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Fundação Getulio Vargas

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WORKSHOP

TRANSATLANTIC ENERGY POLICY: LATIN AMERICAN AND GERMANY

THE DUALITY OF THE NATIONAL INTERCONNECTED SYSTEM (SIN): OUR GREATEST VIRTUE AND OUR BIGGEST OBSTACLE TO ENERGY SECURITY IN BRAZIL.

RESEARCHER: RAFAEL NOGUEIRA

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NATIONAL INTERCONNECTED SYSTEM (SIN):
HISTORY AND FEATURES

- It was created with the objective of maximizing the Brazilian energy use;
- It is a production and large hydrothermal electricity transmission system, with the **majority of hydroelectric plants** ;
- In the mid 70's, South and Southeast became the first regions interconnected by SIN;
- The Electric System National Operator (ONS) is the agency responsible for SIN's control;
- SIN is based on:
  - the operative interdependence between plants;
  - the interconnection of electrical systems;
  - the integration of generation resources and transmission to meet the market.

NATIONAL INTERCONNECTED SYSTEM (SIN):
CAPACITY

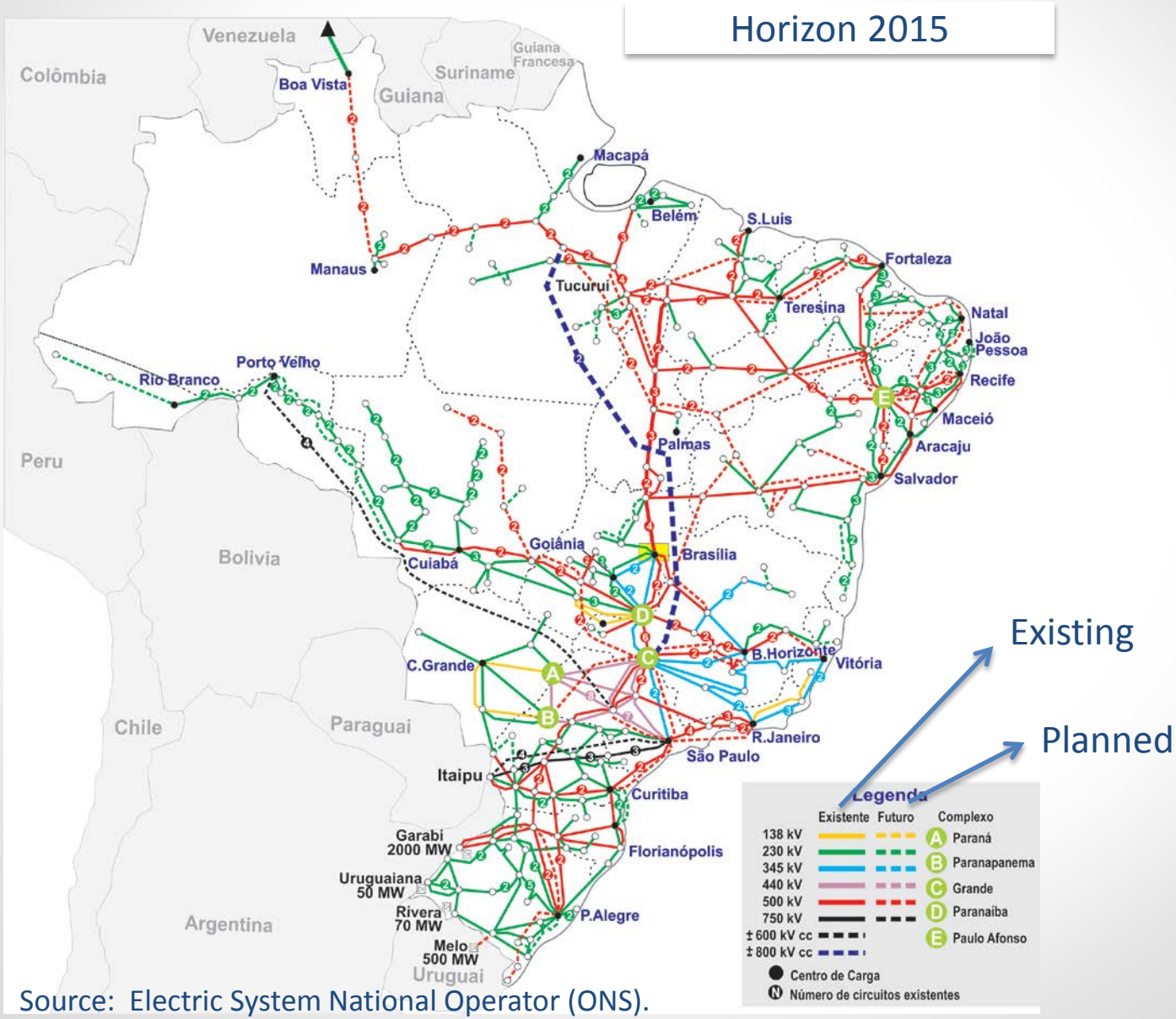
- Currently, SIN connects the South, Southeast, Midwest, Northeast and part of the Brazilian Northern region. With an installed capacity of 133 megawatts (MW);

