

# OFFSHORE RENEWABLE ENERGY IN BRAZIL

**Milad Shadman, D.Sc.**

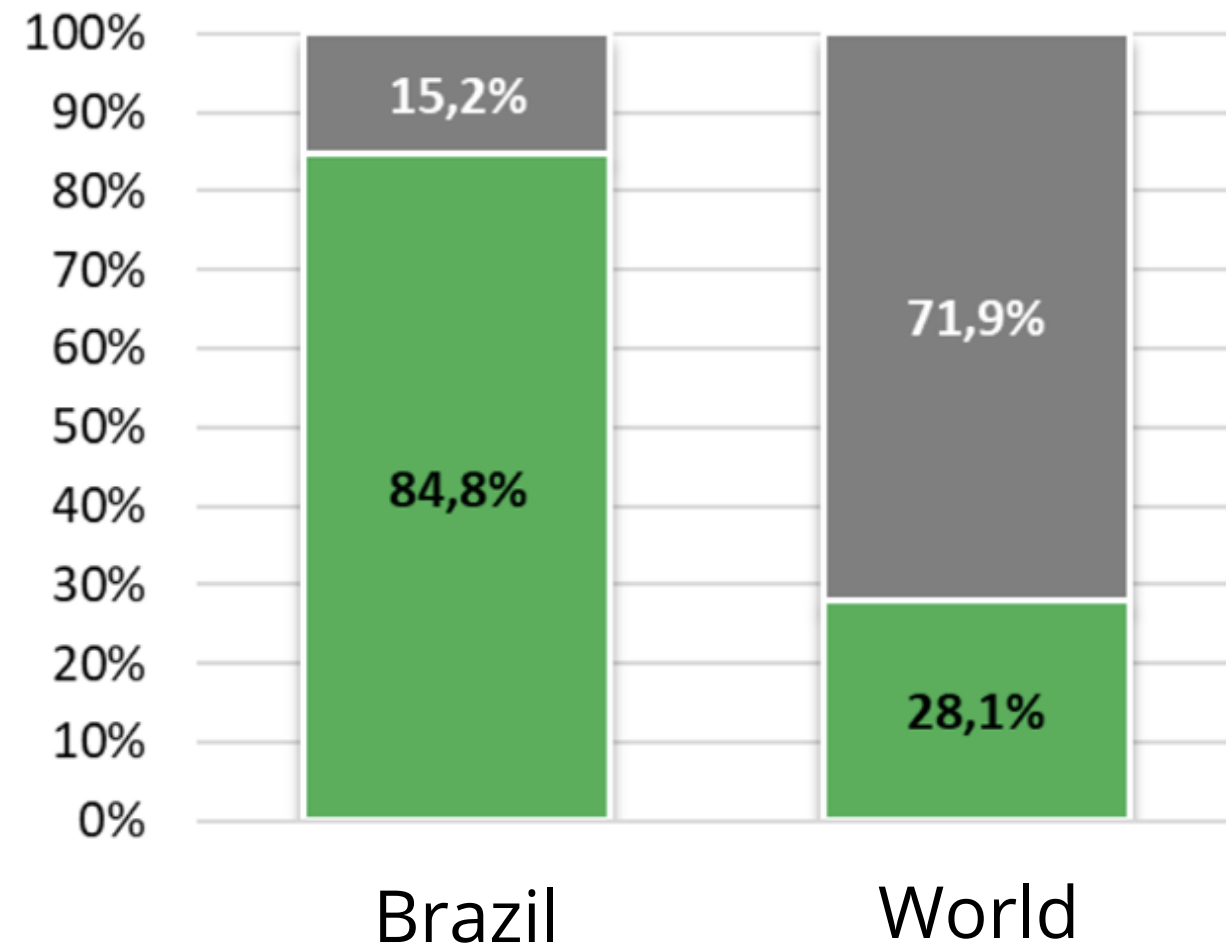
**Professor - Offshore Renewable Energy Systems**

