



## BRICS Network University



**First Conference of the Brics Network University  
Yekaterinburg, April 6th to 9th, 2016.**

Prof. Amir A. M. Oliveira Jr., Ph.D.  
Federal University of Santa Catarina – UFSC  
Florianopolis, SC, Brazil

April 7, 2016.

# BRICS NU - Energy

Three major Brazilian universities



One proposal



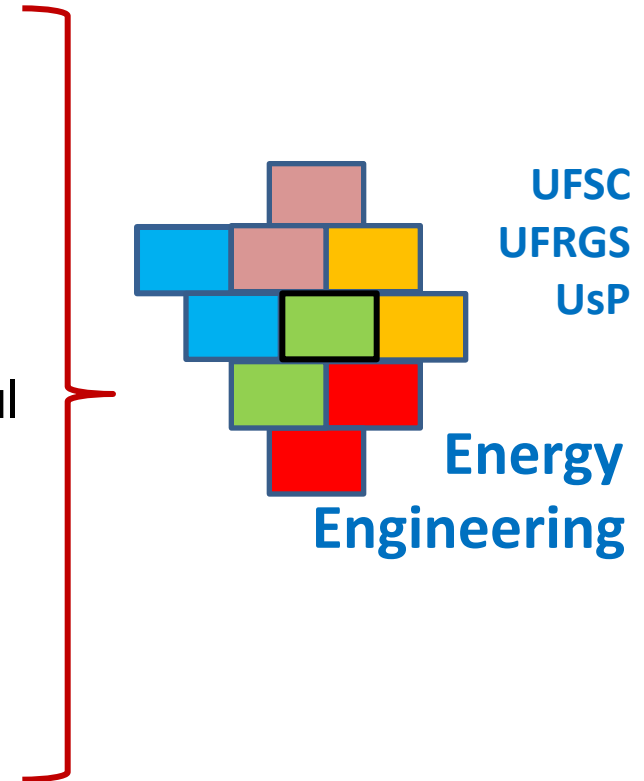
Federal University of Santa Catarina



Federal University of Rio Grande do Sul



University of São Paulo





# BRICS NU - Energy

Localization of the universities involved in this proposal



**Universities** that committed resources to this proposal:

UFSC = Federal University of Santa Catarina

UFRGS = Federal University of Rio Grande do Sul

USP = University of São Paulo

**Partner university / proposal:**

UFV = Federal University of Viçosa



# **BRICS Network University : Energy**

**Energy Engineering + Renewable Energy**

**=**

**Sustainable Energy  
Graduate Program**



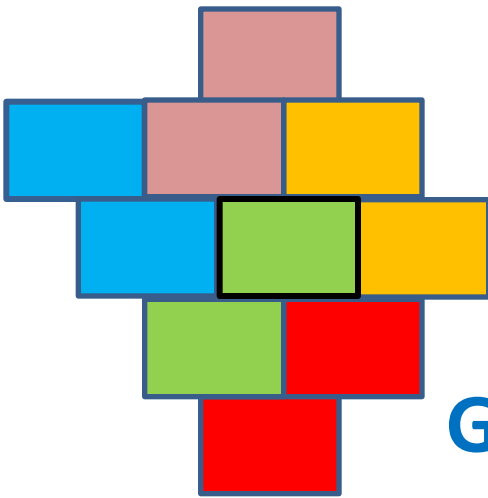
# BRICS NU - Energy

**Brazilian Proposal**



To create a new graduate program:

- Multi-university
- Multi-centered



UFSC  
UFRGS  
UFV  
...

**Graduate Program  
In Energy ...**



# BRICS NU - Energy

## Graduate programs in these universities that support BRICS NU (highly ranked in Brazil):

Federal University of Santa Catarina (UFSC)

- Mechanical Engineering (POSMEC)
- Electrical Engineering (PPGEEL)
- Chemical Engineering (POSENQ)
- Civil Engineering (PPGEC)

Federal University of Rio Grande do Sul (UFRGS)

- Mechanical Engineering (PROMEC)

University of São Paulo (UsP)

- Chemical Engineering (PPGEQ)

**Our strengths** are from:

- **Mechanical**
- **Electrical**
- **Chemical**
- **Civil**

engineering.

