



การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

Overvoltage Consideration in Grounding of Distributed Generation



NAT SONGKRAM

Power Quality Section

Provincial Electricity Authority



การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

Objective

To study electrical phenomena, *overvoltage* that occur in medium voltage 22kV distribution system with *distributed generation*.



การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY



- | | |
|------------------|---------------|
| 1. Mueang Phayao | 6. Pong |
| 2. Chun | 7. Mae Chai |
| 3. Chiang Kham | 8. Phu Sang |
| 4. Chiang Muan | 9. Phu Kamyao |
| 5. Dok Khamtai | |



การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

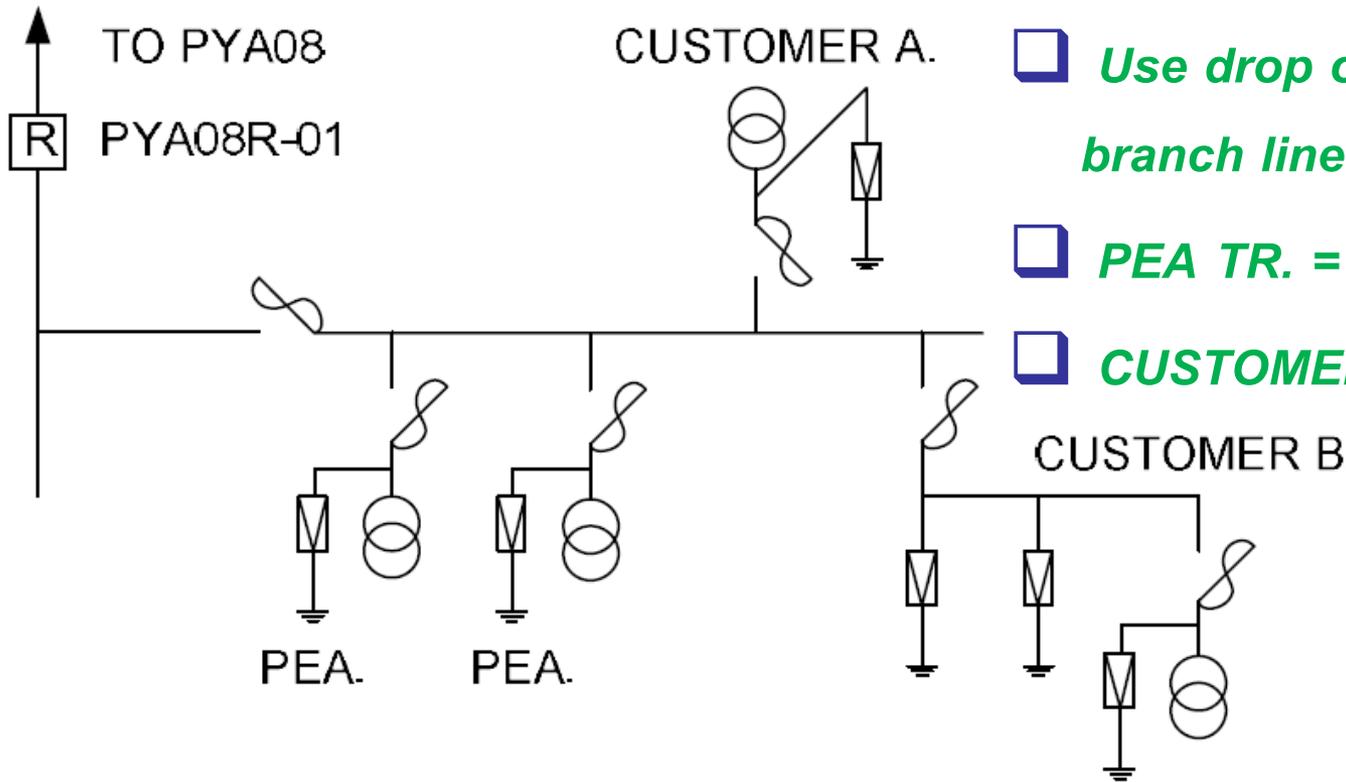
Introduction

- ❑ *From customer complain in Payao province*
- ❑ *Lightning arrester failed quite frequently.*
- ❑ *Long time outage*