**Ocean Engineering Program - COPPE**

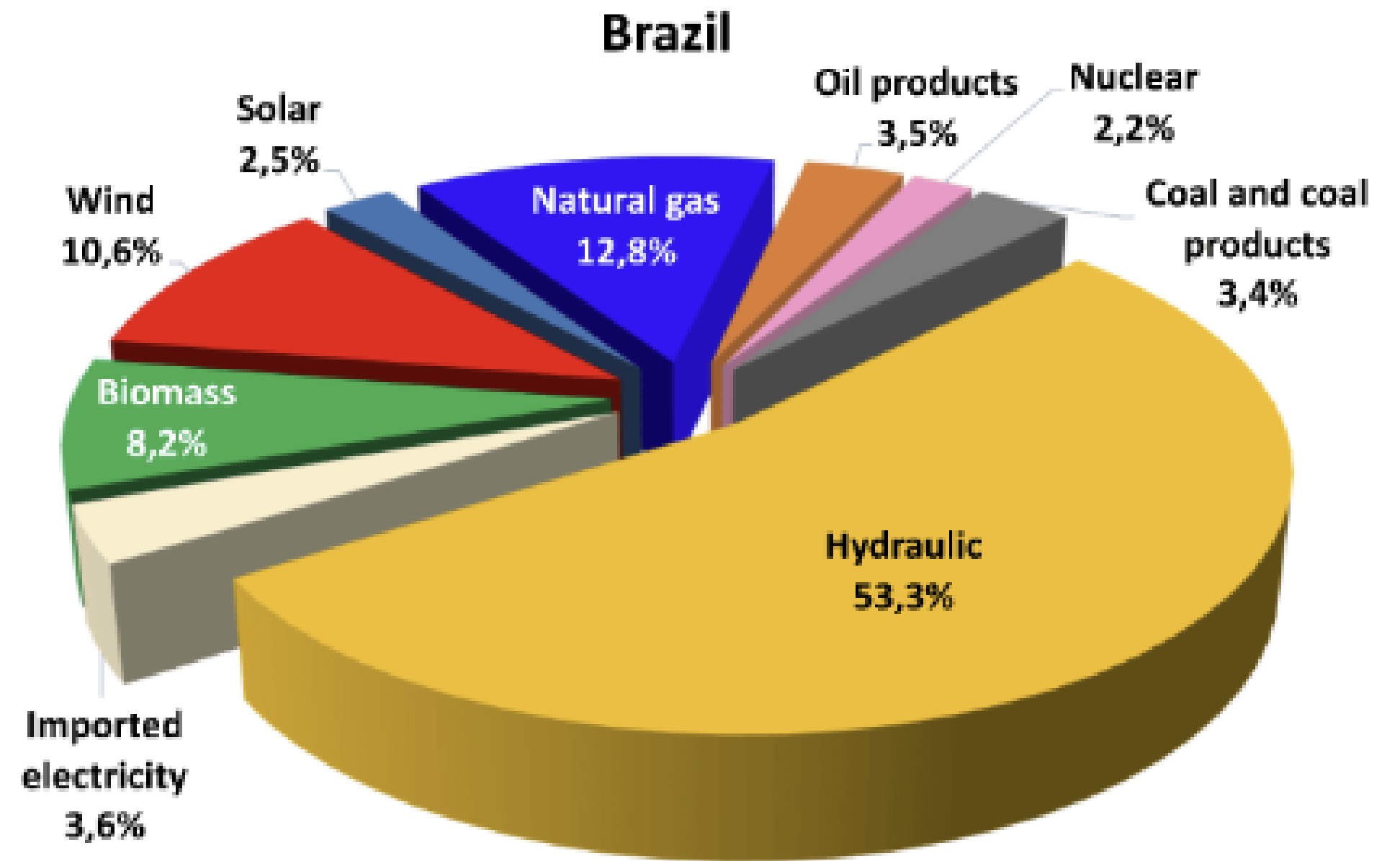
**Federal University of Rio de Janeiro**



# Brazilian Electricity Matrix

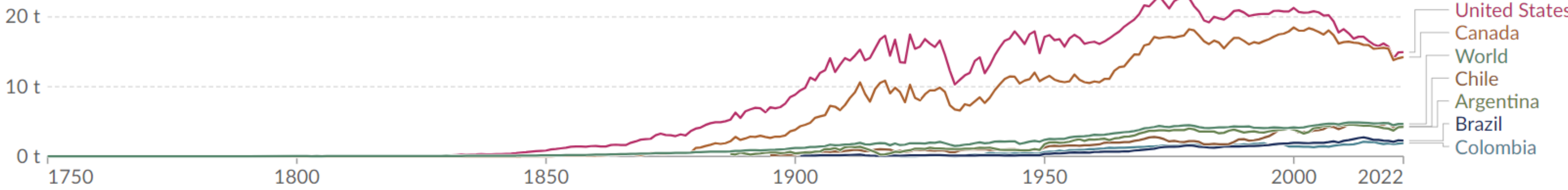
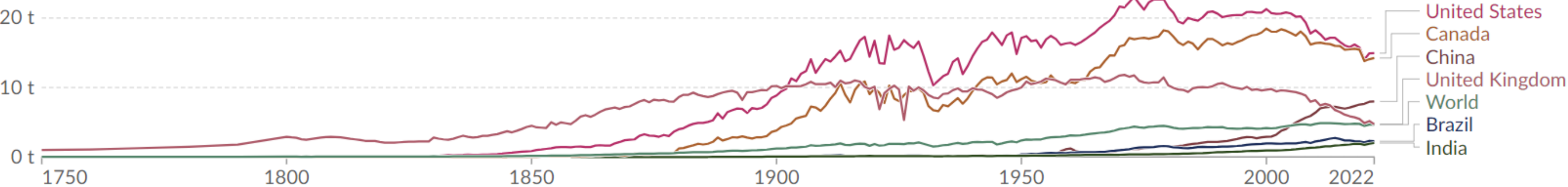


- Non-renewable
- Renewable



Brazilian Energy Office (EPE) - 2022

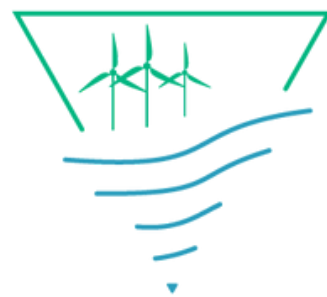
# CO<sub>2</sub> emissions per capita from fossil fuels and industry



