

“Renewable Energy Research at COPPE/UFRJ”

Edson Watanabe
Director – COPPE/UFRJ



Federal University of Rio de Janeiro

- Center of Technology
- Center Health Sciences
- Center of Letters and Arts
- Center of Philosophy and Human Sciences
- Center of Economics and Law Sciences
- Center of Mathematical and Natural Sciences
- Science and Culture Forum

- COPPE
- Polytechnic School
- School of Chemistry
- Institute of Macromolecules
- Interdisciplinary Nucleous for Social Development



Teaching

- Graduate (Master and Doctor Courses)
- Undergraduate (in cooperation with Polytechnic School)
- Extension (Short Courses)
- Graduate (Specialization)

Research

- Basic
- Applied

Innovation

- Development of process and product technology
- Creation of technology-based companies

COPPE/UFRJ

Mechanical
Engineering
(7)

Biomedical
Engineering
(7)*

Chemical
Engineering
(7)

Electrical
Engineering
(6)

Transport
Engineering
(4)

Systems
Engineering and
Computer
Science (7)

Civil
Engineering
(7)

Metallurgical
and Materials
Engineering
(6)

Nuclear
Engineering
(6)

Ocean
Engineering
(5)

Energy
Planning
(6)

Production
Engineering
(5)

Nanotechnology
Engineering
(5)

* Evaluation grade
by CAPES

Personnel

338 Professors

Doctors
Full-time

2.600 Students

1250 M. Sc.
1.350 D. Sc.

120 Post-doctoral
Researchers

295 Administrative
Staff





“Renewable Energy Research at COPPE/UFRJ”

Prof. Segen F. Estefen (segen@lts.coppe.ufrj.br)

Professor of Ocean Structures and Subsea Engineering

Ocean Engineering Program

Abstract – This project is related to the study of the availability of resources associated with all ocean sources of energy (wave, tide, current, temperature gradient, salinity gradient). This includes the need of monitoring resources, R&D activities associated with prototype deployments, comparative advantage due to the recognized leadership in deepwater technology for the oil&gas industry and design, construction, installation and maintenance could benefit from the outstanding field experience for oil&gas.

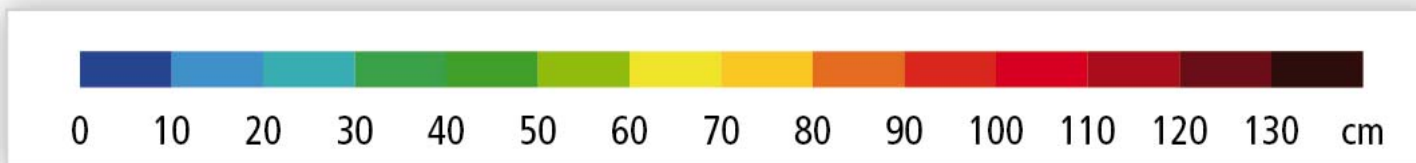
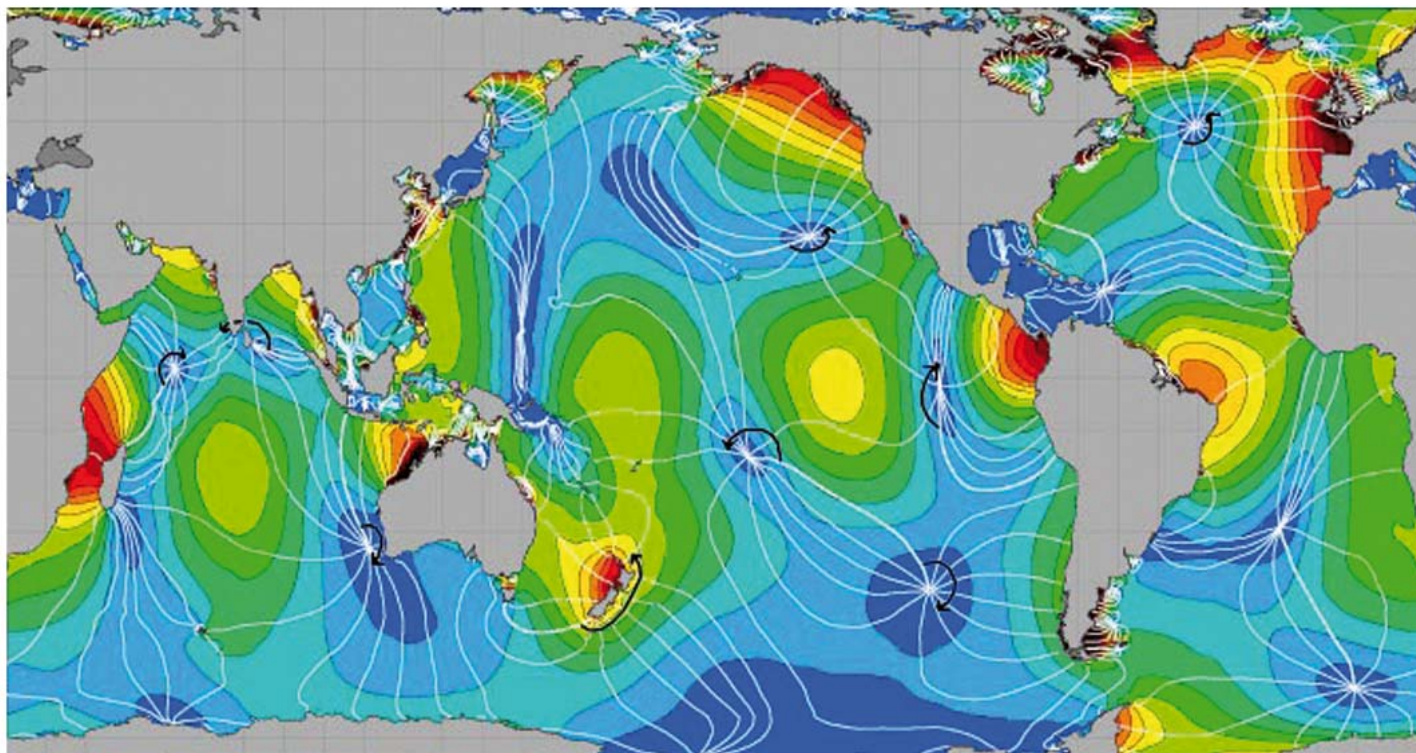
Tidal Energy