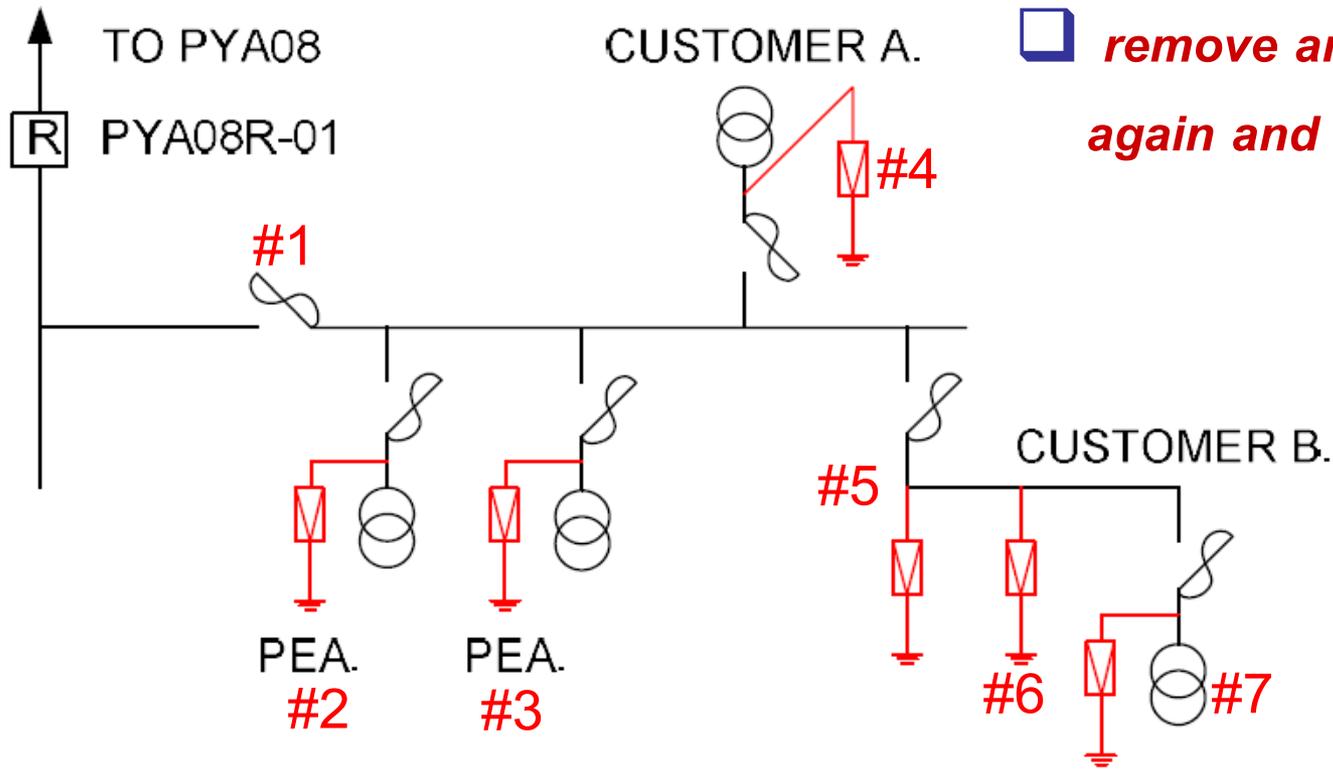




SINGLE LINE DIAGRAM



- Overhead Line 50Sq.mm.ACSR.
- Install recloser in middle of line
- Use drop out fuse to protect branch line
- PEA TR. = 2 sets
- CUSTOMER TR.= 2 sets



Lightning arrester failed the same time ,branch line 6 points.

remove and install new LA again and again.