# BRICS NU - Energy

## Description of the Graduate programs in these universities that support BRICS NU:

	POSMEC UFSC	PPGEEL UFSC	POSENQ UFSC	PPGEC UFSC	PROMECC UFRGS	PPGEQ UsP
Started	M: 1969 D: 1981	M: 1971 D: 1987	M: 1993 D: 1998	M: 1991 D: 1997	M: 1986 D: 1986	M: 1968 D: 1972
Permanent faculty	43	41	16	21	35	24
Students: M	206	144	57	210	130	85
Students: D	136	109	107	120	70	160
Degrees awarded: M	1,293	1,279	391	781	477	460
Degrees awarded: D	380	396	161	179	194	233

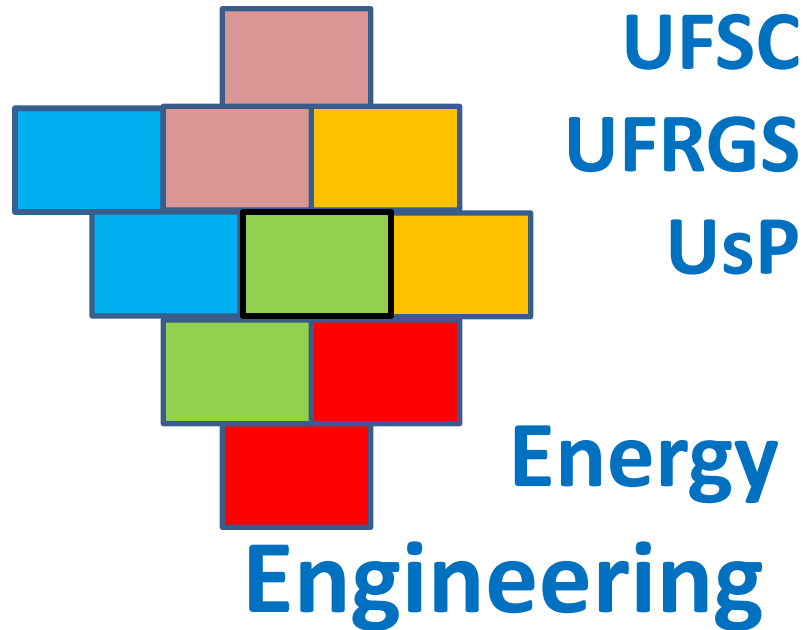
<http://ppgmec.posgrad.ufsc.br/>  
<http://ppgeel.posgrad.ufsc.br/en/>  
<http://posenq.posgrad.ufsc.br/>  
<http://ppgec.posgrad.ufsc.br/>