COPPE
UFRJ

GOT99.2

NASA/GSFC



6/99

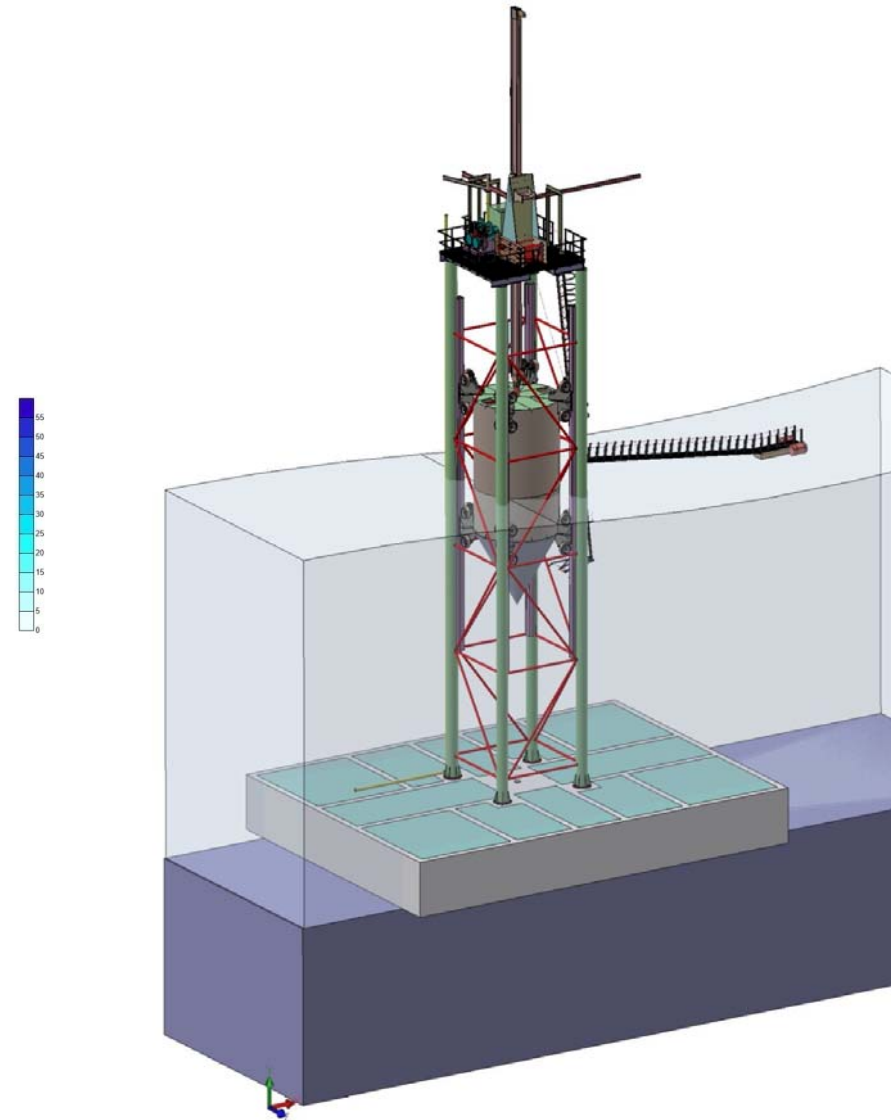