 **#1 Branch line protection**



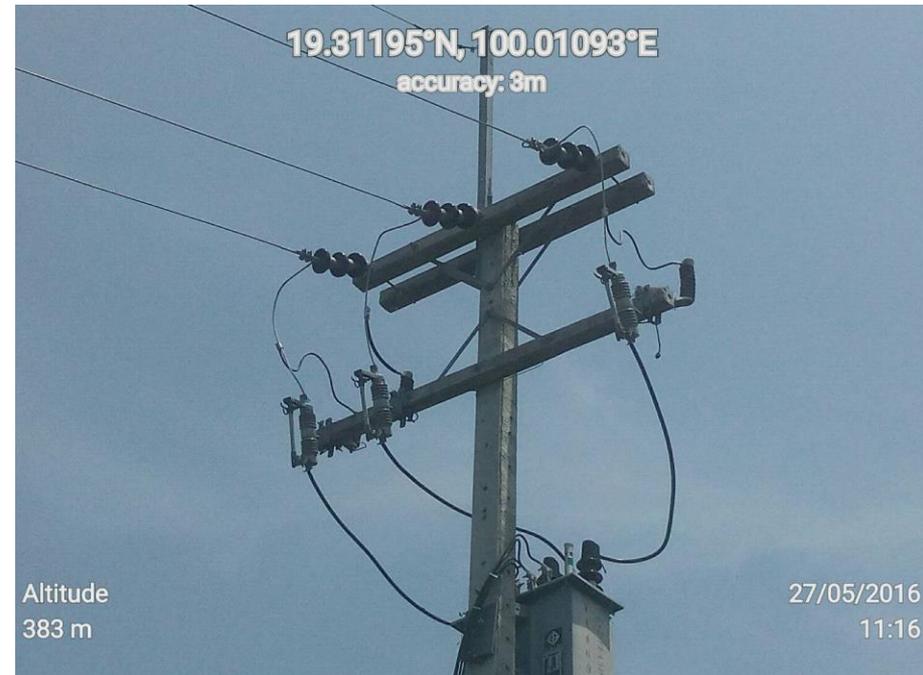
 **#2 PEA. Transformer**



การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY



 **#3 PEA. Transformer**



 **#4 Customer A**



#5 PCC. Metering
point



#5 PCC. Metering point



การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY



 **#6 Middle line in customer B.**



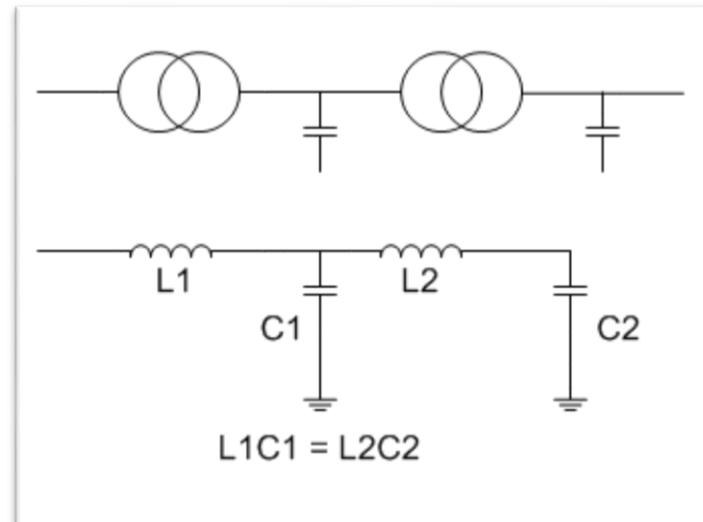
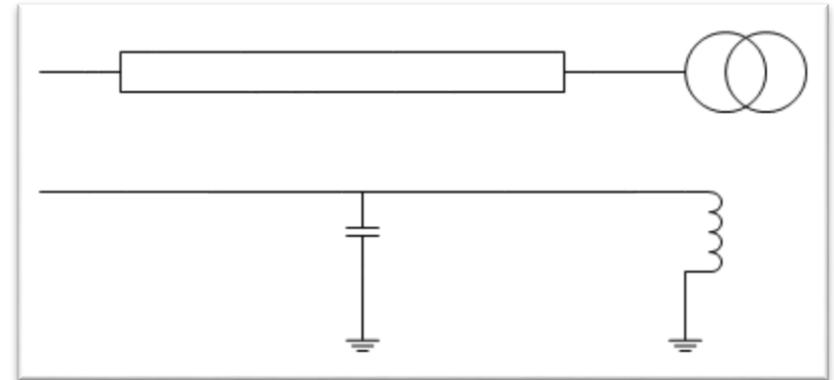
 **#7 Customer B. Transformer**