<http://www.ufrgs.br/promec>  
<http://sites.poli.usp.br/pqi/pos/>



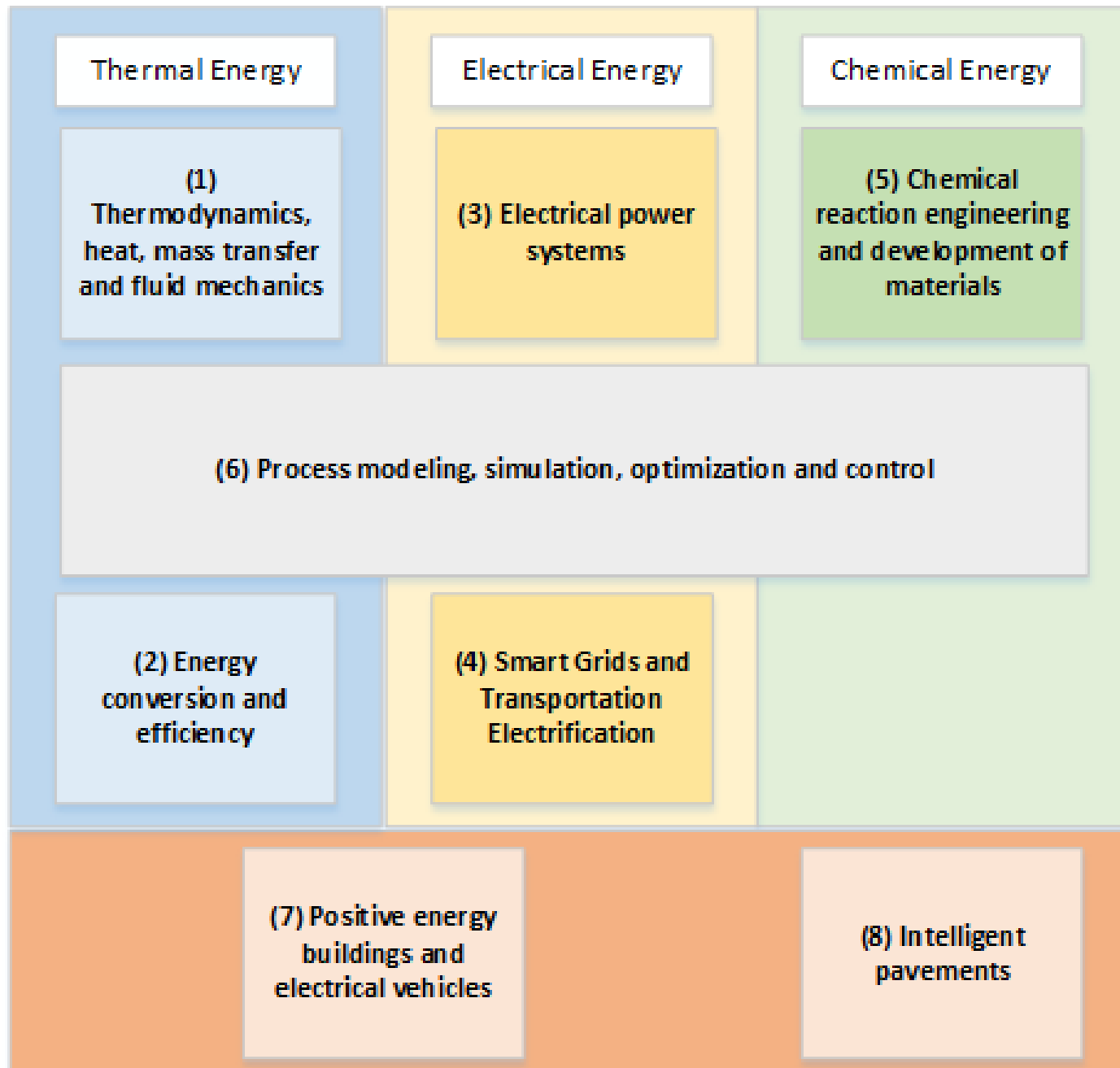
# BRICS NU - Energy

Our **FOCUS: ENERGY ENGINEERING**





# Core areas / Research lines (8)



# Research lines / Opportunities

## 1. Thermodynamics, heat and mass transfer, fluid mechanics:

- Phase change assisted cooling and thermal control devices (heat pipes, loop heat pipes, capillary loops – **Power and refrigeration**)
- Heat transfer (compact heat exchangers, cooling towers – **Power and refrigeration**)
- Thermal properties (thermal conductivity, radiative properties – **Building efficiency**)
- Micro fluid-dynamic and porous media (Lattice-Boltzmann modeling, reconstruction, micro and nano tomography – **Petroleum and materials**)

# Research lines

## 2. Energy conversion and efficiency:

### ☐ Renewable energy

- Solar photovoltaics (Building)
- Concentrated solar thermal (Power)
- Wind energy (Power)
- Wave energy (Power)
- Biomass (Wood chips, wood pellets, straw, residues)
- Biogas (Pork and poultry manure)
- Biofuels (Aviation, second generation fuels, vegetable oils)
- Hydrogen (production and use – fuel cells)