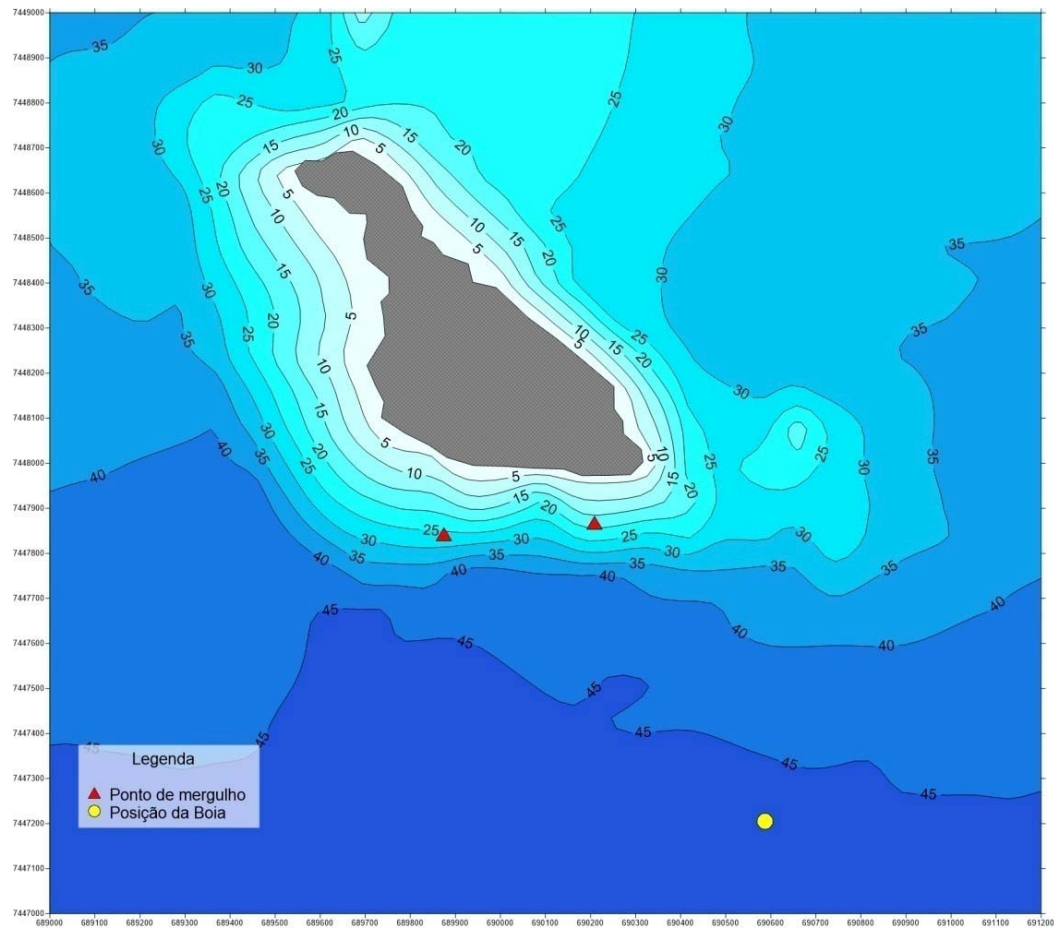
Onshore Prototype – Pecem Port – NE Brazil