# Universities



UFRJ



**GERO**

GRUPO DE ENERGIA RENOVÁVEL  
NO OCEANO



**UFSC**



Universidade de São Paulo  
Agência USP de Inovação



**UFRN**



UNIVERSIDADE FEDERAL  
DO RIO GRANDE DO SUL

# Institutions

Ministry of Science and Technology



INSTITUTO NACIONAL DE CIÊNCIA E TECNOLOGIA  
ENERGIAS OCEÂNICAS E FLUVIAIS



INSTITUTO NACIONAL  
DE PESQUISAS OCEÂNICAS

# Financing mechanisms

TRL 1-4

TRL 4-8

TRL 7-9

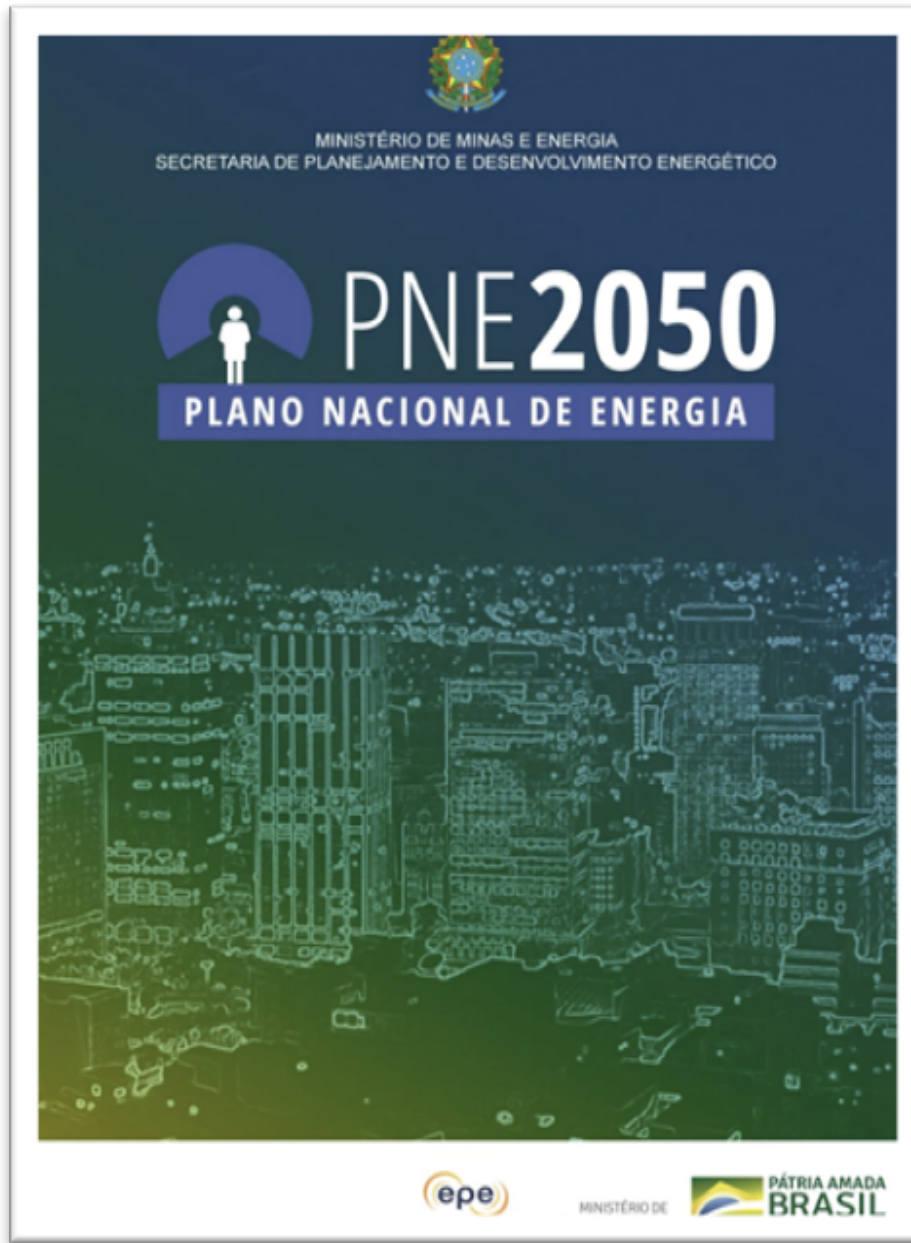


LAW n° 9.478/1997

obligates the oil and gas companies to invest 1% of their annual gross revenue in R&D projects







