

Why Saint-Nazaire?

- SEM-REV grid-connected test site area for multiple WEC technologies.
- Large harbour and offshore ecosystem.
- Marine in. Ideal MRE development.
- Hosting specific Wave Energy Converters (WECs).

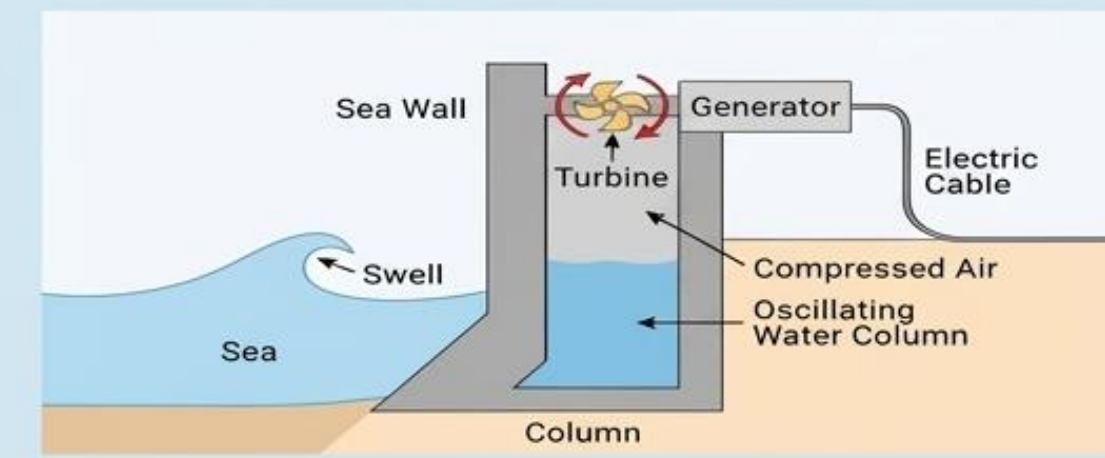
SAINT-NAZAIRE WAVE RESOURCE?

- Significant wave height $H_s > 1$ m for 177 days/year
- Average wave power ≈ 12 kW/m
- Tidal currents up to 2.5 m/s in the estuary
- Tidal range > 5 m (macrotidal)



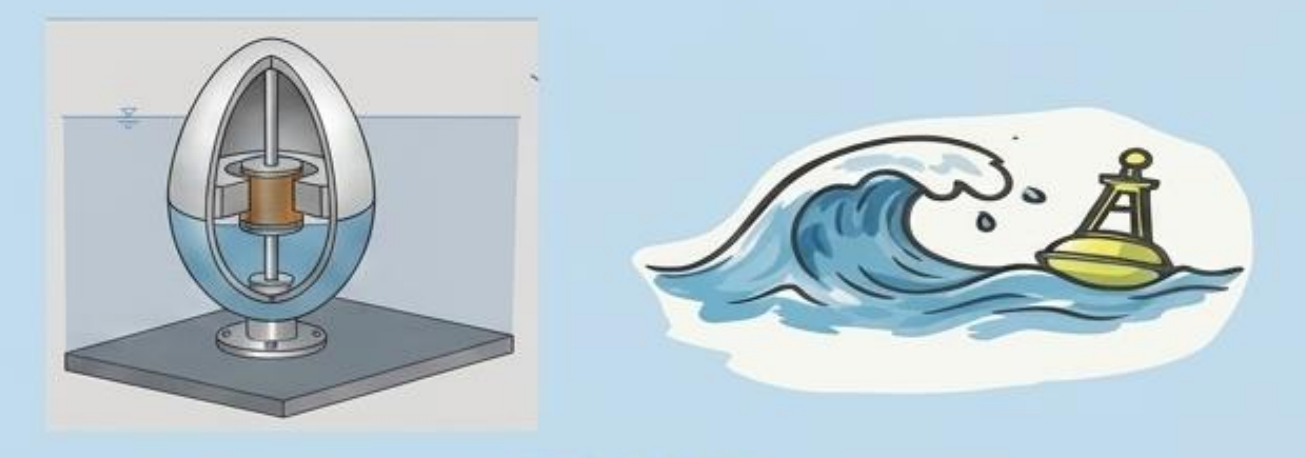
- **SEM-REV**— Grid-connected test site for marine renewables (MR).
- **Wave resource:** $H_s > 1$ m for 177 days/year; average power ≈ 12 kW/m
- **Tidal currents:** up to 2.5 m/s in the estuary
- **Ecosystem** – Large harbour, 480 MW offshore wind farm, and a network of local subcontractors.