COPPE
UFRJ



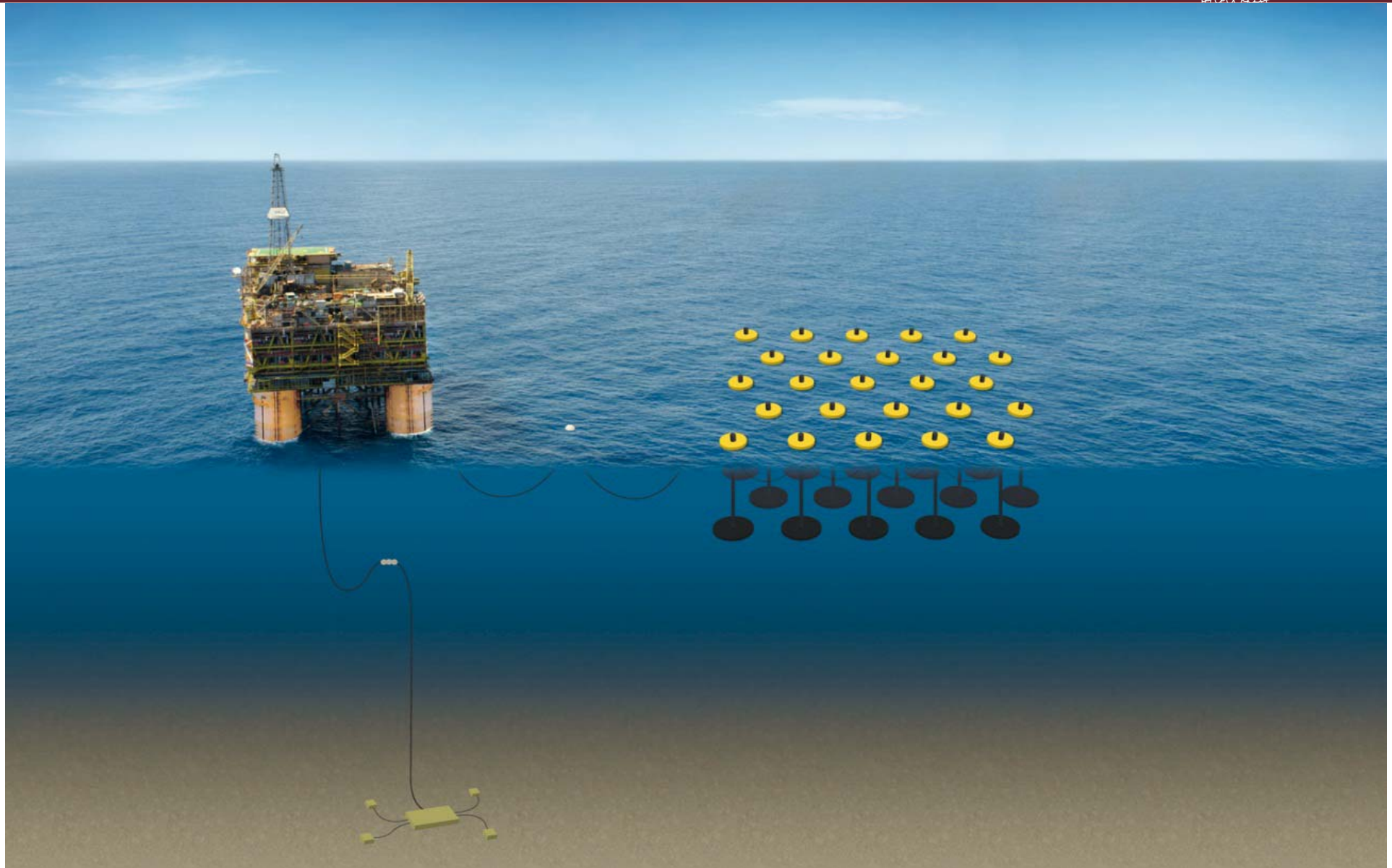
Nearshore Prototype - Rio de Janeiro



Scenario for Offshore Wave Energy Application



COPPE
UFRJ



Vertical Axis Autorotation Current Turbine (VAACT)