2020

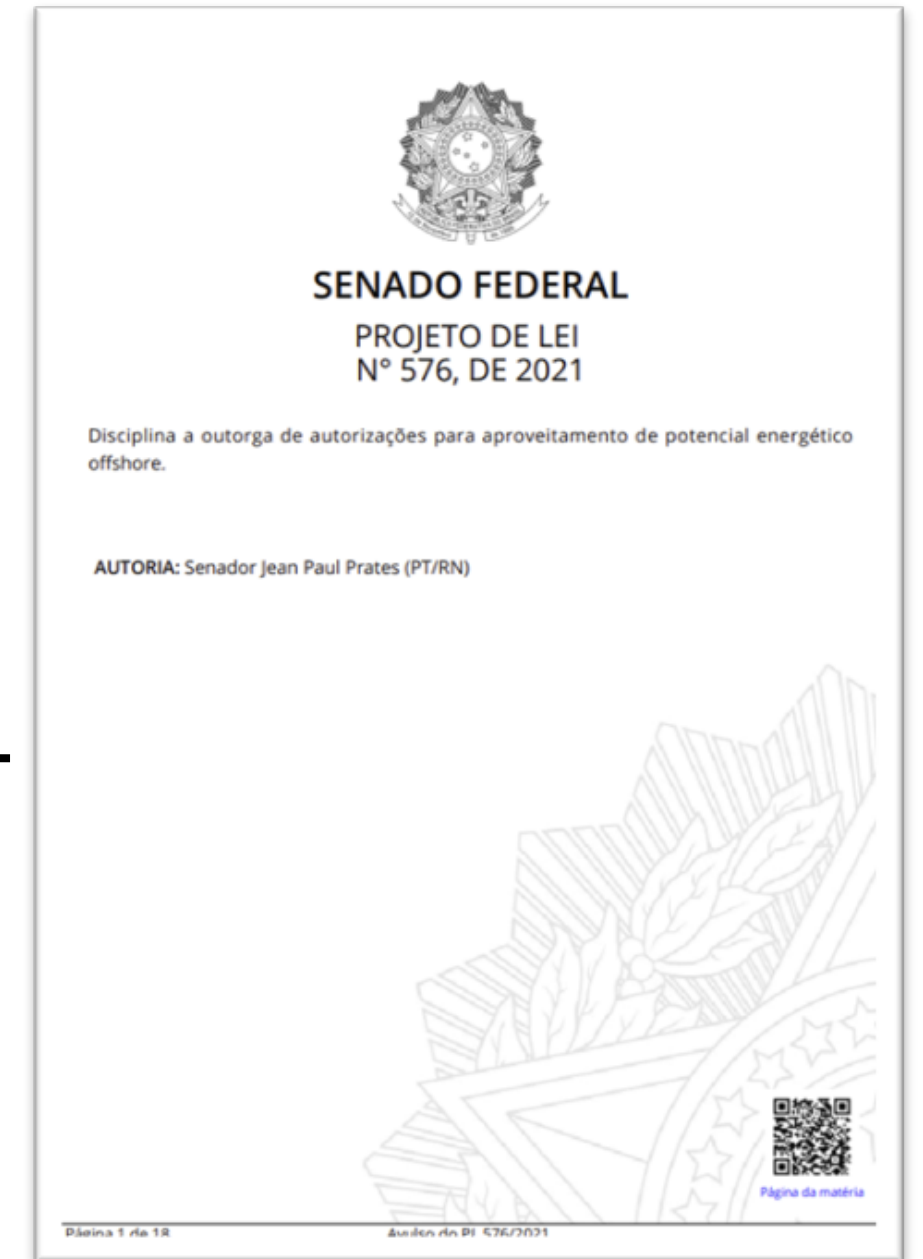
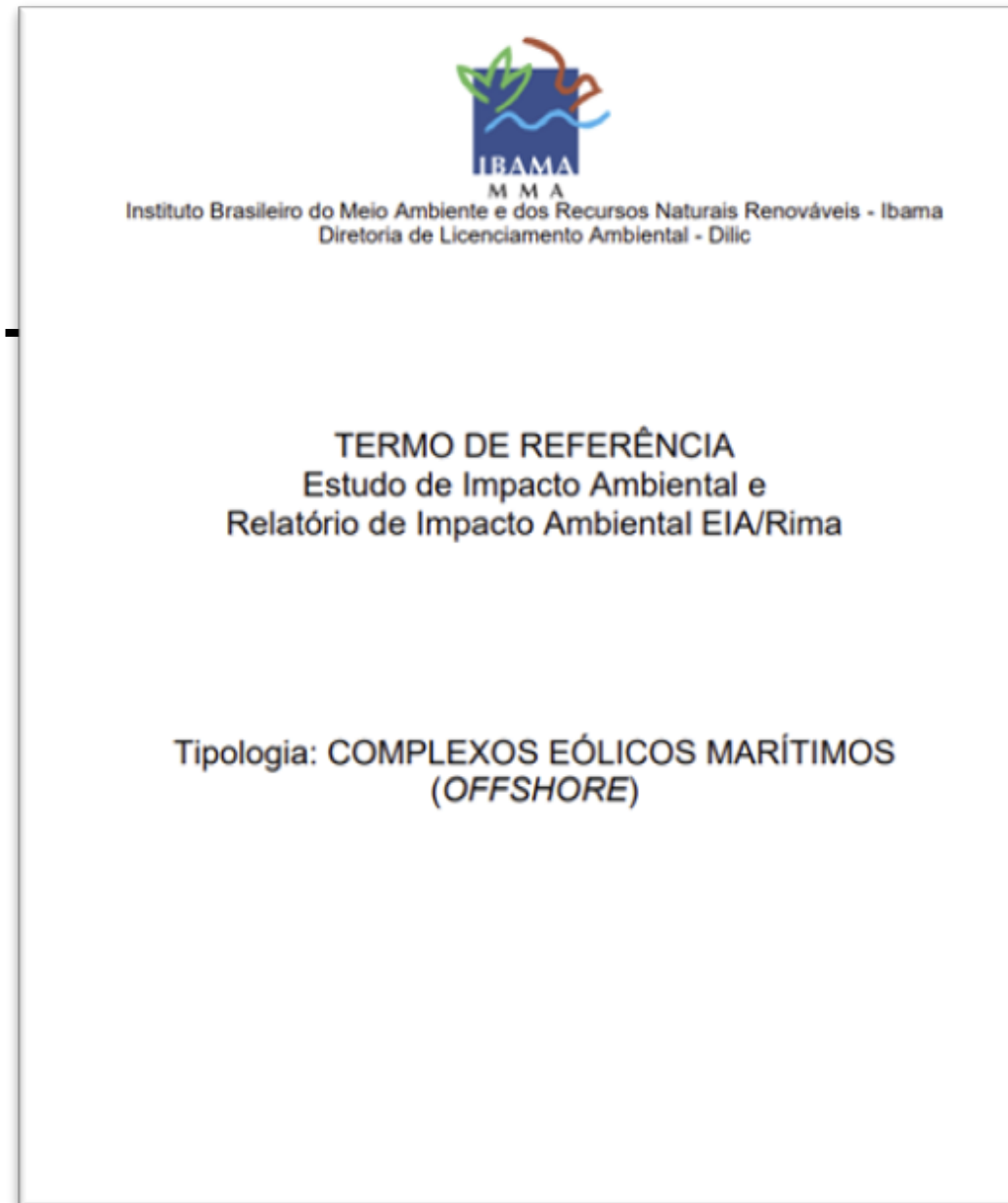
National Energy Plan 2050  
Ministry of Mines and Energy (MME)