Type	#	Installed Capacity (kW)	%
Wind Power Plant (EOL)	228	4.887.694	3,65
Small Hydro Power Plant (PCH)	984	5.098.572	3,81
Solar (SOL)	311	15.090	0,01
Hydro Power Plant (UHE)	202	84.094.838	62,80
Thermal Power Plant (UTE)	1.935	37.826.770	28,25
Nuclear Power Plant (UTN)	2	1.990.000	1,49
	3.662	**133.912.964,00**	**100,0**

Source: Electric System National Operator (ONS).

NATIONAL INTERCONNECTED SYSTEM (SIN):

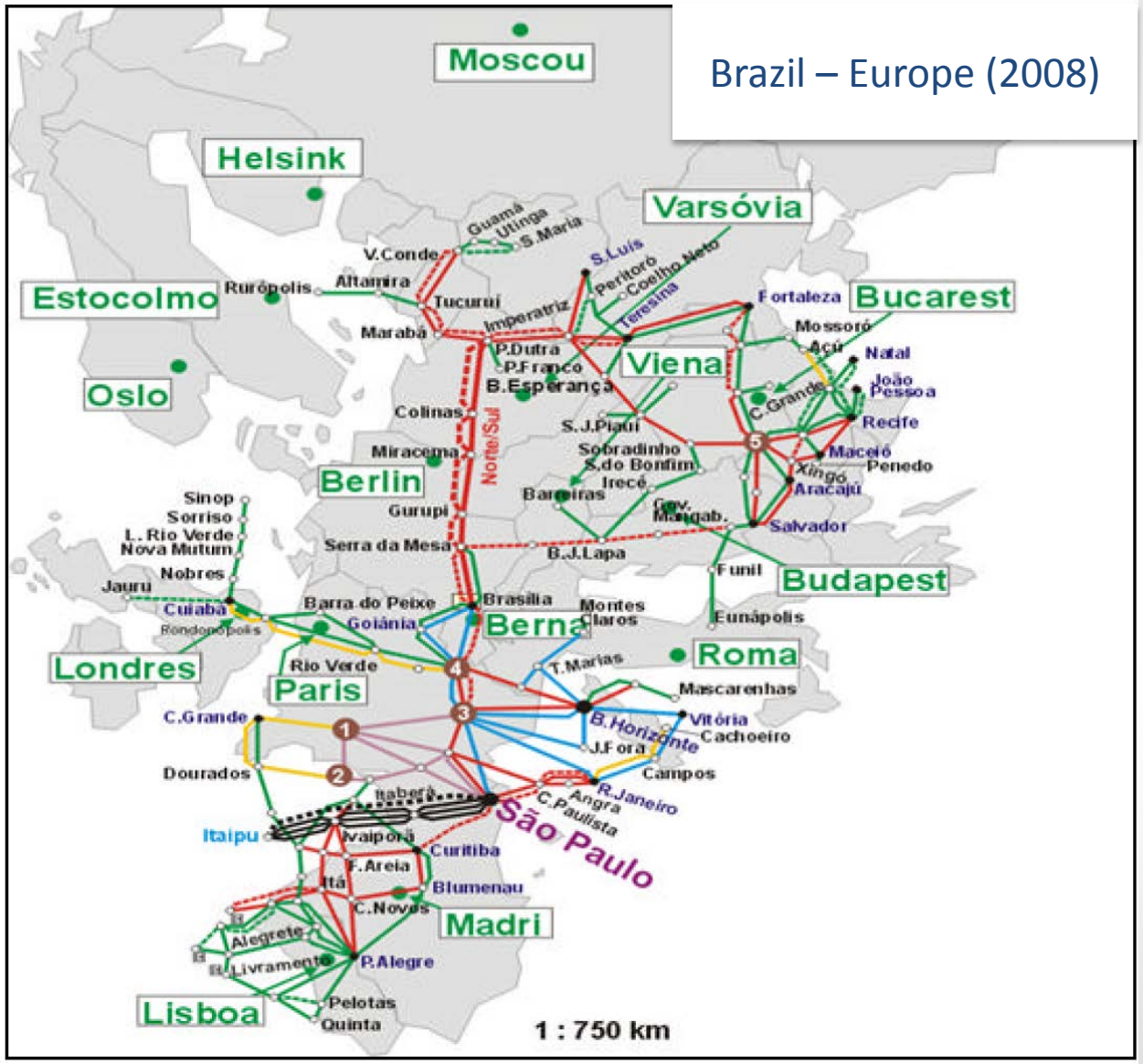
MAP



Source: Electric System National Operator (ONS).

NATIONAL INTERCONNECTED SYSTEM (SIN):

COMPARISON



Source: Electric System National Operator (ONS).

NATIONAL INTERCONNECTED SYSTEM (SIN):
BENEFITS

- The interconnection enables the **exchange of energy between regions**, thus allowing to obtain the benefits of rivers' regime diversity from different Brazilian basins;
- The coordinated operation seeks to minimize the overall costs of electricity production and increase the reliability of the service.

NATIONAL INTERCONNECTED SYSTEM (SIN):
BENEFITS

- **Operating costs reduction and thermal output minimization** (reduce fuel consumption) – whenever there are **hydroelectric surpluses** in other parts of the system .
- Unfavorable hydrological conditions:
  - Thermal plants contribute to supply the market as a whole, and not just consumers of its exclusive business.