Tested WEC Technologies



OWC (OSCILLATING WATER COLUMN)

- **PRINCIPLE:** Wave energy moves an internal water column, compressing and expanding air to spin a Wells turbine.
- **REALIZATION:** Plexiglas chamber, coaxial propeller.
- **MEASUREMENTS:**
 - Max voltage: 3.50 V
 - Electric power: 0.63 W
 - Pneumatic input power: 8.7 W
 - Efficiency $\sim 10\%$



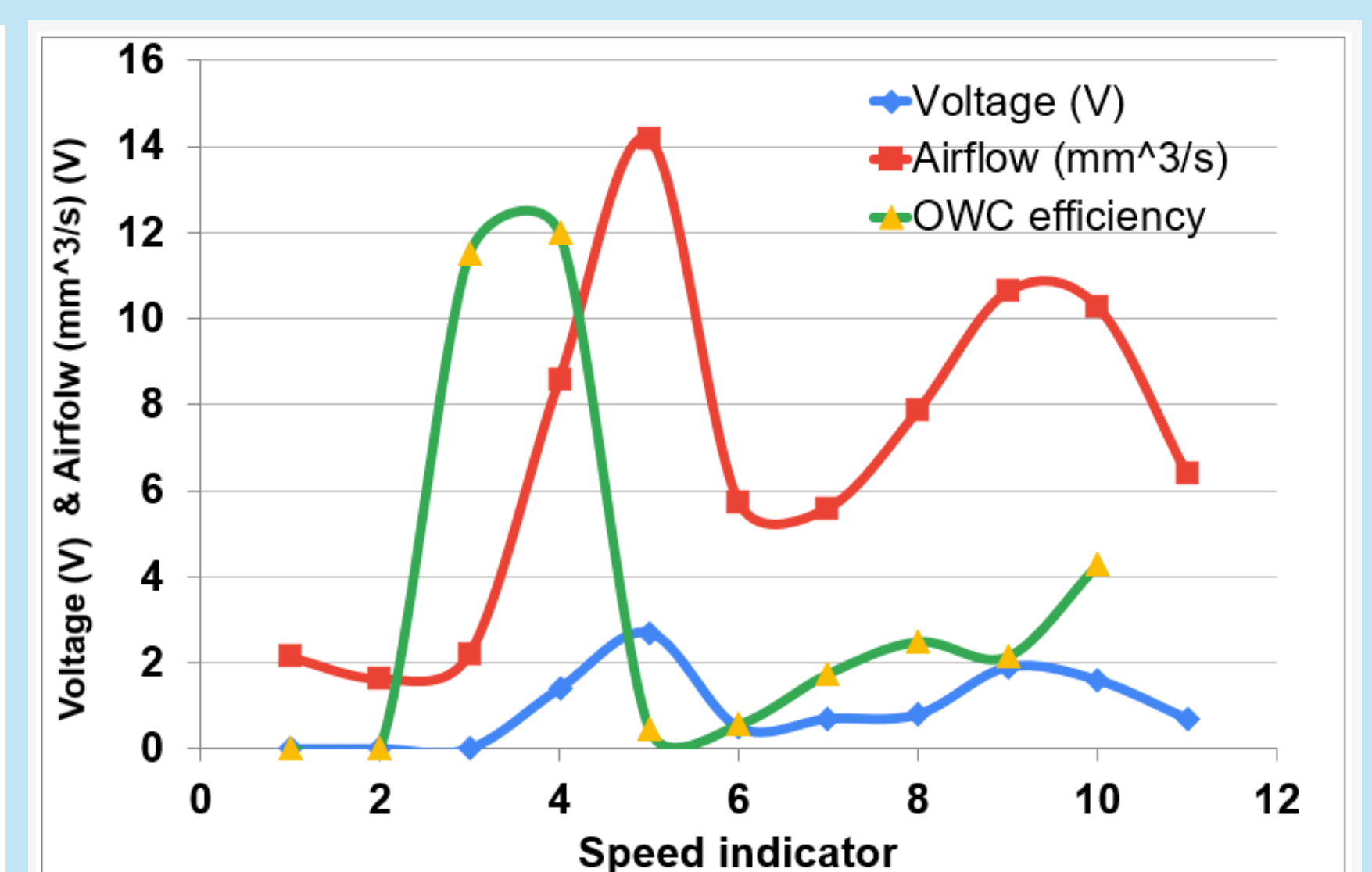
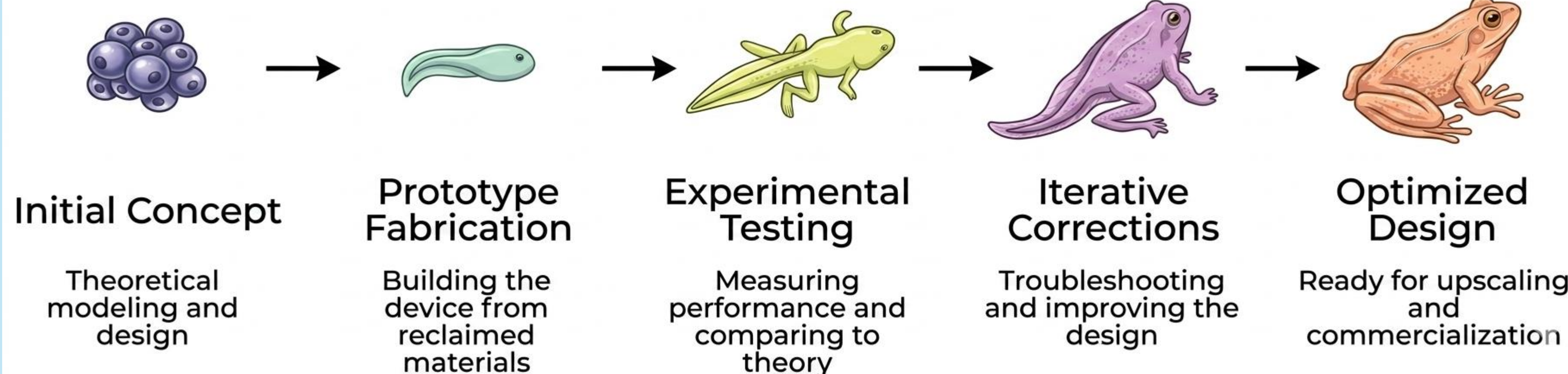
BUOY (POINT ABSORBER)