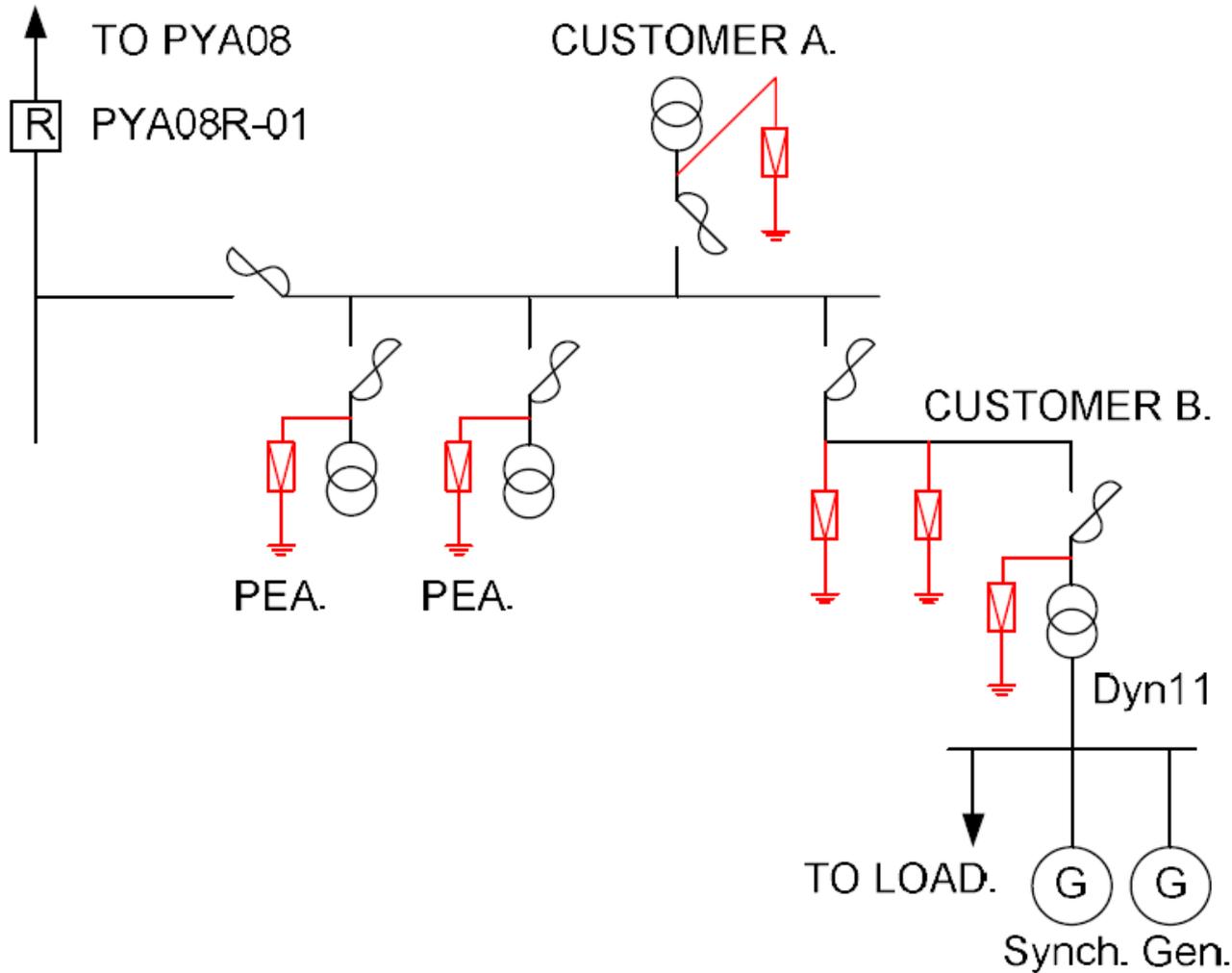


การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

Possible Power Quality Issue

- ☐ *Lightning Impulse*
- ☐ *Poor Lightning Arrester Production*
- ☐ *Voltage Magnification*
- ☐ *Temporary Overvoltage*







There is no 59N

“Ground fault Overvoltage Relay”



