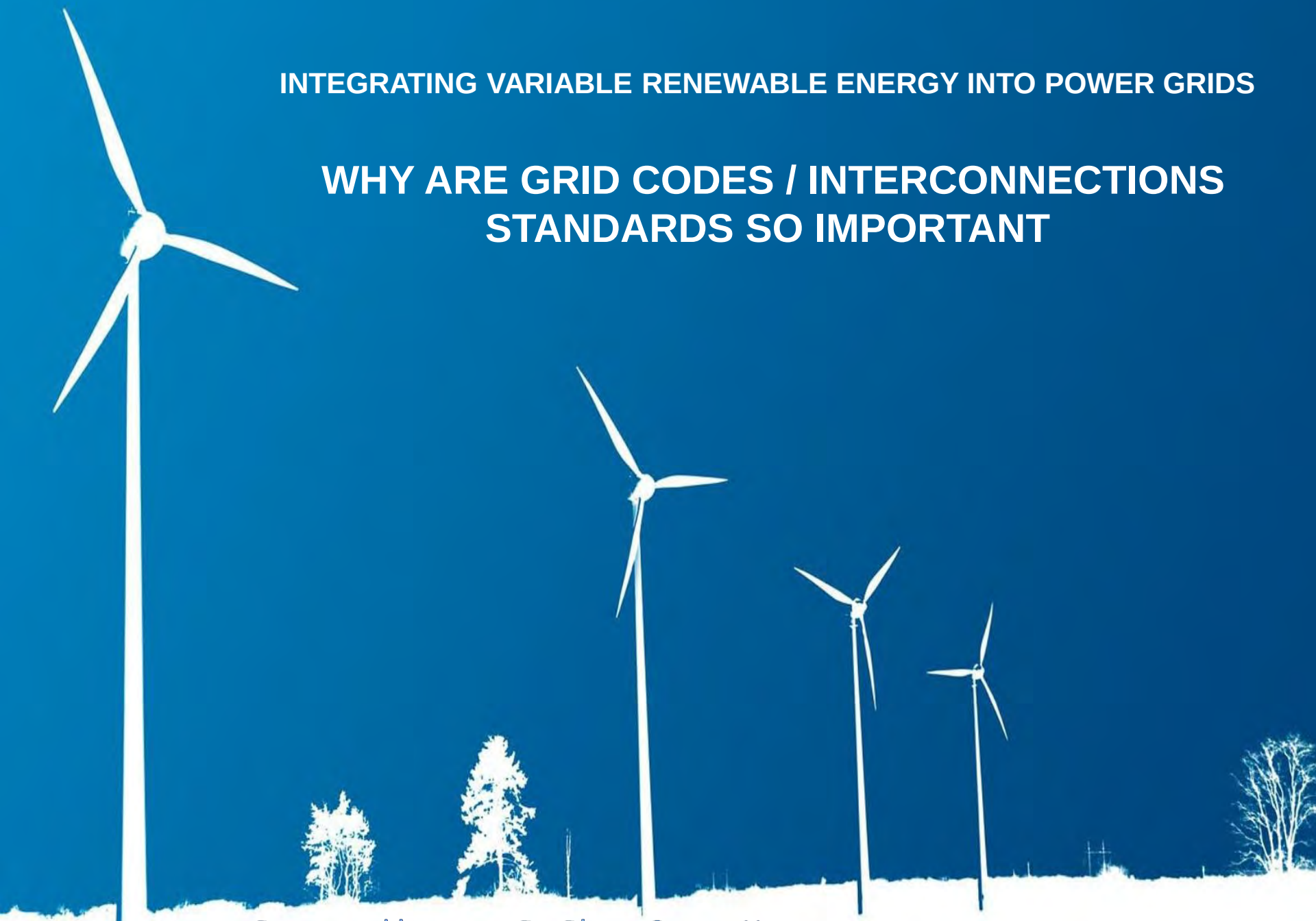
INTEGRATING VARIABLE RENEWABLE ENERGY INTO POWER GRIDS

# WHY ARE GRID CODES / INTERCONNECTIONS STANDARDS SO IMPORTANT



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