国家电网公司
STATE GRID
CORPORATION OF CHINA

3GPP TSG RAN Meeting #94-e
Electronic Meeting, December 6 – 17, 2021

RP-213243

Agenda Item: 8A.5

Source: CEPRI, China Southern Power Grid, CMCC, China Telecom, Spreadtrum Communications

Title: Motivation on smart grid differential protection backup for Rel.18

Document for: Discussion and decision

China Electric Power Research Institute

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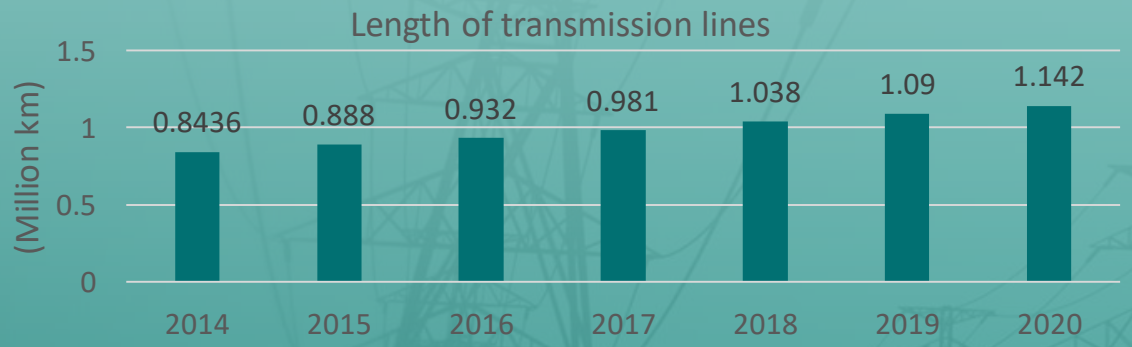
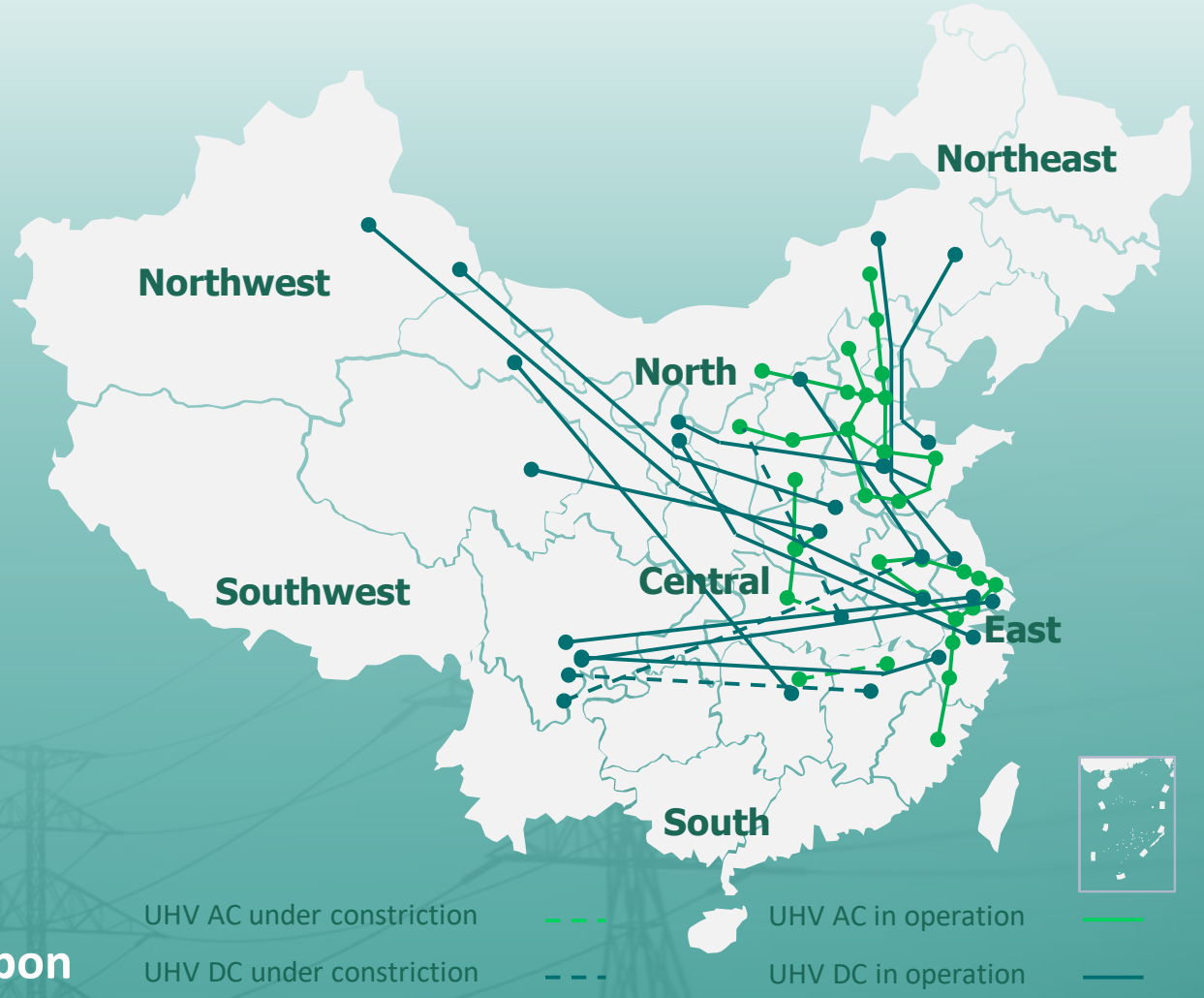
http://www.sgcc.com.cn/