Disruptive Technologies - 2050:  
Wave, Ocean and Tidal Current, OTEC

TOR for Environmental Impact of  
Offshore Wind Farms 2020

Brazilian Institute of Environment and  
Renewable Natural Resources (IBAMA)

2020

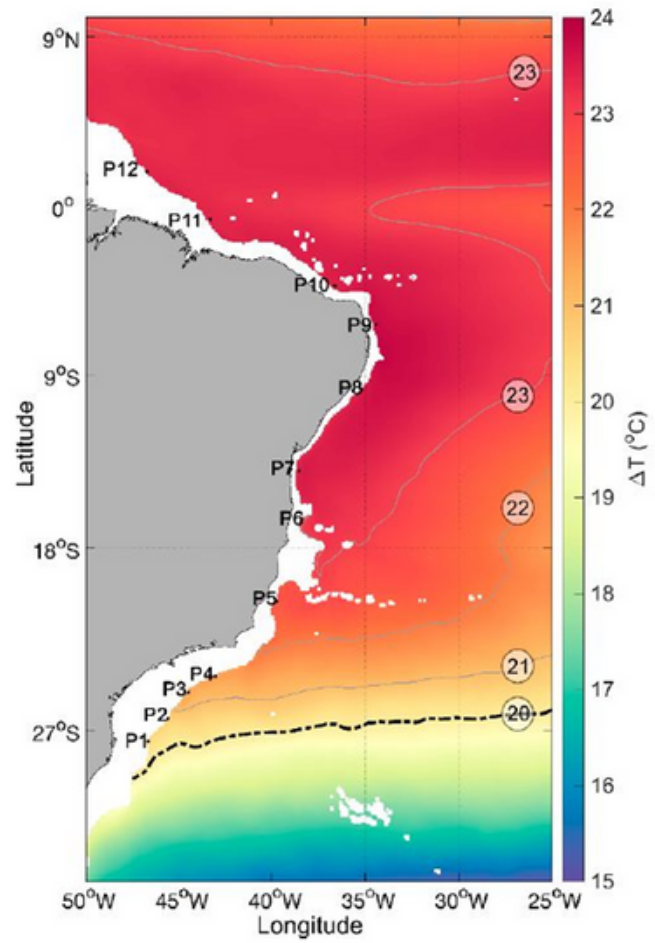


2021 - present

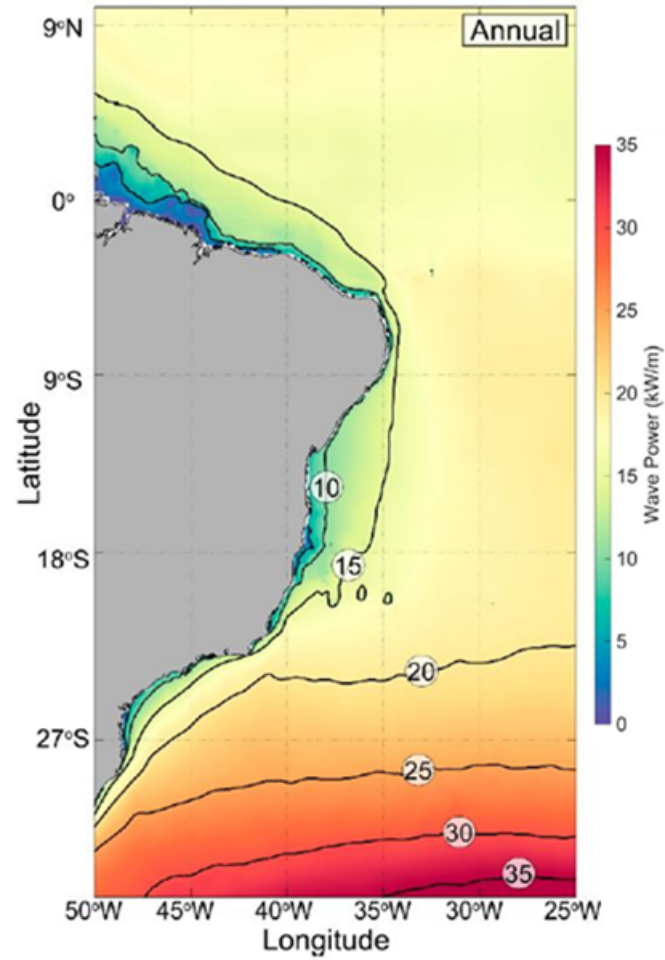
A **Bill** to regulate the authorization for  
the generation from offshore renewable  
sources