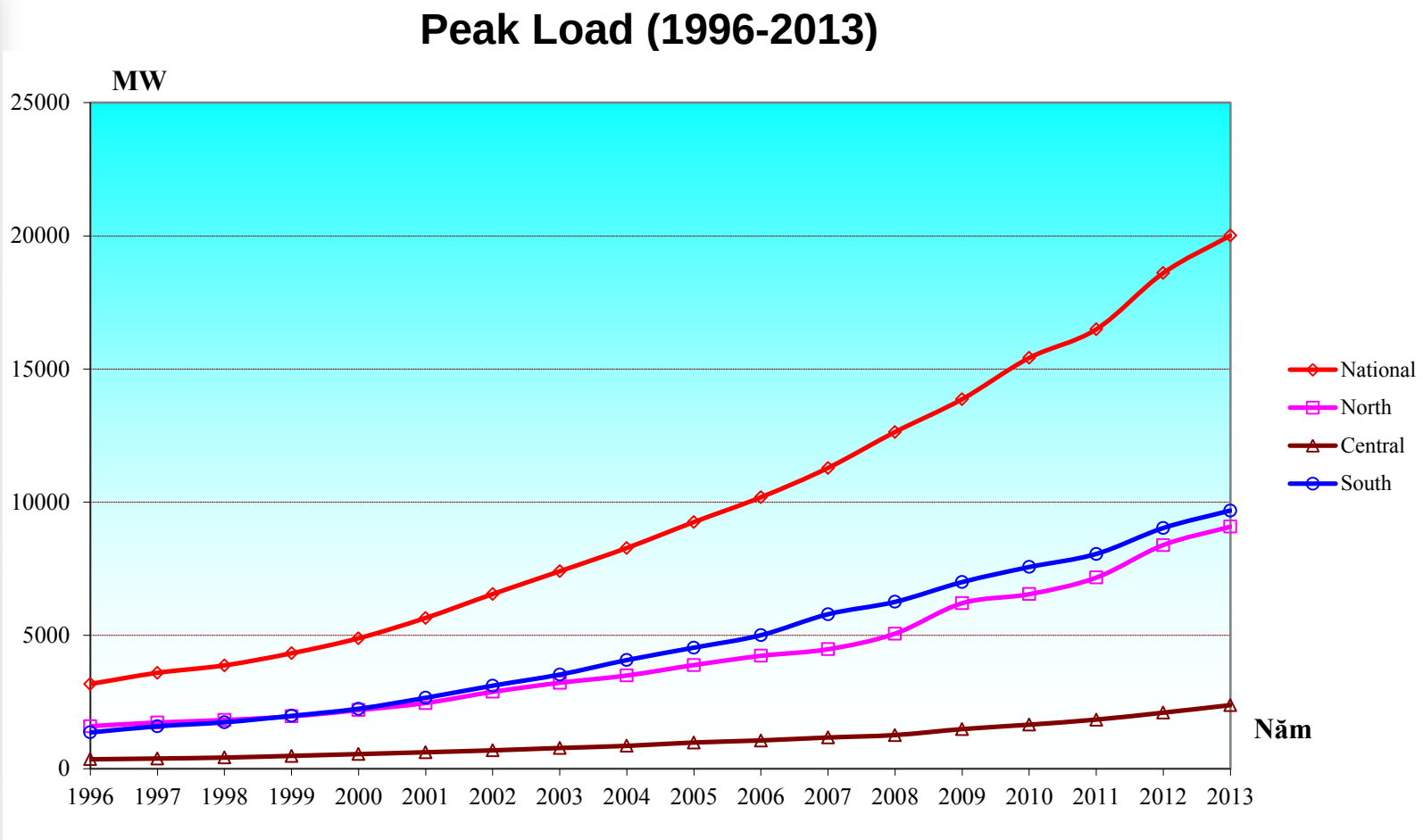
# 1. Vietnam Power system Overview (1)




- Average energy growth rate in 2006-2013: 12.03%
- Energy Consumption in 2013: 115.3 Billion kWh