Introduction on State Grid

State Grid Corporation of China (SGCC)

- The world's **largest** utility, and supplies power to **1.1** billion population with service area covering 88% of Chinese territory.
- Ranking **2nd** on Fortune Global 500 with a total revenue of 410 billion USD.
- Operates backbone energy networks in **9** countries and regions.
- Transformation(converting) capacity is **5.23** TVA(TW).
- Length of transmission lines is **1.142** million km.





SGCC Sustainable Development with Green and Low-carbon

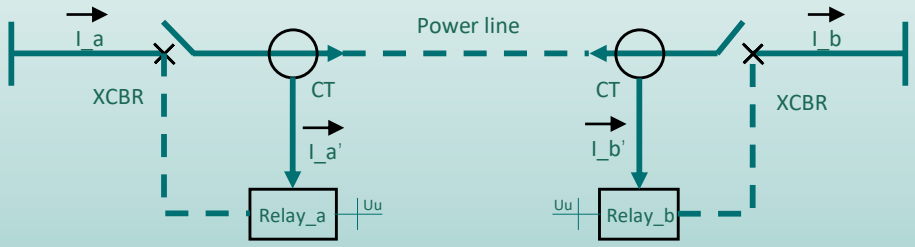
Justification on differential protection backup [1]

Differential protection

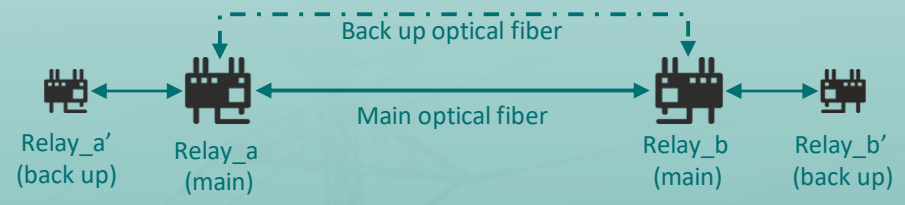
- Differential protection is used to **protect the power line** from being burnt down and any secondary damages a fireball blaze on the power line can cause.
- The mechanism of line current differential protection follows the Kirchhoff's current law, which is that the sum of currents at a junction of a circuit equals to zero.

5G back up for differential protection

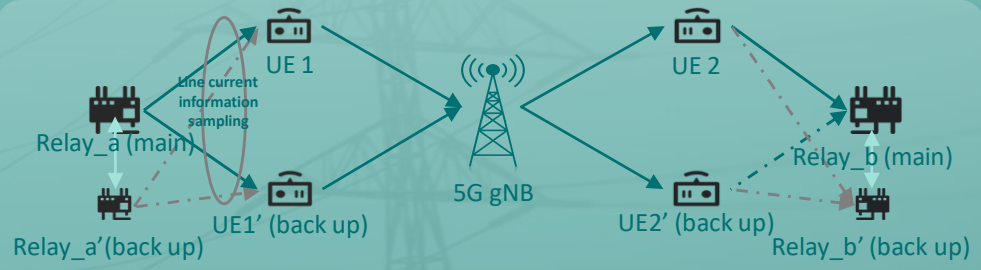
- Traditional differential protection is usually in an 1+1(even 1+N) backup mode via optical fiber. Optical fiber always brings very **high cost** and faces **great construction difficulty** in some areas, this lead to a very low penetration rate.
- **5G NR backup** mode for differential protection can potentially resolve the issues of optical fiber, and also resolve the concern from grid customers on wireless transmission robustness and is aligned with the differential protection devices which are traditionally equipped by 1+1 or 1+N backup modes.



Line Current Differential Protection by two protection relays



Traditional back up for differential protection



5G back up for differential protection

Note: In addition to SGCC, China Southern Power Grid also shows strong requirement on differential protection backup.

Proposal

- Proposal: Based on the Rel.18 candidated items, one of the following options can be considered to support differential protection backup requirement in Rel.18:
  - Option 1: Include the differential protection backup requirement into one of the exist Rel.18 items.
    - The SI or WI, which includes UE aggregation.
    - RedCap enhancement WI.
    - Other suitable R18 items.
  - Option 2: Create a new small WI to specify differential protection backup solution in Rel.18 [2]; TDMed with some Rel.18 items.

Reference

[1] RP-213211, Smart grid differential protection backup requirement for Rel.18, December 2021

[2] RAN#93 MeetingReport, September 2021

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THANKS