PEA MICROGRID FOR REMOTE AREA ELECTRIFICATION

CASE STUDY AT BAN KHUN PAE, CHIANG-MAI PROVINCE

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PEA North Region 1

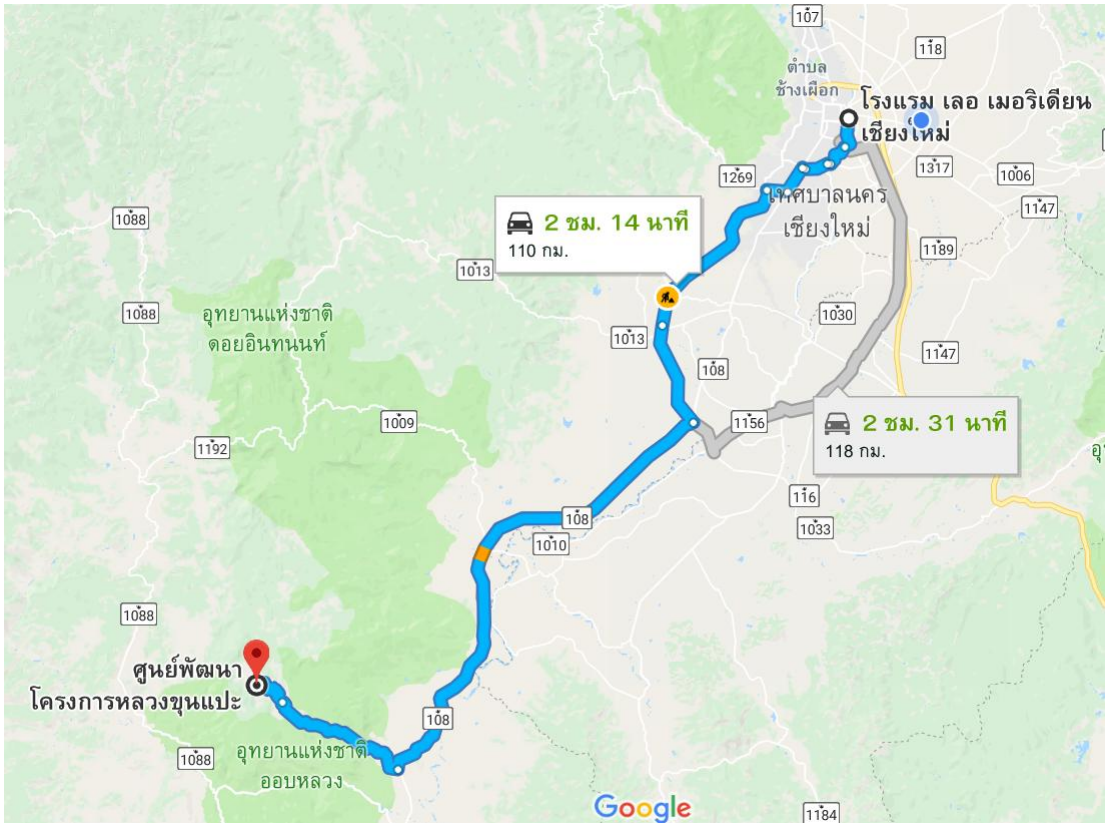
== PEA ==
PROVINCIAL ELECTRICITY AUTHORITY

- Distribution Utility (State own Enterprise)
- 74 provinces electrification (99% of Area)
- Established since 1960 (58 years)
- 19.36 Million customers
- 946 branch offices
- Electrical energy139,548 GWh

