IMDC

International Marine and Dredging Consultants (IMDC) is an engineering and consultancy company specialized in a vast range of water related projects. Our highly qualified staff offers advice based on recent research results of leading universities and research institutes and hands-on experience acquired throughout the years.

One of IMDC's core activities is presented in this product sheet: Monitoring & Modelling for Marine Renewables projects

More information can be found on our website www.imdc.be

Monitoring & Modelling for Marine Renewables projects

Monitoring & Modelling are a crucial aspect in understanding the marine environment and related processes, in which **marine renewable energy devices (wave and tidal energy & floating solar)** are operating. Availability of sufficient qualitative data sets for critical parameters is a key element in tackling design, operational and optimisation challenges for marine renewable energy production.

Marine monitoring services for renewable energy

With this in mind IMDC developed marine monitoring and modelling services to support its clients in their marine renewable projects:

- **Desktop studies** - Leveraging existing knowledge and allocating monitoring plans and budgets efficiently.
- **Environmental surveys** - Including hydrodynamic, geomorphological and ecological effects.
- **Monitoring plans & permitting support** - Tailored strategies and guidance through regulatory processes.
- **MetOcean campaigns** – Long term site conditions datasets capturing seasonal effects and extreme conditions.
- **Sediment dynamics monitoring** – Assessing morphological seabed changes, sediment transport and turbidity effects.
- Data processing, validation and interpretation.
- Turbine design optimization, wake effects and energy production prediction via **Computational fluid Dynamics (CFD) modelling** (OpenFoam, Ansys).
- **Mooring and anchor design** and modelling predictions
- Visualization and data analysis via **SYNAPPS**, our in-house developed web-based platform.

IMDC provides assistance to integrate renewable energy technologies responsibly and efficiently into the marine environment, with a focus on sustainability and compliance.

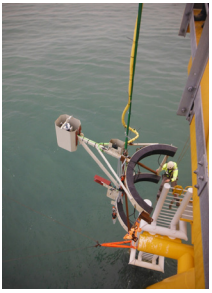
Monitoring services

IMDC develops and applies flexible and targeted monitoring strategies focusing on hydrodynamic, geomorphologic as well as environmental aspects.

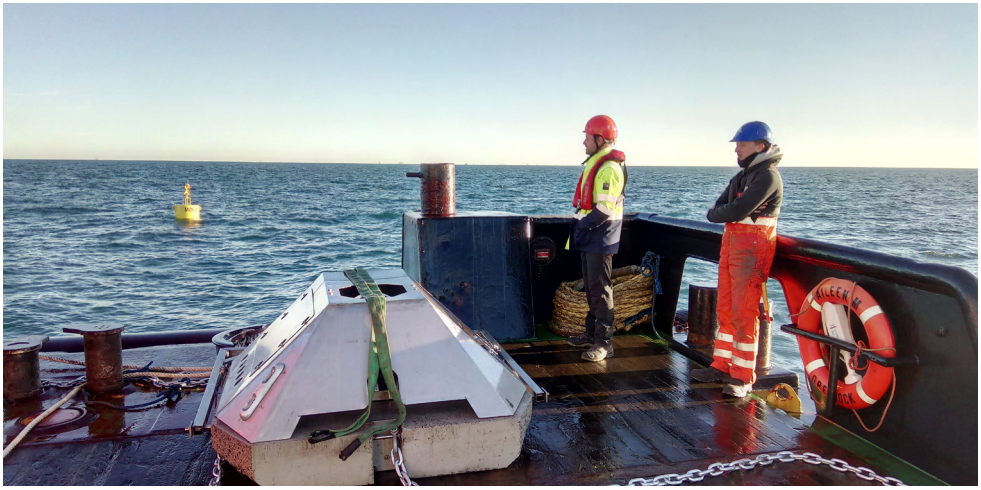
- **Mobile Acoustic Doppler Current Profilers (ADCP) measurements**: predefined patterns around installations to detect wake effects and flow & current velocities changes in the tidal cycle.
- **Stationary metocean measurements** through buoys or seabed frames: equipped with a tailor-made sensor suite for long-term wave, sediment and current monitoring.
- **Environmental Impact monitoring**: Comparative measurements of key metocean and environmental parameters between Baseline and Post-installation cases.
- **Sediment transport measurements** and bathymetric surveys to visualize morphological changes, scour effects and sediment in/outflux.
- **Environmental DNA (eDNA)** monitoring enables cost-effective, non-invasive monitoring of biodiversity, helping assess environmental impacts and support regulatory compliance throughout project development and operation.

IMDC owns and operates a versatile multi-brand collection of monitoring devices that can be deployed during our monitoring campaign such as:

- Acoustic current profilers and point meters, wave sensors, optical and acoustic turbidity sensors, SiltProfiler, multiparameter probes, LISST-200x, mud density profilers, samplers, etc.