### ☐ Refrigeration and air-conditioning

- Energy efficiency of vapor-compression
- CO<sub>2</sub> and hydrocarbon environmentally friendly fluids
- Magnetocaloric and electrocaloric
- Adsorption solar-assisted systems

# Research lines

## 3. Electric power systems:

- Planning and operation of smart electric systems
- Security energetic supply
- System security
- Risk analysis and economic
- Impact of integration of alternative energy resources
- Impact of electric vehicles in the grid

# Research lines

## 4. Smart grids and transportation electrification

### Smart grid

- Microgrid and the multi-microgrid

### Transportation Electrification (TE)

- Grid interface technologies related to power conversion and propulsion for electrified vehicles

# Research lines

## 5. Chemical reaction engineering and development of materials

### □ Chemical reaction engineering

- Thermochemical conversion
- Biomass and residual fuels
- Reduction and mitigation of the environmental impact of energy conversion

### □ Development of materials

- Nanostructures materials for surface finishing
- Catalysis and photo-catalysis

# Research lines

## 6. Processes modeling, simulation, optimization and control

- Analysis and optimization of the energy efficiency of equipment and processes for the energy industry at design and operation levels

# Research lines

## 7. Positive energy buildings and electrical vehicles

- Integration of solar photovoltaic on buildings
- Short-term energy storage
- Vehicle to grid energy storage
- Smart buildings



## 8. Intelligent pavements

- Cold pavements
- Energy generation pavements
- Mitigation of environmental air pollution by photocatalysis

# Brazil – State of Santa Catarina



**Camboriú**



**São Joaquim**



**Blumenau**

## **State of Santa Catarina**

Area: 95 346 km<sup>2</sup>; Population: 6 249 682; GDP per capita: 13 000 USD

293 cities, diverse scenery and culture

One of the highest standards of living in Latin America

# Santa Catarina Island - Florianopolis

Capital of the State of Santa Catarina (1726)



Population of 406,564 inhabitants

# Santa Catarina Island - Florianopolis



**Hercilio Luz Bridge**



**North bay shore**

**Historical  
Downtown**



**Conceição Lagoon**



**Praia Mole  
(Soft Sand Beach)**



**Praia dos Ingleses  
(English Beach)**

# Saint Catherine of Alexandria

Mosaic in the hall of the UFSC Rectory Building



**Patronage:** craftsmen who work with a wheel (potters, spinners); educators; librarians; mechanics; millers; scholars; scribes; students



Prof. Amir A. M. Oliveira Jr., Ph.D.  
Federal University of Santa Catarina – UFSC  
Florianopolis, SC, Brazil  
[amir.oliveira@gmail.com](mailto:amir.oliveira@gmail.com)

<http://combustao.ufsc.br/professores/amir-oliveira/>



# Energy Engineering

## Our **FOCUS**: ENERGY ENGINEERING

Our **VISION**: The development of innovative solutions to improve the energy efficiency, increase sustainability, and reduce the global impact of human actions in energy conversion and utilization is accelerated from a continuous and integrated effort from applied science and materials, to system and process development, ending at the conception, analysis and testing of equipment and devices.



**Coordinating University**

**Federal University of Santa Catarina**

**Coordinating Program**

**Graduate Program in Mechanical Engineering**

- Started awarding master degrees in 1969 and doctor in 1981
- Permanent faculty: 43
- Number of enrolled master students: 206
- Number of enrolled doctor students: 136
- Master degrees awarded (up to Dec/2015): 1,293
- Doctor degrees awarded (up to Dec/2015): 380
- Web: <http://ppgmec.posgrad.ufsc.br/>
- E-mail: [ppgemc@contato.ufsc.br](mailto:ppgemc@contato.ufsc.br)