ELECTRICAL INFORMATION

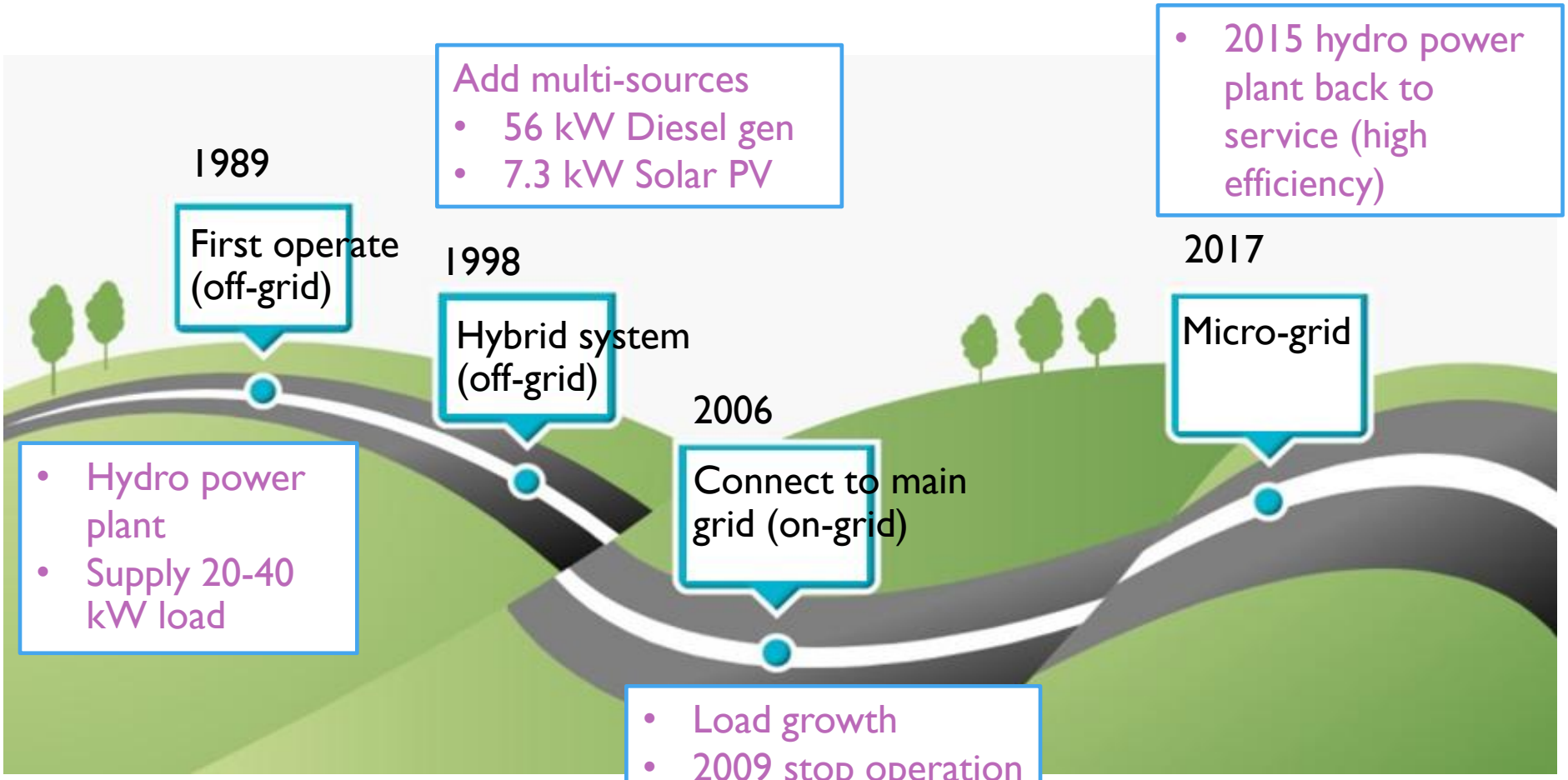
- Peak Load = 19,721 MW (Purchase from EGAT)
- 99.99% Electrification (74,297 villages)
- System voltage 115 kV, 22/33 kV and 380/220 V
- 582 distribution substations
- Overhead distribution line, underground cable, submarine cable (on grid)
- Some off-grid area is developed by DEDE

BAN KHUN PAE, CHIANG MAI



- 35 km from Hod Substation (110 km from Chiang Mai)
- 483 households
- People mostly are agriculturist.
- Land sloping are greater than 12% (75% of the total area)
- Important load
  1. Royal project (Promotion of agricultural occupation in the area)
  2. Public health center
  3. School