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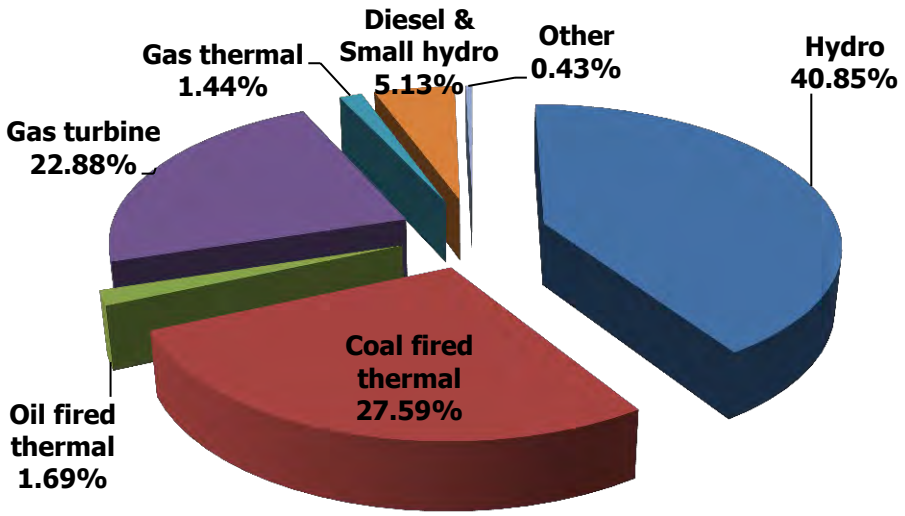
# 1. Vietnam Power system Overview (2)

## Generation Installed Capacity (Sept. 2014)




| Total (MW) | 32,583 |
|---|---|
| Hydro | 13,310 |
| Coal fired thermal | 8,990 |
| Oil fired thermal | 550 |
| Gas turbine | 7,455 |
| Gas thermal | 468 |
| Diesel & Small hydro | 1,670 |
| Other | 139.5 |

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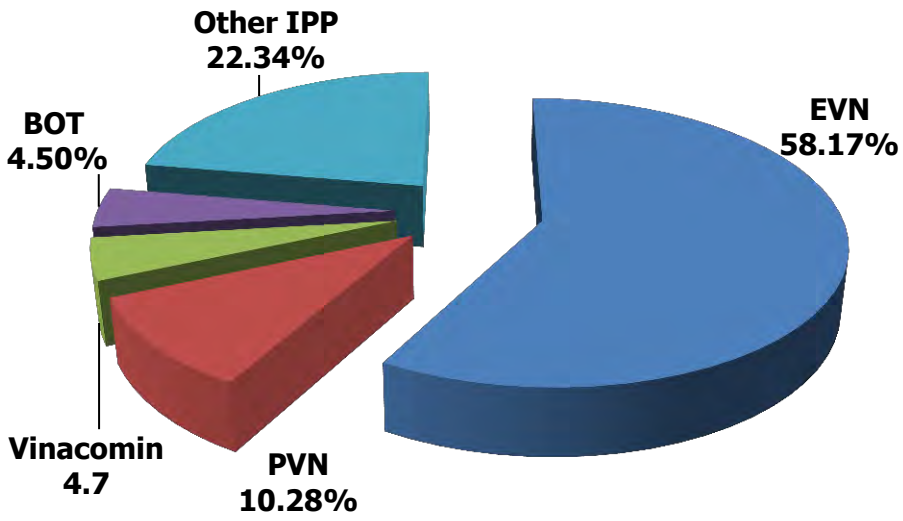
# 1. Vietnam Power system Overview (3)

## Generation Installed Capacity By Owner (Sept 2014)




| Total (MW) | 32,583 |
|---|---|
| EVN | 19,111 |
| PVN | 3,378 |
| Vinacomin | 1545 |
| BOT | 1480 |
| Other IPP | 7339.5 |