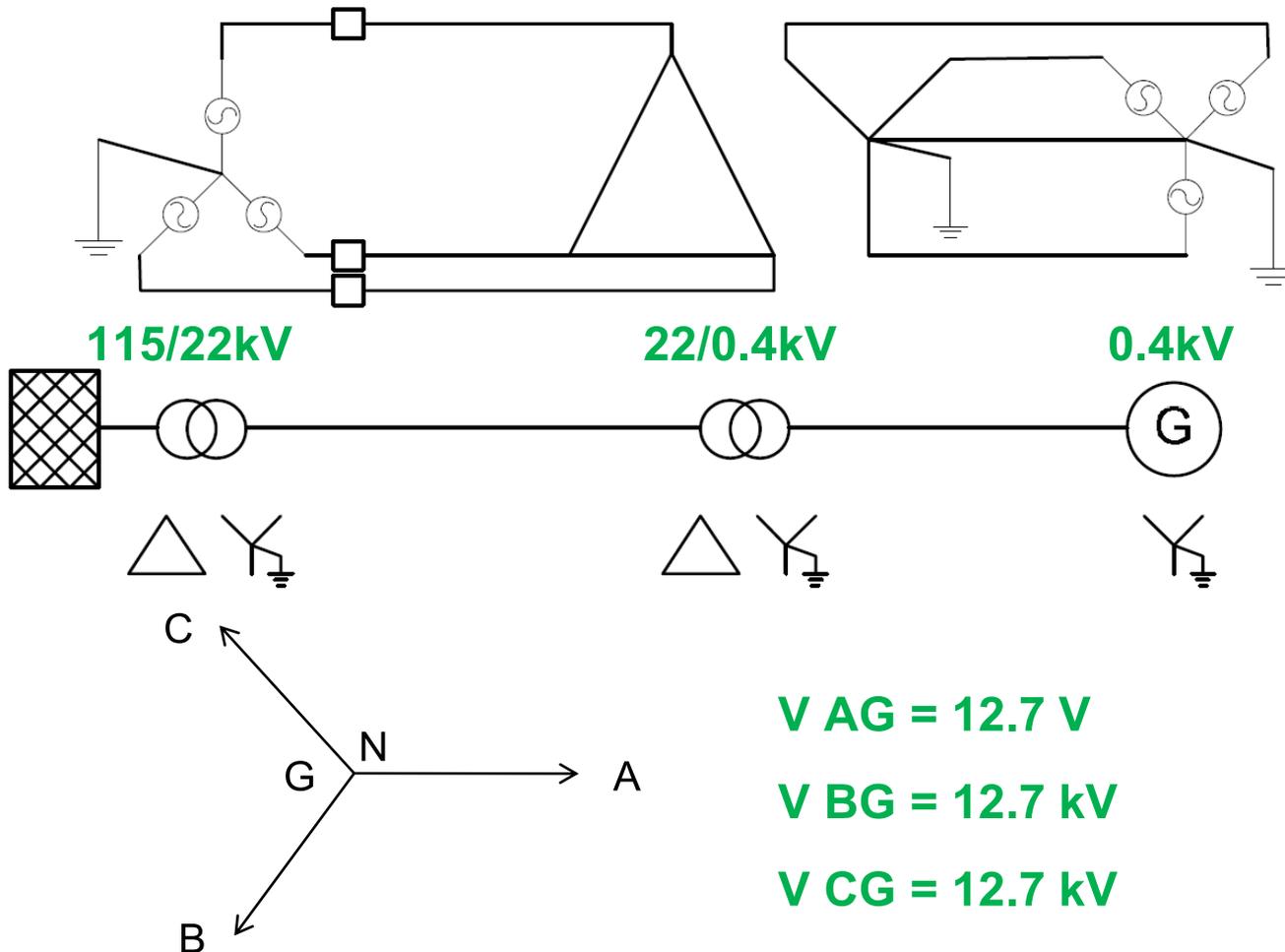
GENERATOR 1



GENERATOR 2

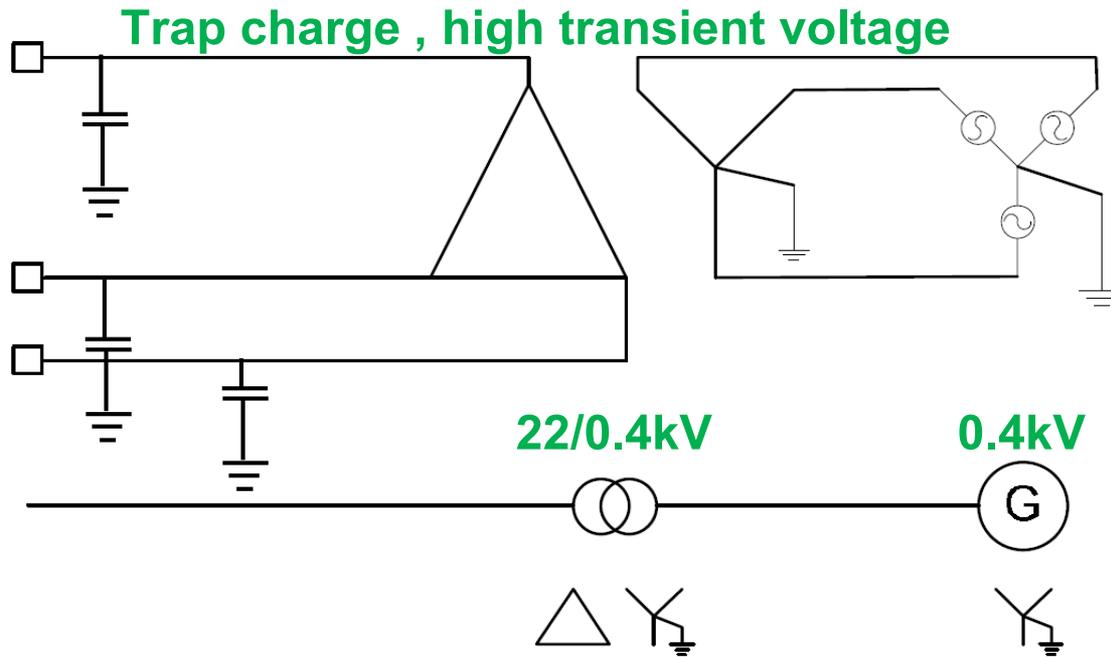


Normal Load Flow



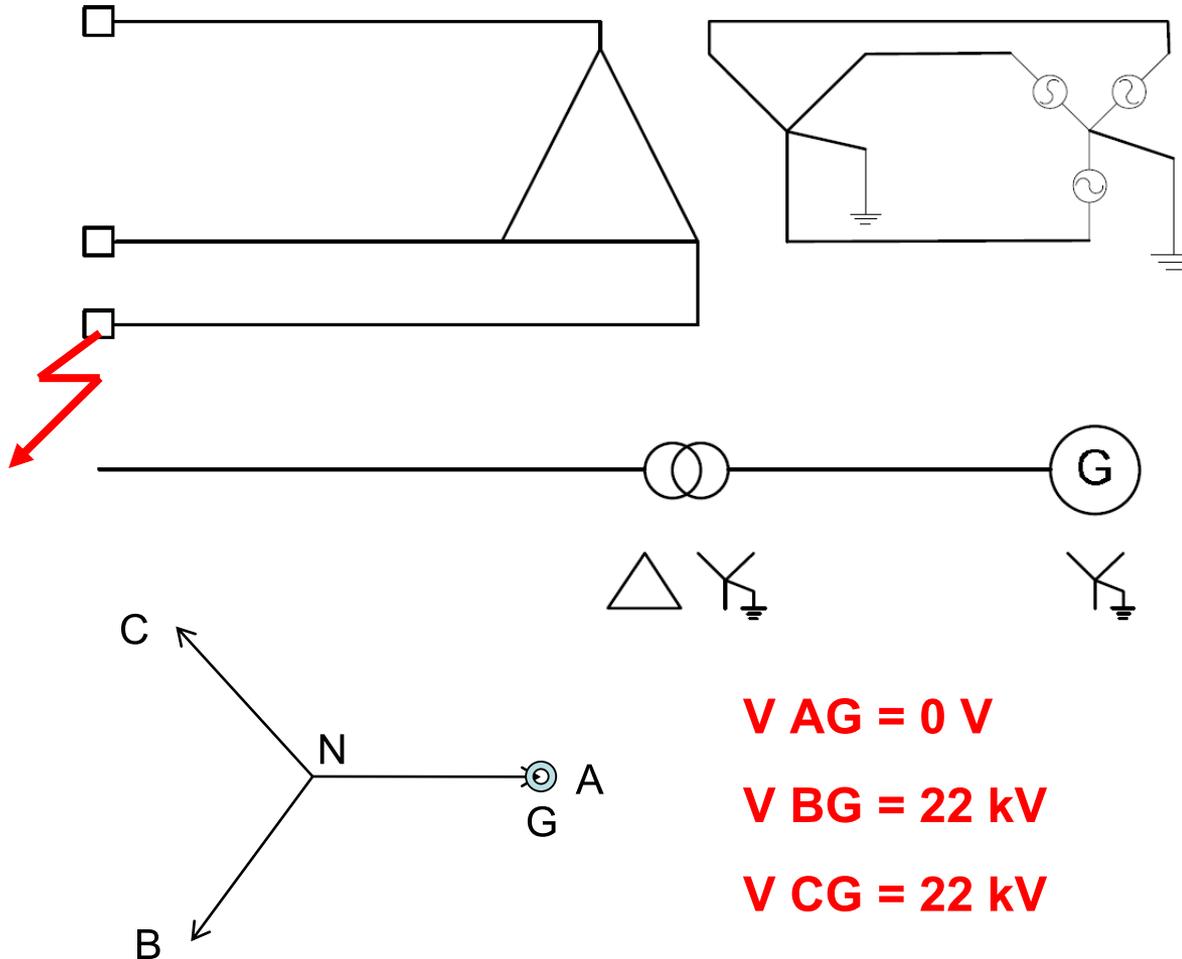


Recloser Open , Ungrounded System



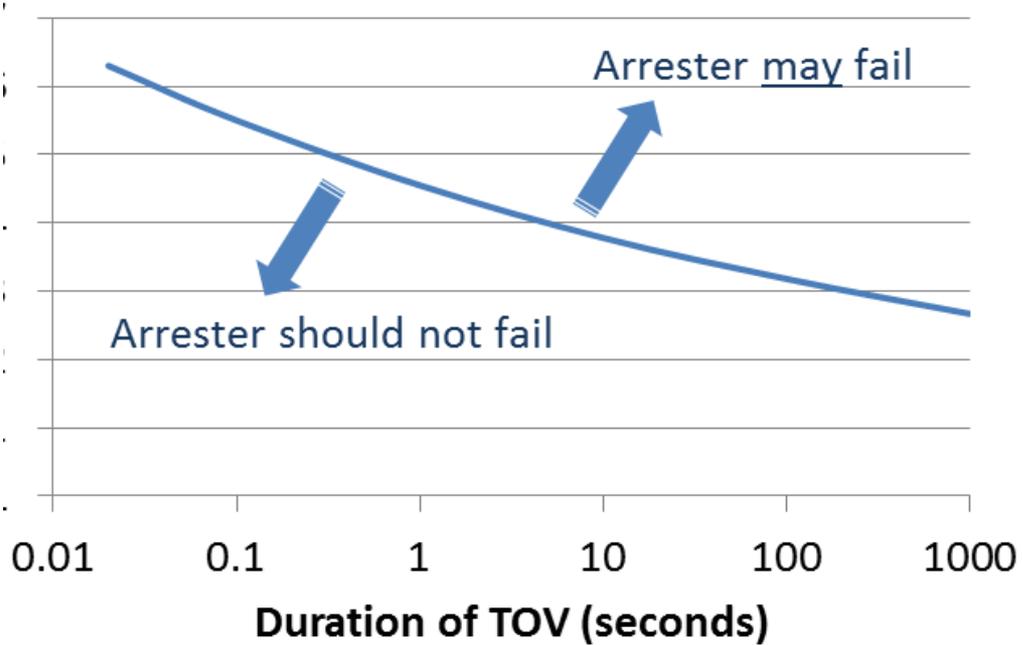


Fault in Ungrounded System





Per unit of MCOV





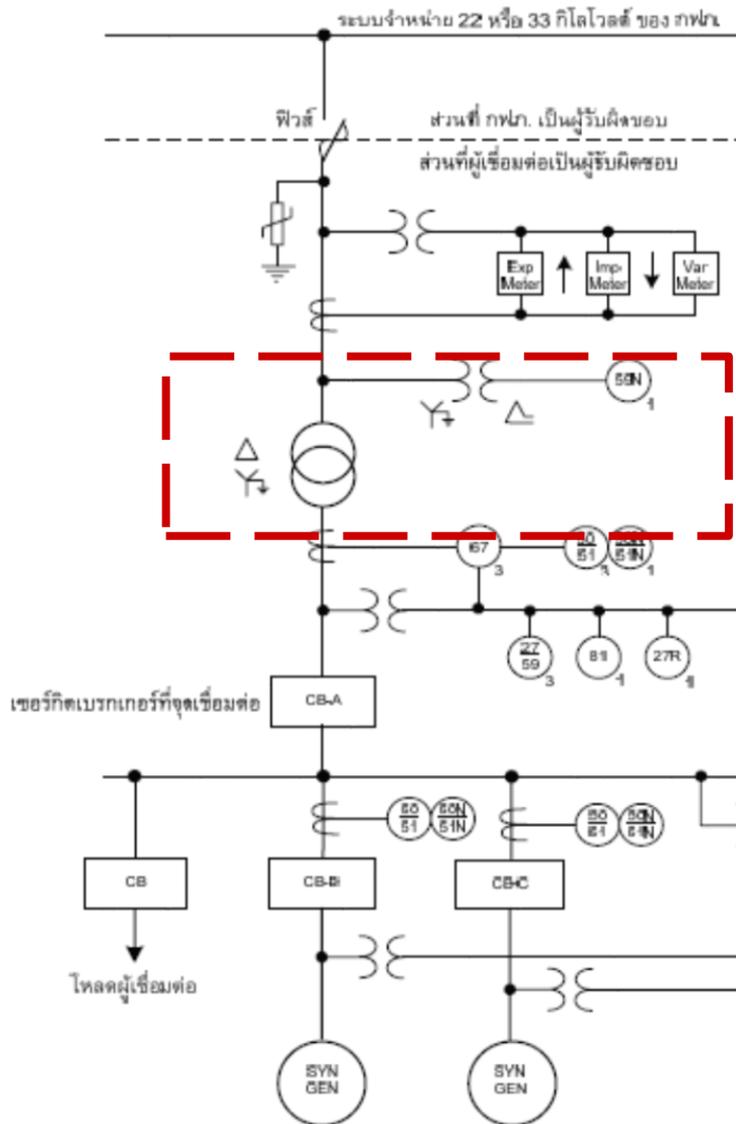
การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

Summary

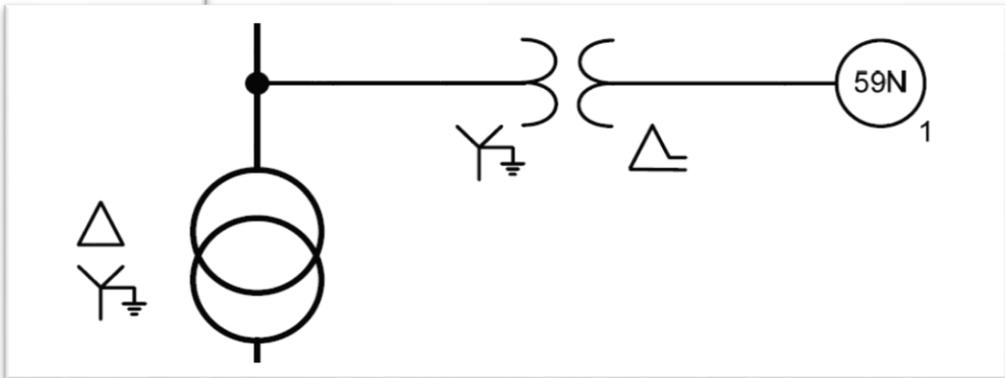
- Ungrounded System may accidentally occur during CB. Open and DG. Connected with Dyn transformer**
- When fault in distribution line , Unfaulted phase Voltage L to G may meet high TOV. about 1.732 times L to N**
- During ungrounded system time LA in unfaulted phase try to transfer energy to ambient . But they can not.
(thermal runaway)**



Solution



PEA. GRID CODE



VT connected in Wye-grounded to broken-delta configuration

1. Install 59N ??
 2. Change Mode.
- No synchronization??**



การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

Conclusion

- This study try to explain temporary overvoltage (TOV.) in distribution system with distributed generation.***
- Follow the PEA. Grid code , can solve the problem TOV. In ungrounded distribution system .***



การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

Overvoltage Consideration in Grounding of Distributed Generation

NAT SONGKRAM

Power Quality Section

Provincial Electricity Authority