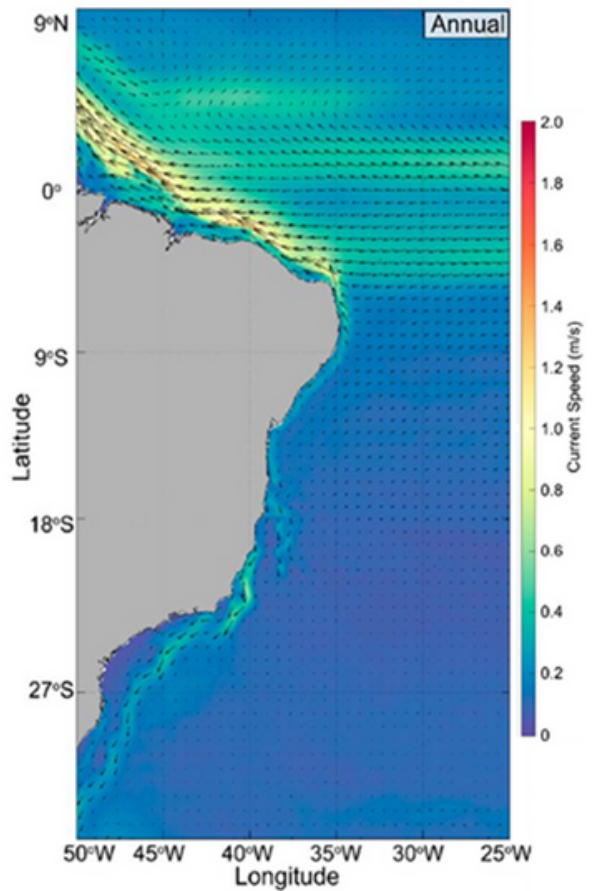
# Thermal gradient



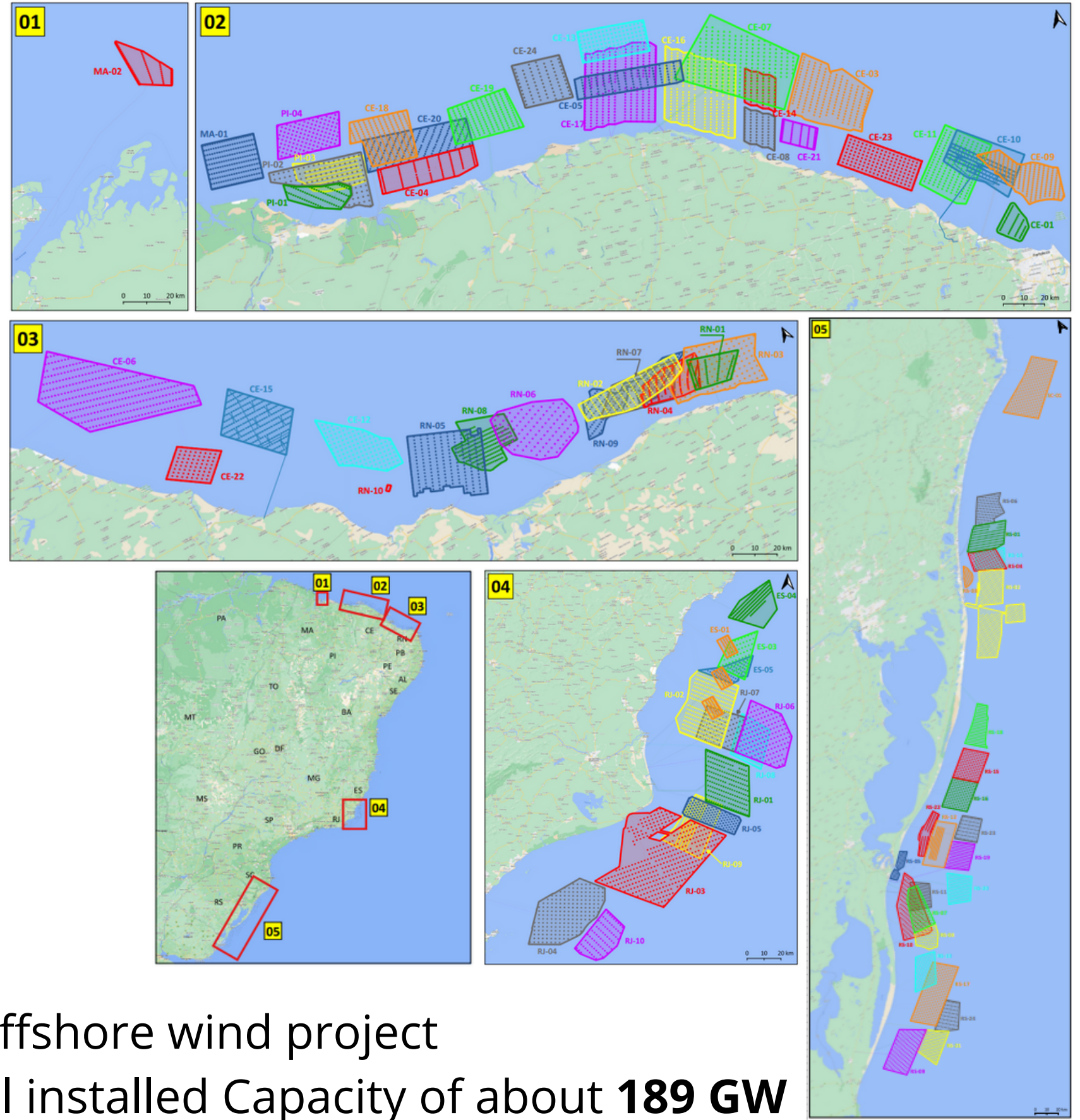
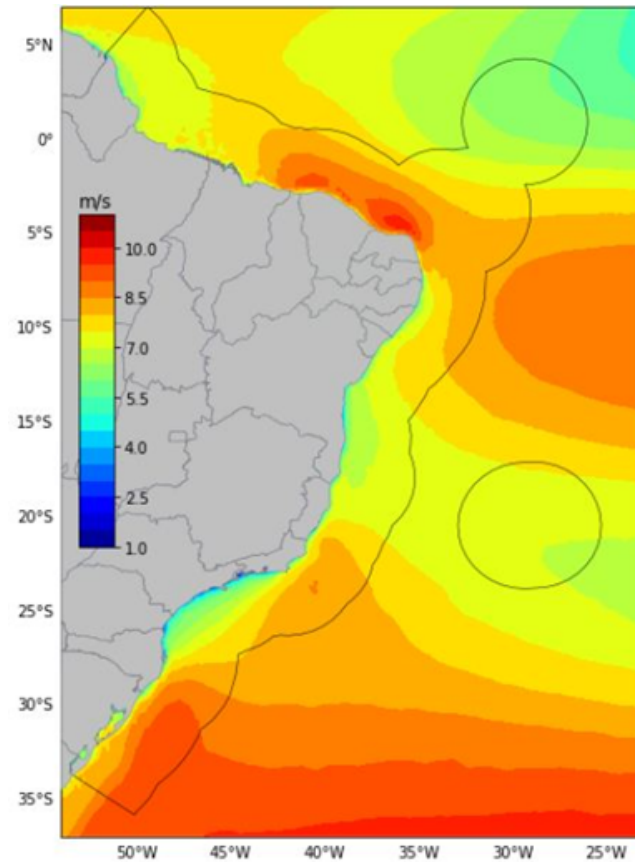
# Wave energy