Prof. Antonio Carlos Fernandes and Dr. Ali Bakhshandeh Rostami

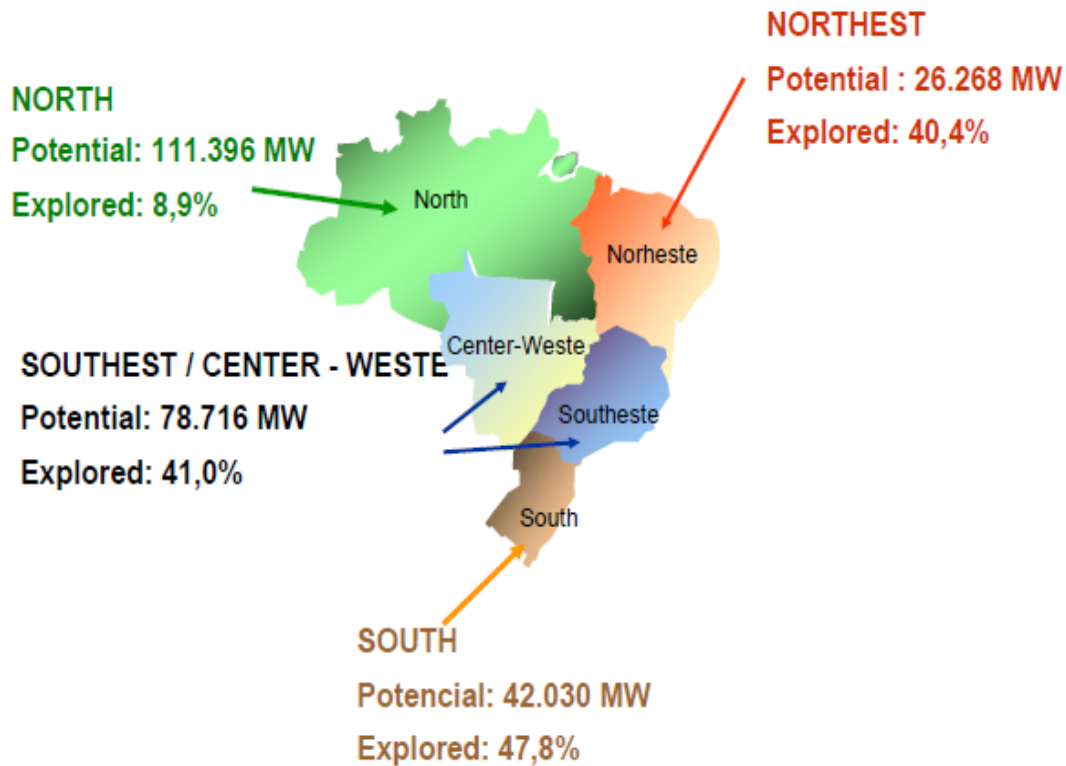
acfernandes@oceanica.ufrj.br bakhshandeh@oceanica.ufrj.br

Ocean Engineering Program

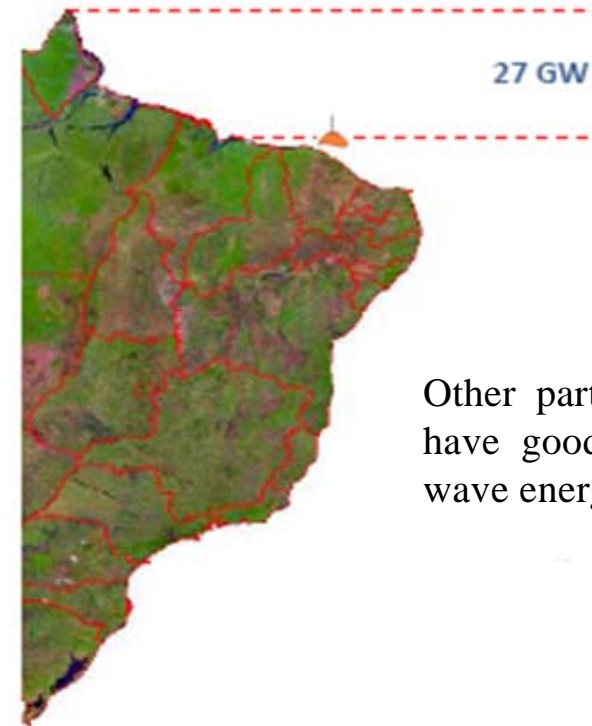
Abstract – This project deals with an innovative **turbine which employs autorotation phenomenon of non-circular objects to harvest energy from very low head currents**. This turbine is referred to as VAACT (see title) and exploits a theory of moment of momentum in mechanics to improve its performance. The VAACT utilizes an extra moment of inertia to increase the efficiency and enhance the impulsive effects of rotation. Therefore, this turbine has smooth rotation with high efficiency in comparison with other turbine types.