  - The complementary participation of thermal plants in the customer service market also requires interconnection and integration among the agents.

NATIONAL INTERCONNECTED SYSTEM (SIN):

CURRENT CHALLENGES

- High funding needs for:
  - Maintenance;
  - Continuous Renovation;
  - Expansion.

- Public financial constraints:
  - BNDES' portfolio restructuring.

- Provisional Measure 579 = > drastic reduction on the cash flow of energy transmission companies and their investment capacity.

- High loss of energy:
  - Due to large distances traveled by transmission lines.

- Local problems can also be propagated by the system:
  - Blackouts.

NATIONAL INTERCONNECTED SYSTEM (SIN):

FUTURE CHALLENGES – DECENTRALIZED GENERATION AND RENEWABLES ENERGY SOURCES

- Regulatory framework: Resolution 482 (NR 482):
  - Defines and sets up a policy towards some sorts of decentralized generation systems.
- Increase of constraints on the construction of large hydroelectric dams:
  - Imposed a limit to this model of power generation.
- Wind farm's strong expansion in recent years and good prospects for its future growth (solar energy, as well):
  - Intermittent energy sources.
- Expectation for renewables' participation in the energy matrix:
  - complementary and not structural.

NATIONAL INTERCONNECTED SYSTEM (SIN)

