Practice of China Southern Power Grid to adapt natural hazards

CHINA ENERGY ENGINEERING GROUP

GUANGDONG ELECTRIC POWER DESIGN INSTITUTE CO.,LTD.

In April 2021

1、Natural hazards

There are a lot of natural hazards affecting power system, such as typhoon, ice, thunder and lightning, earthquake, etc.

The common hazards affecting CSG are typhoon and icing disaster.

Typhoon

- 2005， "Damrey", Hainan province blackout
- 2014, “Ramasoon", CSG was greatly impacted
- I2015, “Mujigae", Zhanjiang power grid was seriously damaged

Ice

- 2008, ice disaster, CSG had split into several isolated grids, 170 counties had power outages,
- Every year, there are some icing hazards

1、Natural hazards

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Typhoon landfall:

Since 2002, there has been 1 super TY, and 9 STY.
since 2013, there have been more than one STY landing every year.

	Tropical cyclone classification	Maximum mean wind speed near the bottom center (m/s)	Maximum wind near bottom center (Lever)
1	Tropical depression	10.8 ~ 17.1	6 ~ 7
2	Tropical Storm	17.2 ~ 24.4	8 ~ 9
3	Severe Tropical Storm	24.5 ~ 32.6	10 ~ 11
4	Typhoon	32.7 ~ 41.4	12 ~ 13
5	Severe Typhoon	41.5 ~ 50.9	14 ~ 15
6	Super Typhoon	≥51.0	16 and above

Year	Time	Lever 12~13	Lever 14	Lever 15	Lever 16 and above
2002	0	-	-	-	-
2003	4	4	-	-	-
2004	0	-	-	-	-
2005	1	1	-	-	-
2006	2	2	-	-	-
2007	0	-	-	-	-
2008	1	-	1	-	-
2009	2	2	-	-	-
2010	2	2	-	-	-
2011	1	-	1	-	-
2012	2	2	-	-	-
2013	2	-	2	-	-
2014	2	1	-	-	1
2015	1	-	-	1	-
2016	3	-	3	-	-
2017	2	1	1	-	-
合计	25	15	8	1	1

2、The impact

	TY	Ice
Mechanical failure	• Damage of O/H transmission line even cause collapse of OHL • Damage of distribution network facilities. • ……	• In 2008, there were 8,709 transmission towers falling on 110kV and above in CSG, and more than 27,000 lines were broken.
Electrical failure	• Flashover due to windage yaw,….	• Ice flash, .,….
Evolution of event	Fast	Slow
Consequence	• May cause power grid blackout.	• Local power grid may be isolated from main grids.

2、The impact

What can we do to the hazards?

Enhancing the Resilience of power grid!!!

3、The main measures

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Measures being taken for typhoon: Managing & Technical aspects

Managing measures

Pre-risk assessment and pre-control:

- operation mode arrangement ;
- special maintenance of key facilities ;
- Environmental improvement for electric power facilities — tree barrier clean, matters easily blown up.

Establishment of the typhoon emergency managing system :

- Systematical management ;
- Emergency equipment, rush-repair teams, emergency supplies.

Establishment of emergency command platform:

- Hardware equipment and software system ;
- Managing and utilizing all information.

Technical measures

Establishing standards contrapuntally:

- *Technical Code for Windproof Design of Distribution Circuit*
- *Technical specification for windproof design of transmission lines*
- *Guidelines for Windproof Works of transmission lines*

High technology helps fight disasters:

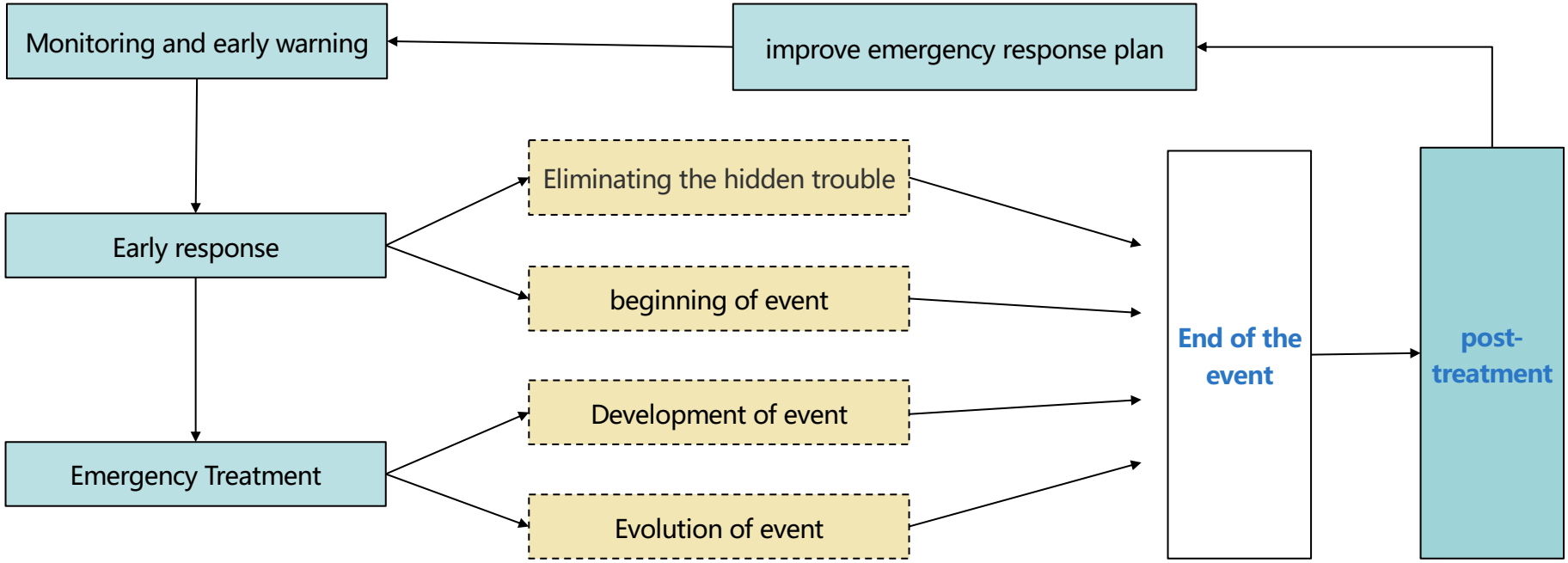
- **Helicopters and UAV :** Survey the damage and search for routine of recovery ;
- **Satellite network** : Transmitting real-time information of site ;
- **"Micro meteorological" system** : Collecting meteorological information in real.

Refining the minimum power grid

- Transmission network: tower reinforcement;
- Distribution network: using underground cable, upgrading and transforming distribution lines.

3、The main measures

Procedure of power grid against typhoon



3、The main measures

Protection measures of power grid against icing

Power Grid Level :

- Establishing real-time icing warning system.
- Establishing Icing observation station .
- Drawing the distribution map of icing range in each province.

Power plant, substation:

- Improve the ice-breaking ability ;
- Optimize insulation design;
- Considering the ice load and its non-uniformity.
- Setting up de-icing device.

Power lines:

- Determine the design ice thickness reasonably ;
- Try to avoid repeating ice areas ;
- **Important user:**
- Equipped with emergency power supply.

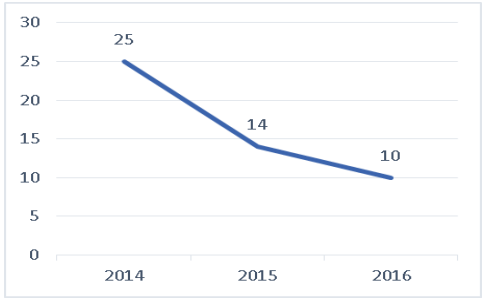
4、The results

Protection effect of power grid against typhoon

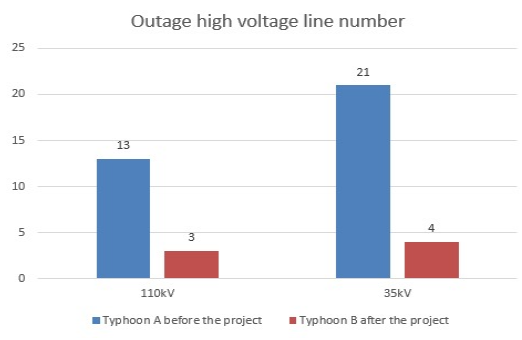
Case : Assessment of Wind Protective Project in a coastal city from 2014 to 2016.

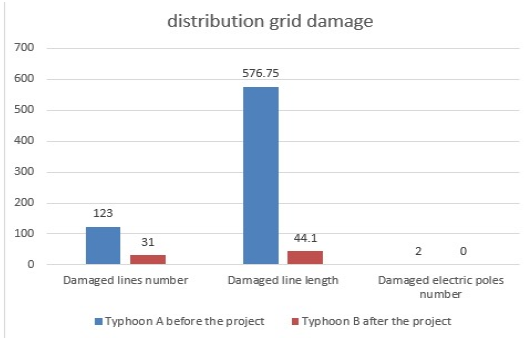
- 107 projects for 110kV, 35kV, 10kV and below
- Investment 17.02 M USD

	2014	2015	2016
Average time for urban power restoration(h)	4	1.78	1.77
Average time for rural power restoration(h)	5	2.49	2.49



Average interruption time





Achievement of power grid against icing

- In 2018, 243 circuit/times melted ice;
- In 2019, 23 circuit/times melted ice;
- In 2020, 252 circuit/times melted ice.

Thanks for Attention!

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