- **PRINCIPLE:** The buoy's vertical movement with waves moves a magnet through a coil (Faraday's Law), generating current.
- **REALIZATION:** Bottle float, linear generator.
- **MEASUREMENTS:**
 - Measured voltage: 0.64 V
 - Sealing validated (full immersion)

Comparing MRE Technologies for Saint-Nazaire

	FLOATING WIND (Haliade-X)	WAVE ENERGY BUOY	TIDAL STREAM
RESOURCE	HIGH	MEDIUM TO HIGH	LOW
PRODUCTION	HIGH	MEDIUM	LOW
MATURITY	★★★★★ HIGH	★☆☆☆ LOW	★☆☆☆ LOW
INSTALLATION	COMPLEX	SIMPLE	VERY COMPLEX
MAINTENANCE	DIFFICULT	MODERATE	DIFFICULT
ENVIRONMENTAL IMPACT	MEDIUM	LOW	MEDIUM TO HIGH
SITE SUITABILITY	EXCELLENT	GOOD	POOR
COST (CAPEX / LCOE)	HIGH	EXTREMELY HIGH	GIGANTIC

Prototype Development & Modelling



Conclusion & Perspectives

CONCLUSIONS

- Experimental validation of both concepts using reclaimed materials.
- 95% theory-experiment agreement for wave generation.
- Measurable electricity production.

PERSPECTIVES

- Short term: improve OWC sealing (industrial gaskets) + add rectifier on buoy.
- Medium term: 1-5 kW demonstrator in Saint-Nazaire basin, then connection to SEM-REV.
- Long term: multi-MW wave farm on the Loire Atlantic coast.