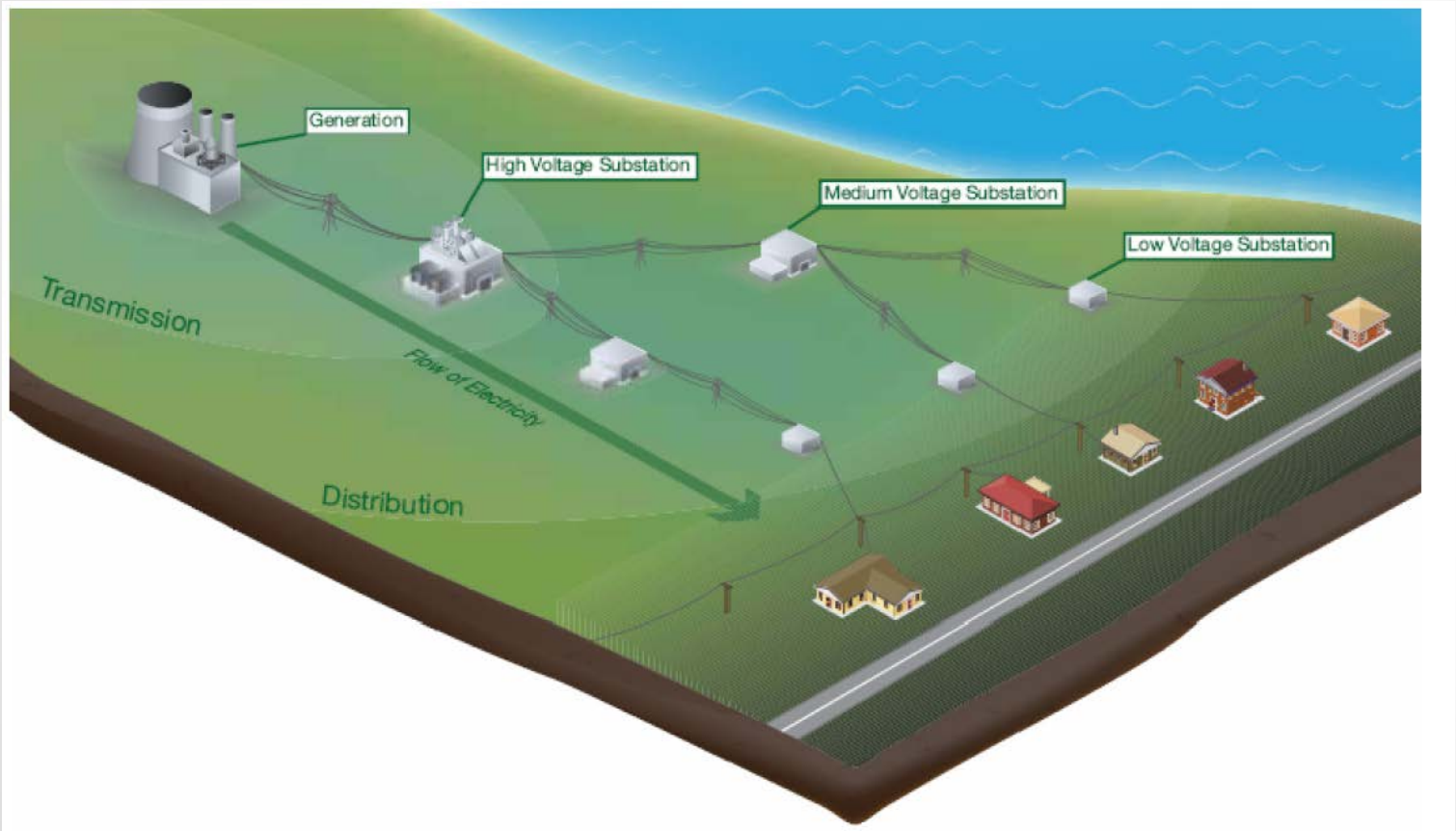
CHALLENGE: FRIENDLY INTEGRATION OF RENEWABLE ALTERNATIVES TO THE SYSTEM

- New procedures and resources for daily load curve's forecast:
  - appropriate centralized dispatch.

- Establishment of connection requirements in order to:
  - Prevent shutdown during faults and other disturbances in the SIN (ride through capability);
  - Collaborate in the voltage control at the connection point;
  - Limiting the power rate range from the wind speed variation (ramp rate control);