Vertical Axis Autorotation Current Turbine (VAACT)

High Potential in Brazilian Rivers



High Tidal Potential in Brazilian Coast Line in the North



Other parts of cost line have good potential for wave energy

Brazil also has a Hydrokinetic potential of 258 MW, which it is currently tapped at only 28%.

Vertical Axis Autorotation Current Turbine (VAACT)

Low mass moment of inertia (Fluttering)



High mass moment of inertia (Autorotation)



**Fluttering
(Oscillation rotation)**



**Extra moment of
inertia**



Autorotation

Autorotation



Continuous rotation
without external
supplied power



Extract the
energy from
the current

VAACT

Photovoltaic System for Ancillary Services in a Thermal Power Plant

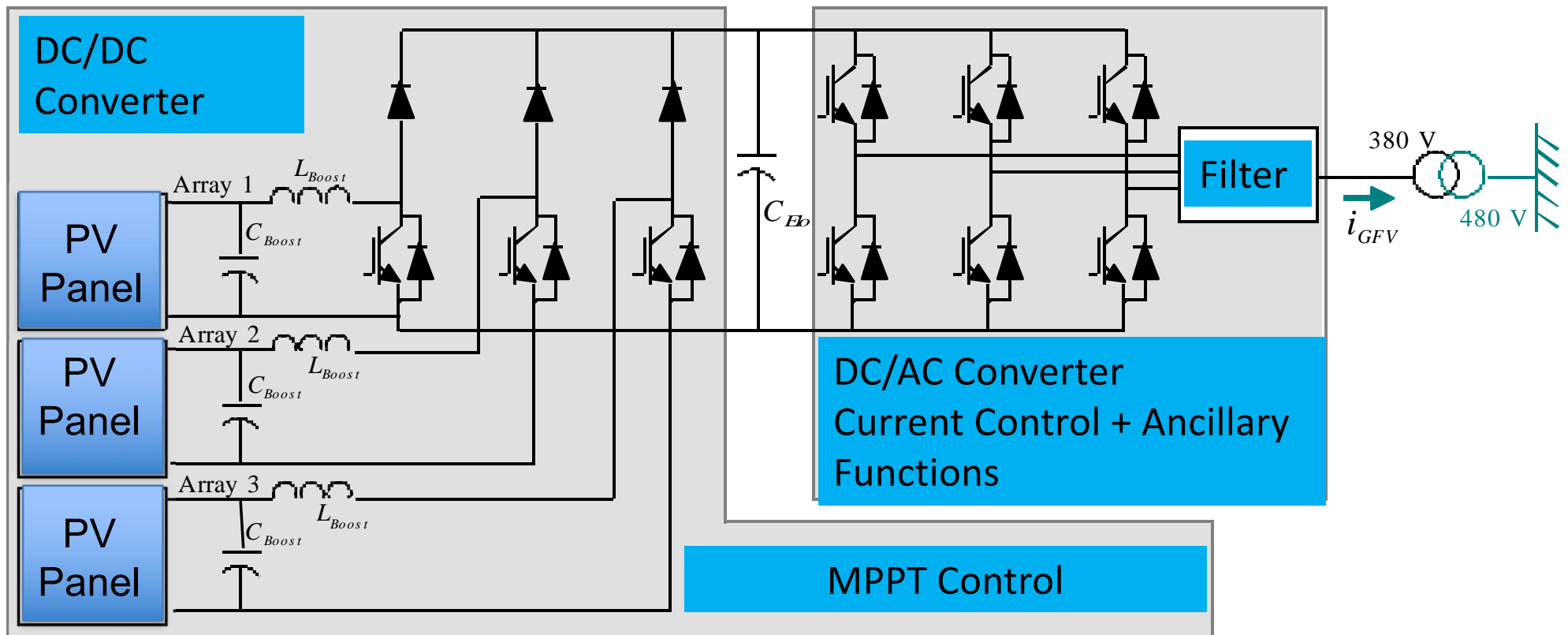


Prof. Luis Guilherme B. Rolim (rolim@ufrj.br)

Electrical Engineering Program

Abstract – Development of photovoltaic converter for ancillary services like reactive power compensation or harmonic current compensation operating in conjunction with a thermal power plant.