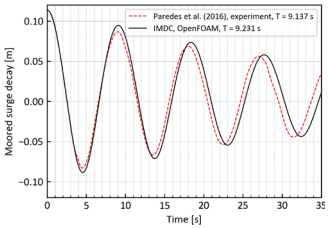
Instrumentation & technical capacity

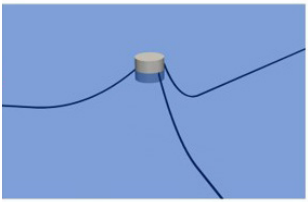


Data analysis and modelling

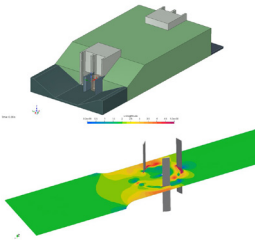
IMDC has built up a vast experience in analyzing acquired measurement data, applying these datasets for validation of numerical models and visualizing effects. Field-collected datasets can be applied by IMDC' experts to validate tailor-made **CFD modelling for marine renewable energy applications**:

- **Turbulence and Design optimization** simulates water-structure interactions, air-water interfaces, and sediment transport and settlement, this is essential for assessing fatigue, vibrations and structural integrity.
- **Sediment transport modelling** predicts sediment movement and impact on components like cables or anchors, affecting performance and increasing maintenance costs. Understanding sediment dynamics helps in optimal siting and design of devices to minimize these risks.
- **Fish Impact risks** assess the impact on fish behavior, migration, and habitat use, analyzing collision and noise-related risks, and recommending mitigation measures to support marine biodiversity conservation.
- **Large scale (wave and tidal) farm layout** assesses wake effects and interaction studies, impact of marine infrastructures in wave and current velocities baseline conditions.
- **Machine Learning combined with CFD models** optimizes turbine control strategies, predict performance, and reduce computational cost.
- **Physical Model Tests** aim to experimentally evaluate the device performance, hydrodynamic behavior and environmental interactions under controlled conditions to validate numerical models and optimize design parameters.

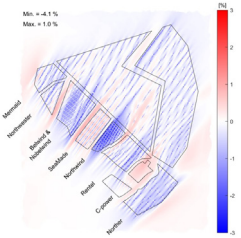




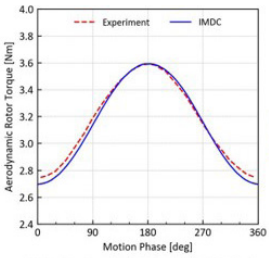
Validation of surge motion or a moored floating cylinder

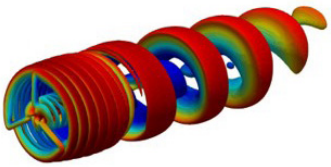


Modelling for vertical axis water turbine (courtesy of Water2Energy)



Analysis of the impact of WTGs foundations in current velocities patterns (Alemi et al., 2025)





Validation of vortical structures generated by a rotor employing Actuator Line Method (ALM)

Key references

Offshore for Sure

Country: North Sea
Year: 2023-2026
Client: nterreg Vlaanderen - Nederland

Renewable energy from the sea is set to experience a major boom in the coming years. Fifteen partners joined forces in the OFFSHORE FOR SURE (OfS) project, funded by the Interreg Flanders-Netherlands program 2021-201, to test and demonstrate 5 promising energy solutions including wave energy by Dutch Wave Power (DWP) and tidal energy by Water2Energy (W2E). Within this project, IMDC provided consultancy and engineering in the field of CFD modelling and environmental services, by supporting DWP (Dutch Wave Power) and W2E (Water2Energy) with turbines optimization via CFD modelling and physical model tests, project implementation and derisking, environmental impact assessments, installation methodologies and other services. IMDC has also provide consultancy and engineering services during the deployment of a pilot project for Ocean of Energy (floating solar concept) for the anchoring design.

Sustainable Development Goals

Multi-use offshore energy ETF

Country: Belgium
Year: 2023-2026
Client: Federal Public Services Economy, SMEs, Middle Classes, and Energy

IMDC, in collaboration with UGent, VUB, and Sirris, was awarded an R&D project funded by the Belgian Federal Ministry of Economy through the 2022 Energy Transition Fund. The Multi-(Re)Use project delivered a comprehensive feasibility study—technical, economic, environmental, and legal—on the reuse of offshore wind monopile foundations as a multifunctional end-of-life strategy.

The study aimed to expand knowledge on hybrid reuse concepts by exploring the integration of alternative energy technologies such as wave energy converters (WEC), tidal energy converters (TEC), and floating solar panels. These were assessed in combination with energy storage systems and aquaculture components, offering innovative pathways to extend the lifecycle and functionality of offshore infrastructure.

Sustainable Development Goals

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A hybrid Wave Energy Converter for Ports (WEC4Ports)

Country: Belgium
Year: 2020-2023
Client: Agentschap Innoveren & Ondememen

The WEC4Ports project aimed at the development of a novel hybrid technology to be integrated in port breakwaters to harvest ocean wave energy. During the project the key components and subsystems of the hybrid energy device - e.g. the turbines - were built and tested for demonstration in real ocean environment at Mutriku testing site in Spain, after being experimentally and numerically designed and optimised.

Sustainable Development Goals

Sustainable Energy at Sea Ports

Country: Portugal
Year: 2017-2019
Client: Agentschap Innoveren & Ondememen

The main goal of the SE@PORTS project was to assess existing Wave Energy Converters on their suitability to be integrated in port infrastructure. Despite the large number of WEC concepts developed to date and the advances in the state-of-the-art of conventional methods, research and development efforts are still required to make these appropriate for implementation in port infrastructure. In collaboration with other partners IMDC developed a new system by combining the main current principles in wave energy harnessing, aimed at overcoming the individual limitations of each technology, while presenting a breakthrough and efficient approach to harness wave energy in sea port breakwaters

Sustainable Development Goals

Innovation HKN

Country: The Netherlands
Year: 2020-2020
Client: Engie

Support to ENGIE-EDPR for the concept development of an innovative floating solar panel installation in an offshore windfarm. IMDC assessed the required mooring and anchoring set-up and made an estimate of the available area for floating solar panels. Furthermore, IMDC assessed the impact it had on the environment, how this would/could affect the permit requirements, and how this could be monitored.

Sustainable Development Goals