

Study Committee C2

Power system operation and control

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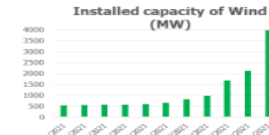
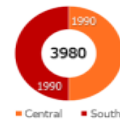
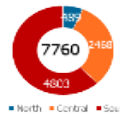
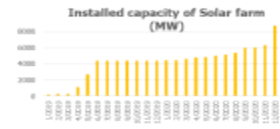
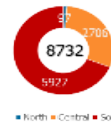
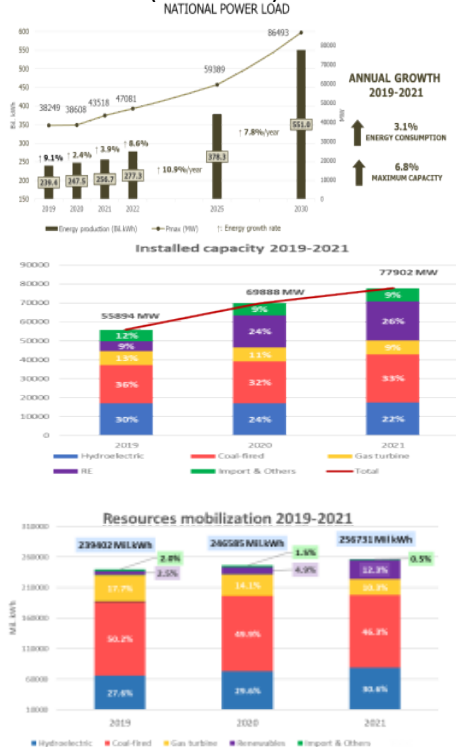
Challenges and responding to the booming of renewables in Vietnam's power system

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Motivation

- Recent development of renewable in Vietnam in the last three years
- The effect of this boom on system operation and system stability
- The solution that has been applied to cope with those challenges by the National Load Dispatch Centre of Vietnam (EVNNLDC)



Aims of the study

- Power system operation and stability problems:
 - Grid congestion
 - Power system instability: Reduced system inertia, low Short Circuit Ratio, voltage instability
 - Forecast error
- Solutions that have been applied:
 - WAMS/FR/PMU
 - AGC control
 - Inertia monitoring
 - Tuning RE/conventional control system

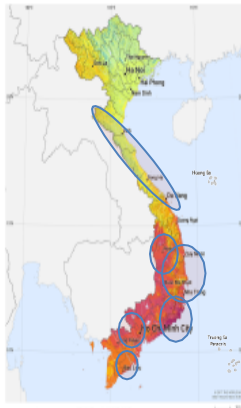
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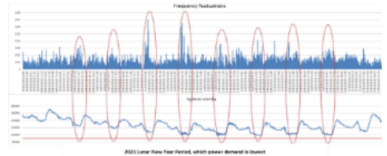
Grid Congestion

- Frequent transmission congestions in the regional 220/110 kV grid and 500kV backbone transmission lines.
- In 2021, accumulated RE curtailment reached 1.53 TWh – max 5.67 GW.



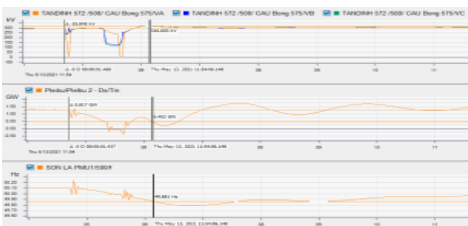
Reduced inertia

- High penetration of renewable affects system stability by reducing system inertia, reducing frequency control capabilities



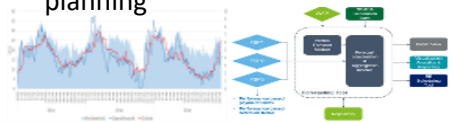
Voltage Instability and Frequency Oscillation

- Not well-calibrated Fault Ride Through (FRT) parameter of RE.
- On 13th May 2021, a consecutive of one phase to ground fault and two-phases fault led to the under-voltage to around 0.45pu, followed by ~2500 MW solar lost.



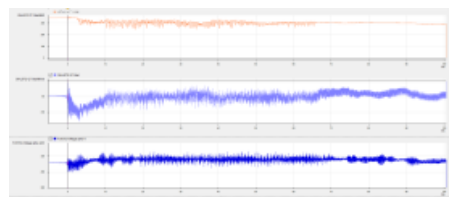
Forecast error

- High renewables forecast errors increase the absolute value of imbalance and bring difficulties in system planning



Low SCR

- Low SCR of 500kV connected solar plant resulted in high order harmonic and voltage fluctuation



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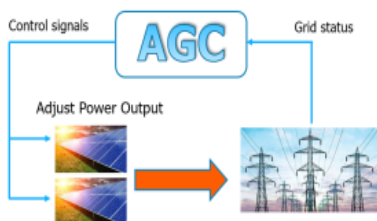
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AGC for grid congestion control

- AGC system to ensure the power grid operates within the limit permitted on both the 110kV/220kV regional grid as well as on the 500kV transmission backbone grid.



WAMS/PMU/FR and PQ systems

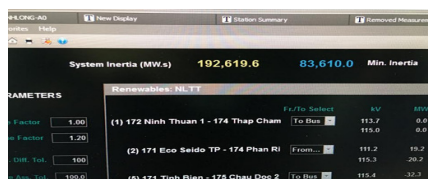
- WAMS/PMU system to monitor dynamic processes/ states power networks in real-time.
- The FR/PMU installed at:
 - 29 500kV substations, 46 220kV substations and power plants
 - More than 200 RE plants

Power plant control

- Appropriate FRT parameter of RE
- Activate Power System Stabilizer at conventional power plants

Inertia monitoring

- Tool to calculate and monitor online the system inertia and send an automatic warning to the dispatcher based on the SCADA/EMS system



Conclusion & Lesson learned

- The remarkable growth of RE at a very high rate in a short time scale has made the power system operation several problems
- Solutions include upgrading existing monitoring and controlling system such as: operating AGC, deploying WAMS/PMU system and Power Quality System, advancing renewables forecasting system, monitoring online system inertia, tuning FRT and PSS at plants