THE CURRENT ELECTRICITY GRID

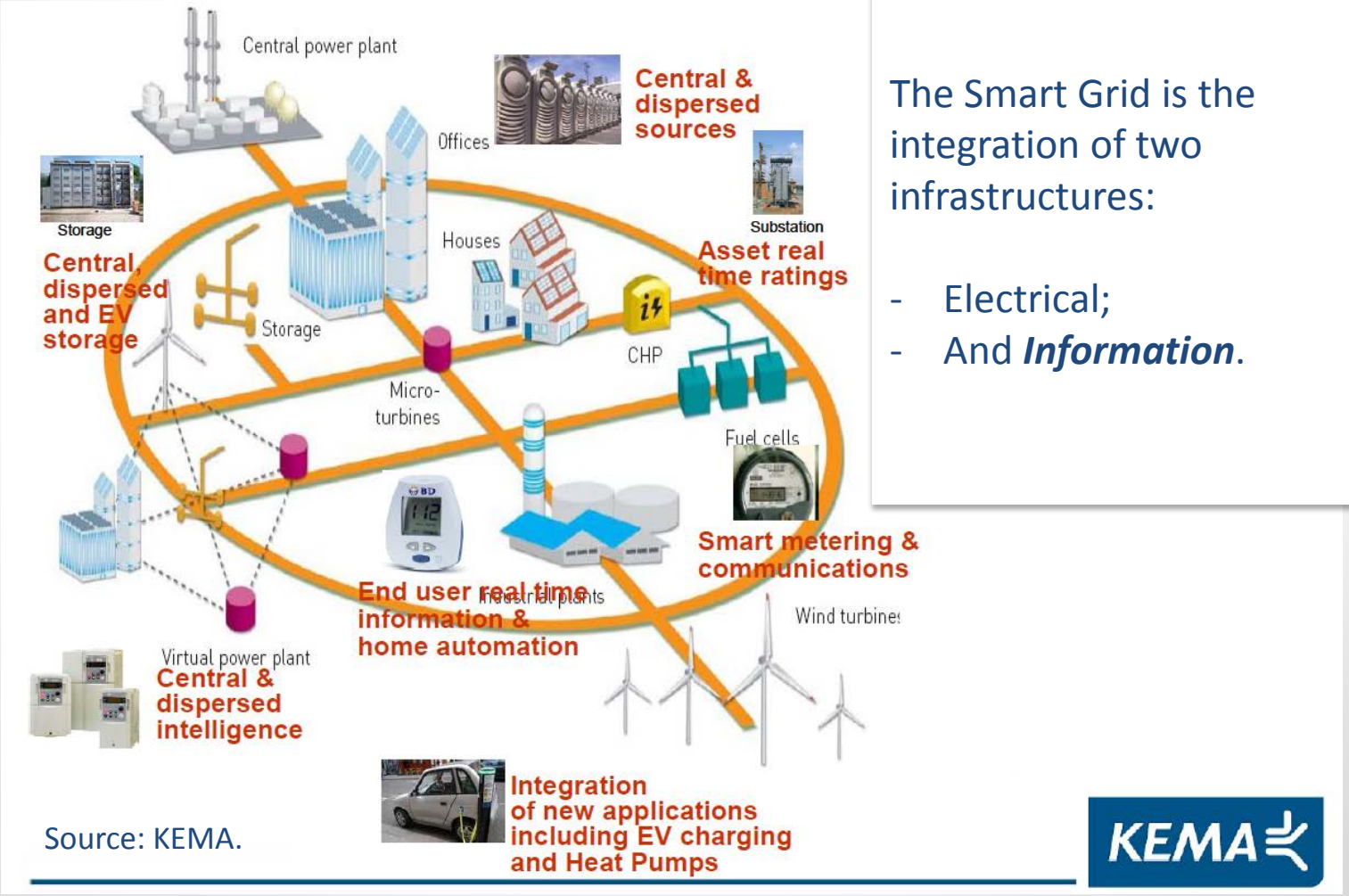
WE NEED TO MOVE FROM THIS…



Source: KEMA.

THE FUTURE OF ENERGY GENERATION, TRANSMISSION AND DISTRIBUTION: SMART GRID OVERVIEW

TO THAT…



The Smart Grid is the integration of two infrastructures:

- Electrical;
- And ***Information***.

NATIONAL INTERCONNECTED SYSTEM (SIN):
CONCLUSION

- SIN has provided better security, development and expansion of the electricity supply in Brazil.
- In the future, SIN should be more reliable, robust and manageable, properly integrating alternative renewable sources:
  - Providing a "friendly" integration of renewable energy sources to the SIN, through connection requirements and operating procedure, is mandatory.
- System's redesign to attend the increase of decentralized generation.
- New challenges for predicting the load curve to perform centralized dispatch.
- High investment needs for migrating to a smart grid transmission system.

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