation cost.

Drop-in Fuels

- Fossil fuel may be replaced totally or partially by “drop-in” liquid fuel(s).
- **Additional storage capacity and piping flexibility** for multiple liquid fuel types.
- **Adjust demand calculations** based on fuel efficiency.
- Maximum flexibility comes at a cost.

Power Supply for Batteries

- New **energy demand calculation** for battery charging.
- **Usage patterns** may differ due to autonomy limitations.
- **Slow-charging at berth** demand calculation, added to the traditional power demand at pedestals (baseline).
- **Fast-charging stations** require especial considerations (power demand, “fuel dock” space, cost, etc).
- New approaches to service charges

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

Other Considerations

Planning and Development

- New vs Retrofit
- When and how to adapt
- Evolving role and sizing of fuel docks
- Fuel storage and handling safety considerations

Operational

- Fire prevention and marina safety
- Support for vessel safety services

Electrical Design

- Use of vessel batteries as energy storage
- Enhanced marina onsite energy generation
- Overall energy demand and grid limitations
- Electrical service platforms and new pricing structures

Investment

- Carbon accounting (Scope 3 emission)
- Carbon credits, embodied carbon of new construction
- Sustainability metrics

There are other layers of analysis

Working Group 217 Outline (DRAFT)

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

2 ALTERNATIVE FUELS AND RECREATIONAL BOATING

2.1 TRENDS IN ALTERNATIVE PROPULSION SYSTEMS

2.2 DROP-IN FUELS

2.3 ELECTRIC

- 2.3.1 Existing Technology
- 2.3.2 Commercially Available Vessels

2.4 HYDROGEN

- 2.4.1 Technology
- 2.4.2 Vessels
- 2.4.3 Marina Implications

2.5 OTHERS

3 ELECTRIC PROPULSION AND MARINA FACILITIES

3.1 NEW DEMANDS AND OPPORTUNITIES FOR MARINAS

3.2 CHARGING TYPES CHARACTERISTICS

- 3.2.1 Slow charging
- 3.2.2 Mid charging
- 3.2.3 Fast charging

3.3 DEMAND LOADING

- 3.3.1 Energy Demand
- 3.3.2 Equipment Installation Power Demand
- 3.3.3 Load Shedding

3.4 MARINA ELECTRICAL INFRASTRUCTURE AND EQUIPMENT

- 3.4.1 Grid Availability
- 3.4.2 Onsite Generation & Storage
- 3.4.3 Pedestal Outlets
- 3.4.4 Charging Stations
- 3.4.5 Adaption of Existing Fuel Systems

3.5 TECHNICAL REQUIREMENTS

- 3.5.1 Codes and Standards

3.6 MARINA PLANNING

3.7 SYSTEMIC ISSUES

3.8 CONSIDERATIONS FOR CARBON ACCOUNTING

4 DROP-IN FUELS AND MARINA FACILITIES

4.1 MULTIPLE LIQUID FUEL TYPES

4.2 STORAGE CAPACITY EVALUATIONS

4.3 INFRASTRUCTURE AND EQUIPMENT

4.4 TECHNICAL REQUIREMENTS

- 4.4.1 Codes and Standards

4.5 MARINA PLANNING

4.6 CONSIDERATIONS FOR CARBON ACCOUNTING

5 MARINA MANAGEMENT

5.1 SPECIALIST TRAINING

5.2 FIRE RISK

5.3 FINANCIAL MANAGEMENT

6 CASE STUDIES

APPR Associação Portuguesa de Portos de Recreio

ICOMIA International Council of Marine Industry Associations

Working Group 217 Path Forward

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

- Receive input from vessel designers, manufacturers, and industry associations to complete the assessment of trends.
- Collaborate with ICOMIA to incorporate marina requirements that emerge from Ricardo Study and other research.
- Refine structure and content.
- Define Case Studies.
- Complete the report technical sections.

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

Other Related PIANC Working Groups

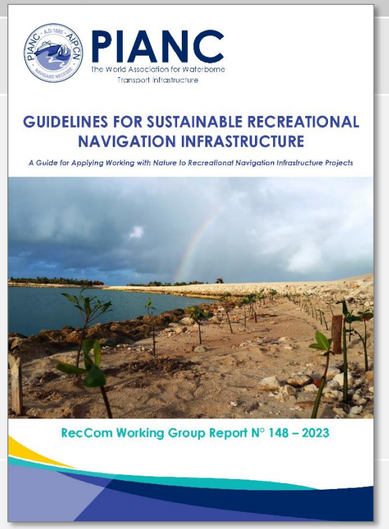
PIANC ENHANCED SUSTAINABILITY CONTEXT

Recent and Upcoming PIANC Sustainability Reports

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

WG	PIANC EnviCom General applcation to ports and waterways
136	Sustainable Maritime Navigation
150	Sustainable Ports – A Guide for Port Authorities
174	Sustainability Reporting for Ports (in progress)
176	Guide for Applying Working With Nature to Navigation Infrastructure
195	An Introduction to Applying Ecosystem Services for Waterborne Transport Infrastructure Projects
214	Beneficial Sediment Use
178	Climate Change Adaptation for Maritime and Inland Port and Navigation
188	Carbon Management for Ports