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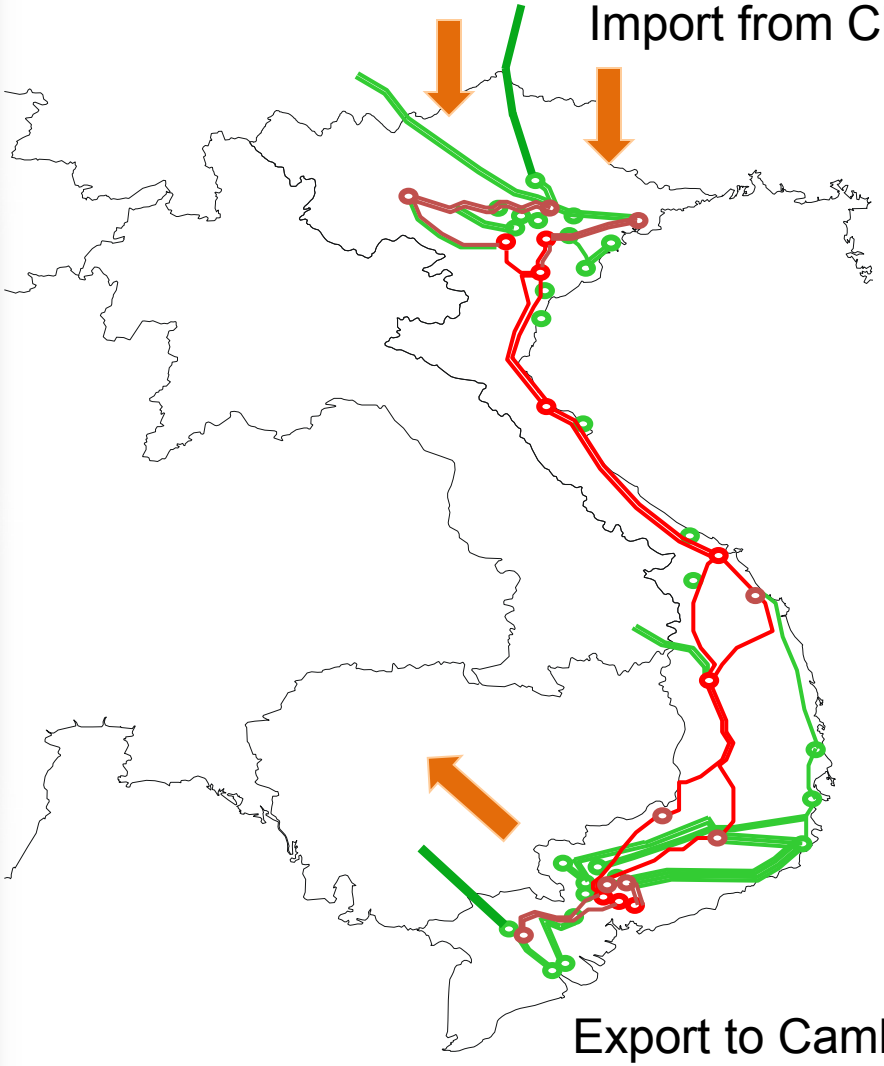
# 1. Vietnam Power system Overview (4)

## Transmission Network




Transmission Voltage Level: 500kV, 220kV, 110kV

- 500kV: Spine line, 3 region link
- 220kV: Transmission line in each region, 2 region link
- 110kV: Connected to 220kV Substations or power plans.
- Electrification: 97,5%

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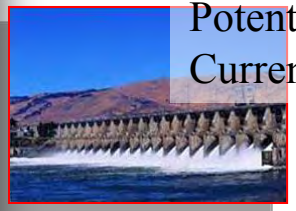
# 2. RE POTENTAL IN VIETNAM

- Grid connected RE projects (to 2013): ~1800MW (mostly SHPs)
- Off grid: mini hydro, micro hydro, wind, solar, biogas: ~ 45-60MW

**Small hydro power**

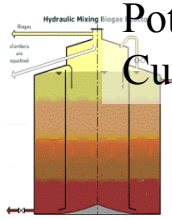


Potential: > 7.000 MW
Current use:1466 MW

**Biomass**

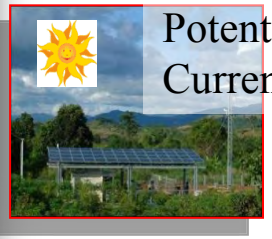
Potential: >3000 MW
Current use: 150 MW

**Biogas**




Potential: 58 MW
Current use: 0.5 MW

**Solar power**

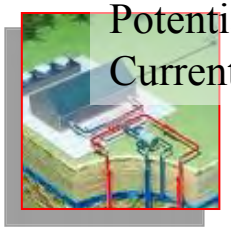


Potential: 4-5 kWh/$m^2$
Current use: 3.5 MW

**Wind power**

Potential: 7000MW
Current use: 52 MW (3 projects – 2 on grid)