Photovoltaic System for Ancillary Services in a Thermal Power Plant



Photovoltaic System for Ancillary Services in a Transmission Line

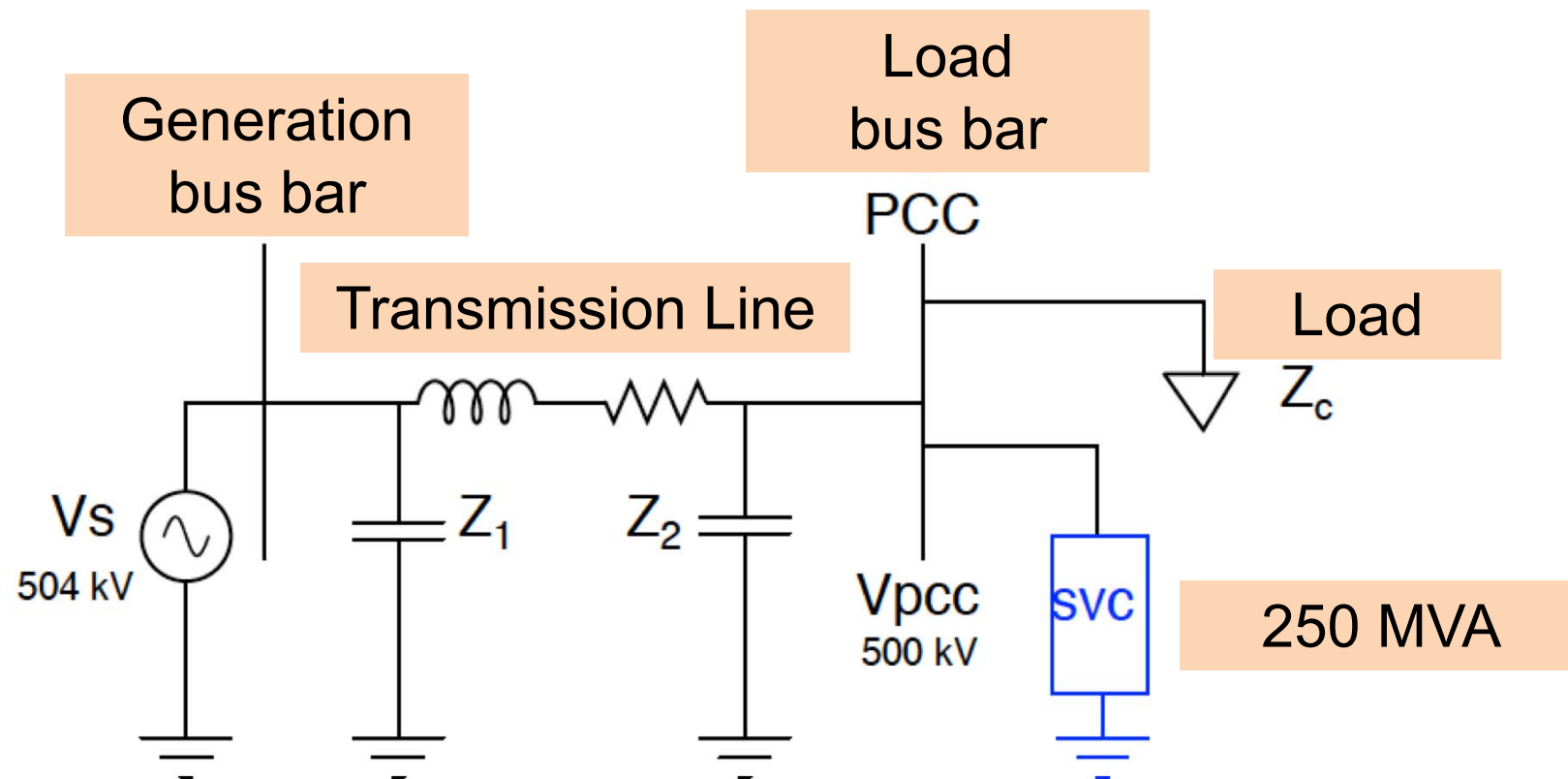


Prof. Edson Watanabe (watanabe@coe.ufrj.br)
Electrical Engineering Program

Abstract – Study on the use of large photovoltaic system for ancillary services like reactive power compensation for voltage control in transmission lines.