# Current energy



# Offshore wind



**78** offshore wind project  
Total installed Capacity of about **189 GW**

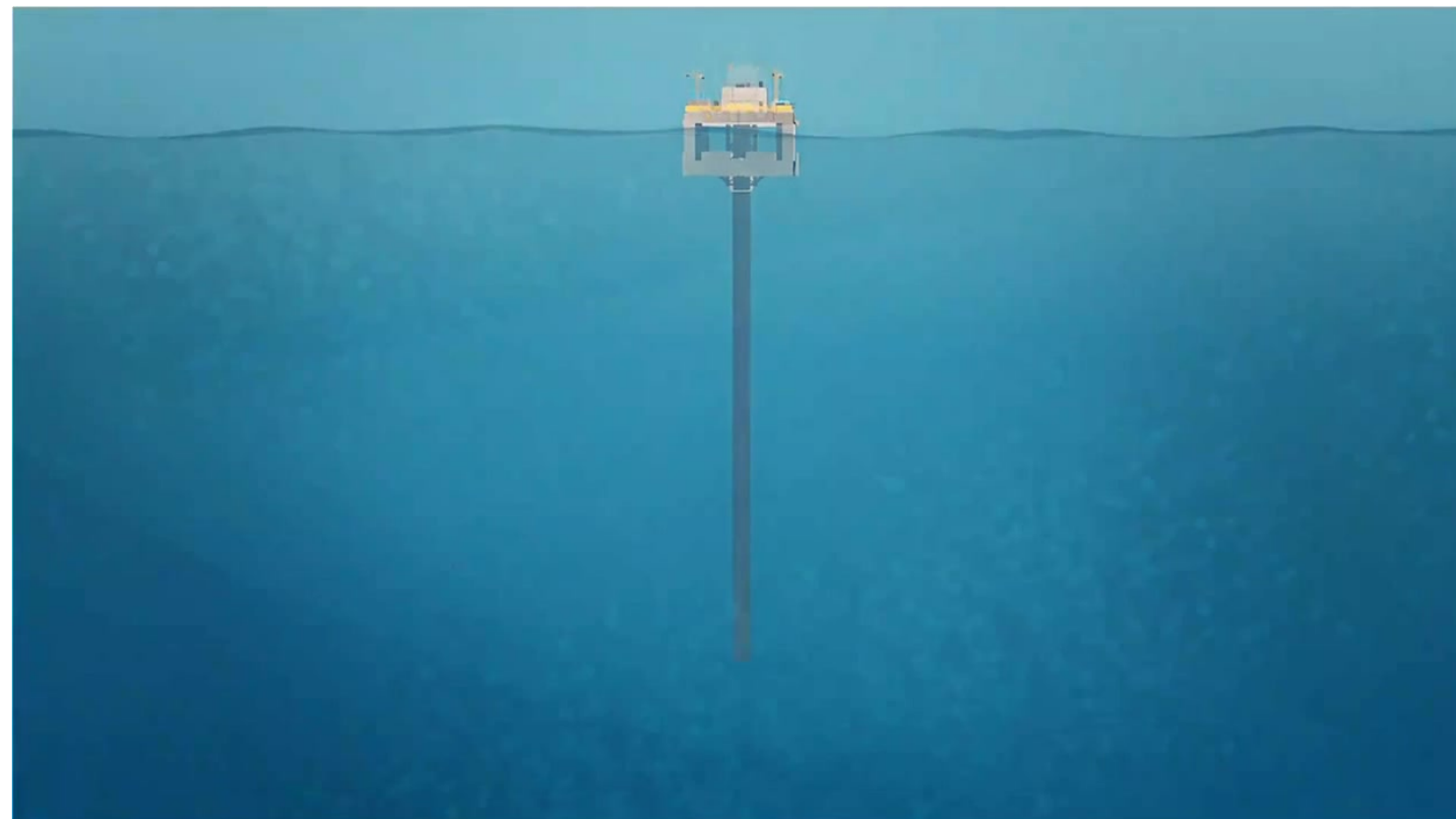
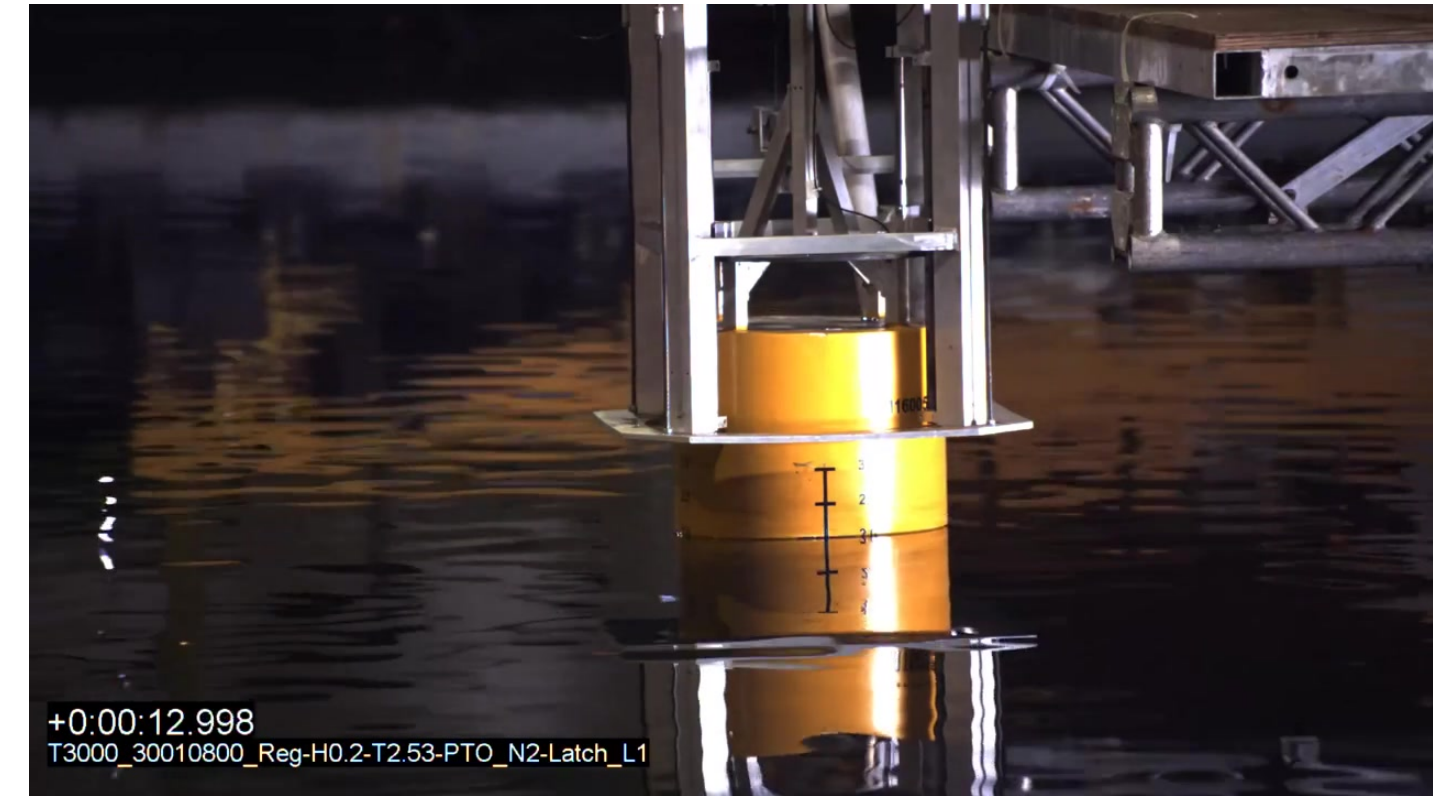


# Ongoing R&D projects - highlights

- Development of a floating Llidar (BRAVO) for offshore wind measurements
- Offshore wind assessment using satellite images
- Offshore wind prediction using Artificial Intelligence (AI) techniques
- Floating wind turbines for deep and ultra-deep waters
- Hybrid offshore wind-wave-solar systems for oil and gas decarbonization in Pre-salt region
- Offshore wind-powered hydrogen production
- Using OTEC for oil and gas decarbonization in deep waters
- Grid connection of large-scale offshore wind turbine
- Islanded large-scale microgrids for offshore renewable sources
- Development of a linear permanent magnet generator for wave energy converters
- Offshore wind pilot project for Rio de Janeiro - An initiative of the Government of the Rio de Janeiro State



# Projects - highlights





**Thanks to INEOF for the support!**



**Milad Shadman**  
Offshore Renewables - Professor at  
COPPE/UFRJ



**[milad.shadman@lts.coppe.ufrj.br](mailto:milad.shadman@lts.coppe.ufrj.br)**