WG	PIANC RecCom Specific to marinas
148	Guidelines for Sustainable Recreational Navigation Infrastructure
149	Guidelines for Marina Design (Part 3)
244	Climate Change Adaptation Planning for Marinas and Boat Harbours
245	Carbon Management for Marinas and Boat Harbours
217	**Impacts of Alternative Fuel Propulsion Systems for Recreational Vessels on Marina Design**



APPR Associação Portuguesa de Portos de Recreio

ICOMIA International Council of Marine Industry Associations

Ongoing Working Groups on Climate Change

WG	RecCom Working Group Name	
217	THE IMPACTS OF ALTERNATIVE FUEL PROPULSION SYSTEMS FOR RECREATIONAL VESSELS ON MARINA DESIGN AND MANAGEMENT	MARINAS SUPPORT BOATING INDUSTRY GHG EMISSION REDUCTIONS
244	CLIMATE CHANGE ADAPTATION PLANNING FOR MARINAS AND BOAT HARBOURS	PHYSICAL IMPACT OF CLIMATE CHANGE, RISK MANAGEMENT, RETROFITING, TCFD
245	CARBON MANAGEMENT FOR MARINAS AND BOAT HARBOURS	COMPREHENSIVE GHG ACCOUTING, GHG MANAGEMENT, MITIGATION CREDITS, TCFD

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

Sustainability Frameworks and our Role Interpreting and Implementing them

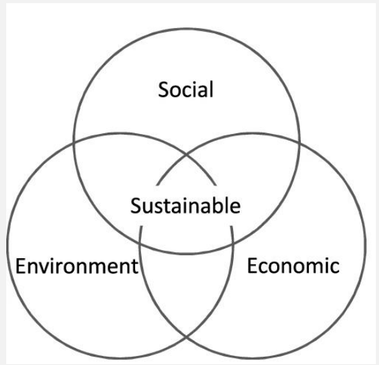
FITTING INTO GENERAL SUSTAINABILITY DRIVERS

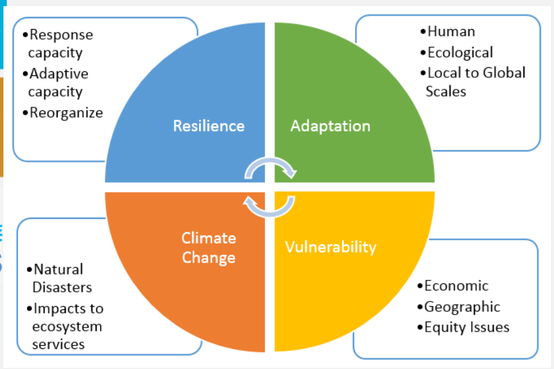
APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

Multiple Layers and Dimensions of Sustainability

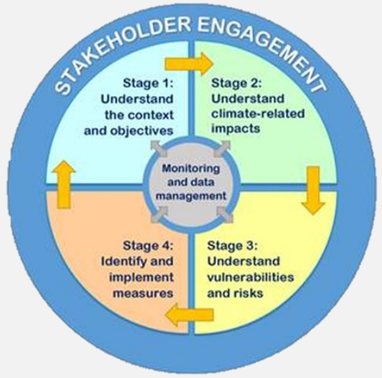
- Three (or four) Pillars
- SDG - UN Sustainable Development Goals
- Taxonomy
- ESG
- Climate Adaptation
- Climate Mitigation (Carbon emission reductions)
- TCFD
- Resilience
- Engineering with Nature
- Building with Nature
- PIANC Working with Nature





TCFD

TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES



EcoShape
building with nature

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

Sustainability Frameworks and Technical Guidance

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

From General to Particular, we can interpret and implement frameworks

Underlying Principles — **Three (4) Pillars**

- Economic
- Environmental
- Social
- Governance

Broad Frameworks — **UN SDG** → Goals

Financial Frameworks — **ESG** **TCFD** →

TCFD
TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

Technical Guidance →

PIANC
The World Association for Waterborne Transport Infrastructure

- **Environment Technical Commission**
- **Permanent Task Group on Climate Change**
- **Working with Nature Initiative**

ICOMIA
International Council of Marine Industry Associations

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

Sustainability Frameworks Impact us

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

Broad and Financial Sustainability and Climate Frameworks provide an analytical structure and metrics.

Top-Down Frameworks are used by governments to develop regulations and incentive programs.

Financing for marina will be influenced by frameworks like ESG, TCFD.

Technical people in the marina industry (owners, investors, operators, designers, etc.) have no influence in the development of the frameworks.

Our industry international associations and develop industry-specific guidance to interpret those frameworks for our industry.

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations

FINAL THOUGHTS

Marina Guidelines fit into a larger system

ICOMIA 2023
WORLD MARINA CONFERENCE
VILAMOURA - PORTUGAL

From Particular to General, our guidelines should fit into top-down drivers

- Marina Design Guideline for new propulsion systems in recreational vessels
- Rethinking marina planning approaches, to best adapt to new recreational boating patterns
- Embracing sustainability and climate change mitigation and adaptation needs
- Provide industry-specific interpretations and implementation recommendations for top-down frameworks

APPR
Associação Portuguesa de Portos de Recreio

ICOMIA
International Council of Marine Industry Associations