**Geothermal**



Potential: 340 MW
Current use: 0 MW

**Municipal wastes**

Potential: 220 MW
Current use:2.4 MW

**Tidal**

Potential: 100-200 MW
Current use: 0 MW

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# 2. RE POTENTAL IN VIETNAM

(According to the Power Master Plan VII)

## For grid connected renewable energy targets:

- Increase the RE share in total generation: 4.5% in 2020; 6% in 2030
- Wind power: 1,000 MW in 2020 (0.7% of the total electricity generation) and 6,200 MW in 2030 (2.4% of the total electricity generation)
- Biomass and cogeneration: 500 MW (0.6%) in 2020 and 2,000 MW (1.1%) in 2030

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# 3. INCENTIVE MECHANISMS FOR RE (CURRENT)

**General incentives:**

- Import  tax exemption for goods which can not be produced inland
- Corporate tax exemption as highest priority.
- Obligation to purchase electricity: EVN must purchase all electricity generated from renewable energy sources in 20 years
- Land use fee exemption for renewable energy projects
- Free Environmental protection fee

**Specific policy:**

- Decision No.18/2008/QD-BCT dated 18/7/2008 on avoided cost tariffs for small hydro projects (for Small Hydro power plants)
- Decision No. 37/2011/QD-TTg  dated 29/6/2011 on support mechanism for wind power projects
- Circular No.32/2012/TT-BCT dated 12/11/2012 on development wind power projects and power purchase agreement for wind power projects

**Implementing:**

- Incentive mechanisms for solar energy are developed by support from Gov. of Spain
- Incentive machanisms for biogas/wastes/biomass was developing by support from GIZ.

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# 4. GRID CODES
## (TRANSMISION AND DISTRIBUTION CODES)

## Purpose:

- Promote open, transparent and fair access to the Grid
- States the relationships between the TNO, DNO, SMO and Grid Users
- Safe, secure and stable operation of the National Power system.
- Meet the electricity system conditions and the requirements of establishment of Competitive Market in Vietnam.

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# 4. GRID CODES
## (TRANSMISION AND DISTRIBUTION CODES)

## Main contents

- Power System Performance Standards
- Investment and Development Plan
- Demand Forecasting
- Connection to the Grid
  - Procedures for connection to the Grid
  - Defines boundary of investment, management and operation
  - Defines technical requirements for connection for hydro and thermal power plants.
- Grid Operation
  - Ensure secure, reliability of power system operation;
  - Ensure transparency, fairly and equitably of Grid Operation
- Metering regulation
  - Technical requirements for low, medium and high voltage
  - Defines investment responsibilities

❖ The Performance standards and technical requirements for connection of RE are not regulated detail in current Grid Code. The remaining regulation (for example: Wind Code) is developing and issuing in near future.

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# 4. GRID CODES
## (TRANSMISION AND DISTRIBUTION CODES)

## Technical requirements for Connection

- **General requirements for customers:** Voltage balance, Harmonic, Voltage flicker, Grounding requirements, Power load factor, Under frequency relays system, metering system
- **Withstanding the maximum short circuit current**
- **Protection system**
  - Hydro and thermal power plants
  - Customers
- **SCADA/EMS(DMS) system**
- **Communication/information system**
- **Active and reactive power control**
  - Hydro and thermal power plants
- **Excitation systems**
  - Hydro and thermal power plants
- **Governor response**
  - Hydro and thermal power plants
- **Black start**