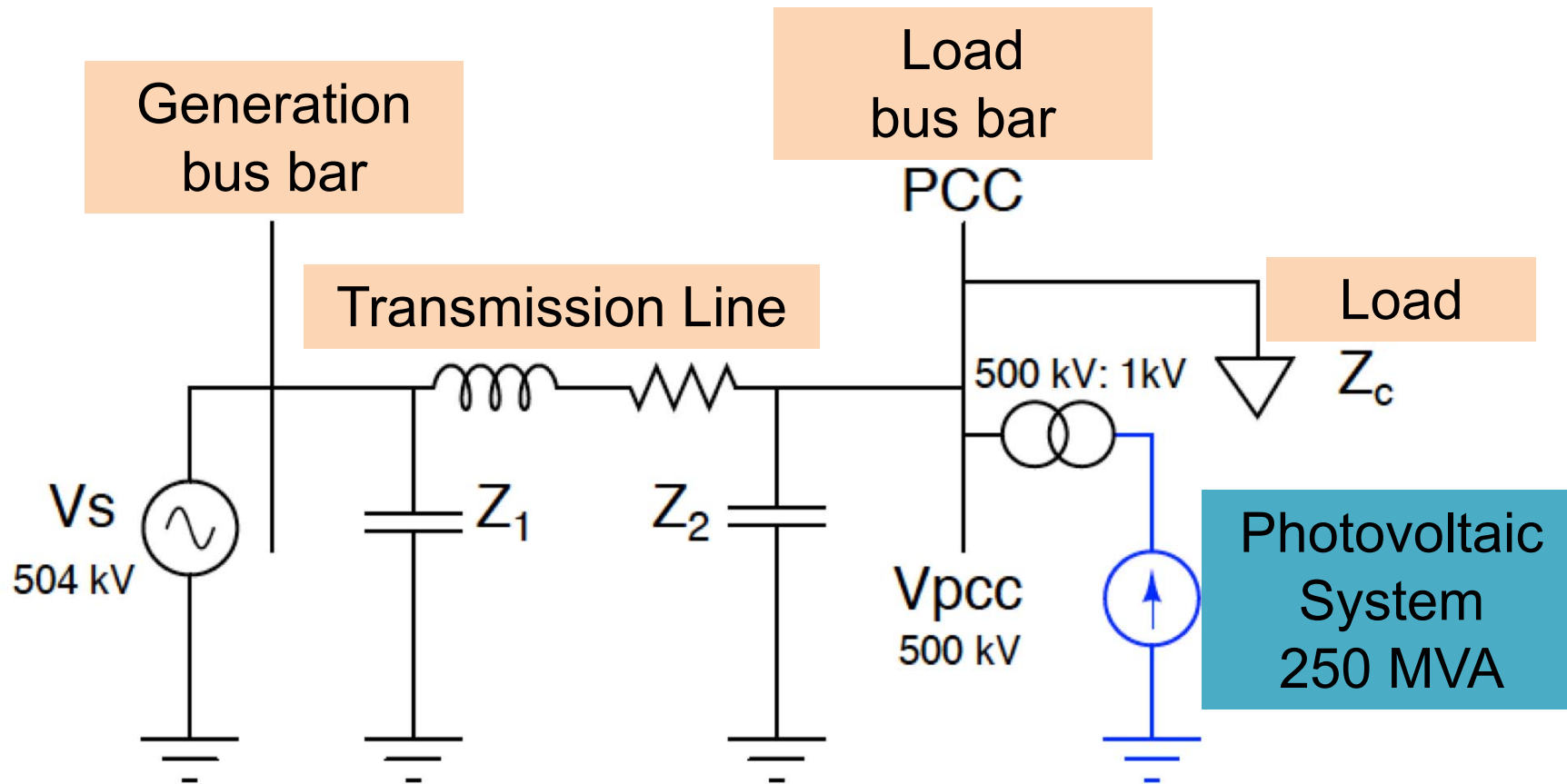
Photovoltaic System for Ancillary Services in a Transmission Line

The problem today



Photovoltaic System for Ancillary Services in a Transmission Line

The problem today





Prof. Claudio Fernando Mahler (mahler@coc.ufrj.br)

Civil Engineering Program

Abstract – Almost 55% of the waste produced in Brazil are organic . The aerobic and anaerobic treatment enables environmentally and economically important solutions. Studies have shown the potential of energy use, either for domestic conditions, either for energy production or vehicle fuel . Such studies are being conducted by our research group (GETRES) in the last years with promising results, either by aerobic processes, either by anaerobic processes .