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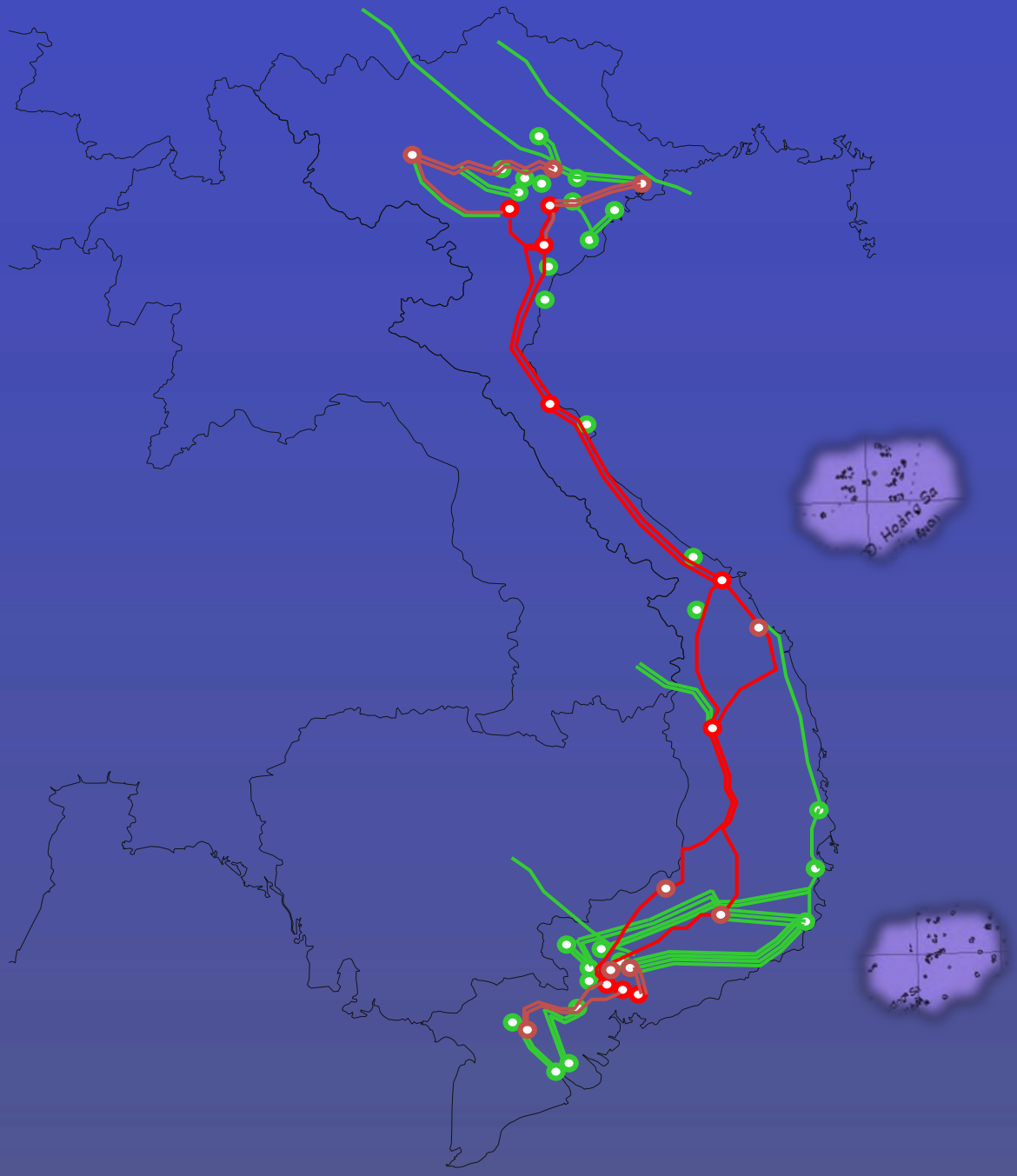
# 5. CONCLUSIONS

- Vietnam is considered to have great potential for renewable energy as well as opportunities of RE developments. RE source is one of the necessary solutions to meet energy demand and ensure power energy security, especially for remote areas, islands.
- Current Grid Codes significantly contributed to improve the safe, secure and stable operation of the Power system; enhance the open, transparent and fair of stakeholders.
- To meet the increasing of penetration of RE in power system, the technical regulation for RE need to regulate and combine with the current Grid Codes.
- Support from international organizations/developed countries in terms of financial and technical support to promote RE development in Viet Nam is really needed.

# THANKS FOR YOUR KIND ATTENTION



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