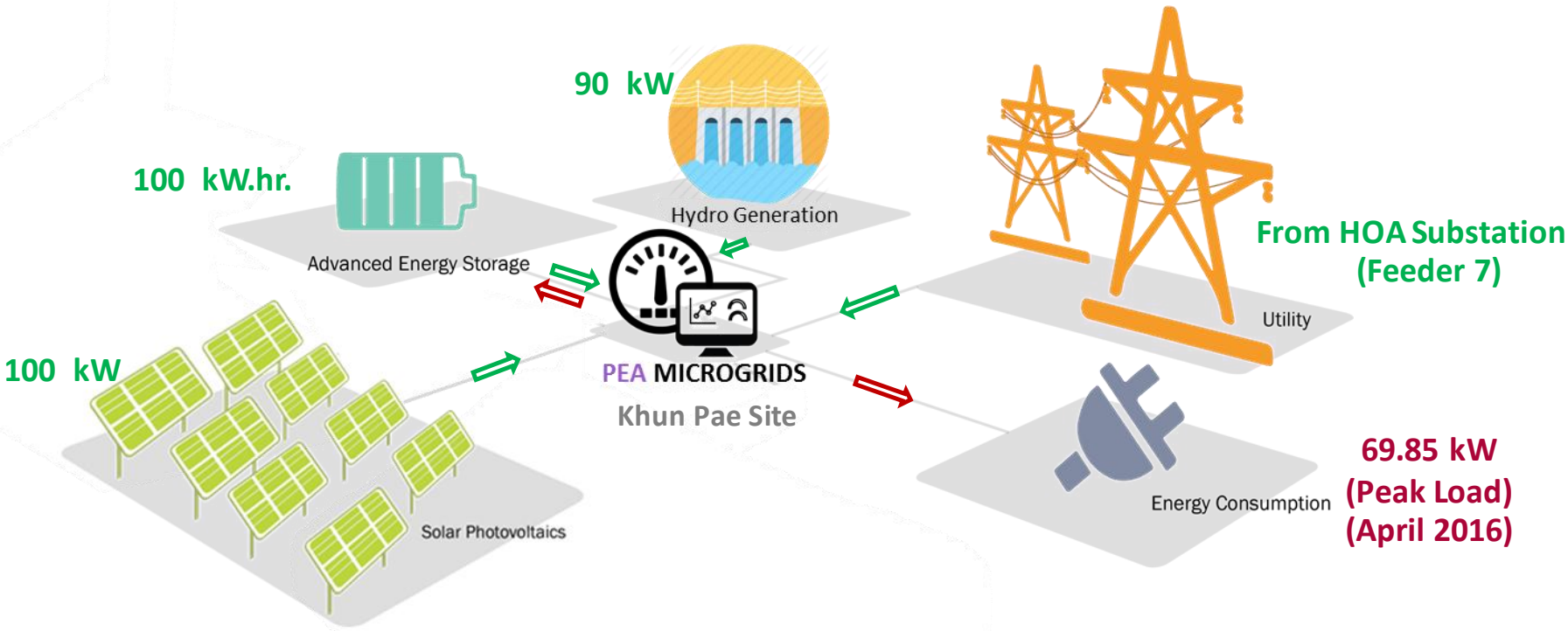
HISTORICAL OF ELECTRIFICATION



MICRO GRID DEVELOPMENT OBJECTIVE

1. Research and development in new technology
2. Improve system reliability and quality of supply
3. Power loss reduction
4. Utilize local energy resource and green energy
5. CSR project

MAJOR SYSTEM COMPONENT

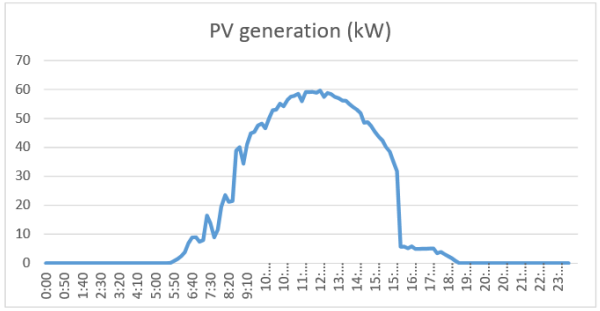


HYDRO POWER PLANT

- New turbine design for high efficiency
- Rated = 90 kW (Avg. = 36 kW, Max = 56 kW)
- Less energy production during summer
- Energy production = 320,000 kWh/year

SOLAR FARM

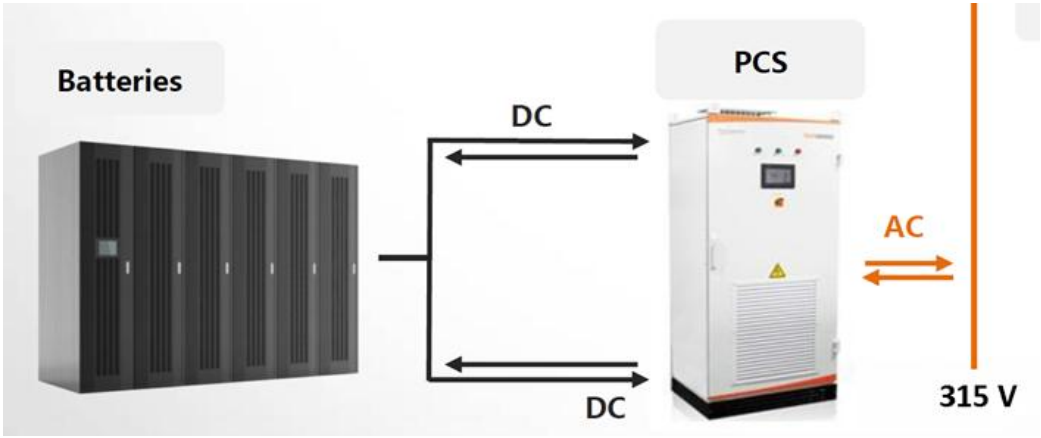
- Size = 100 kWp
- Energy production = 120,000 kWh/year



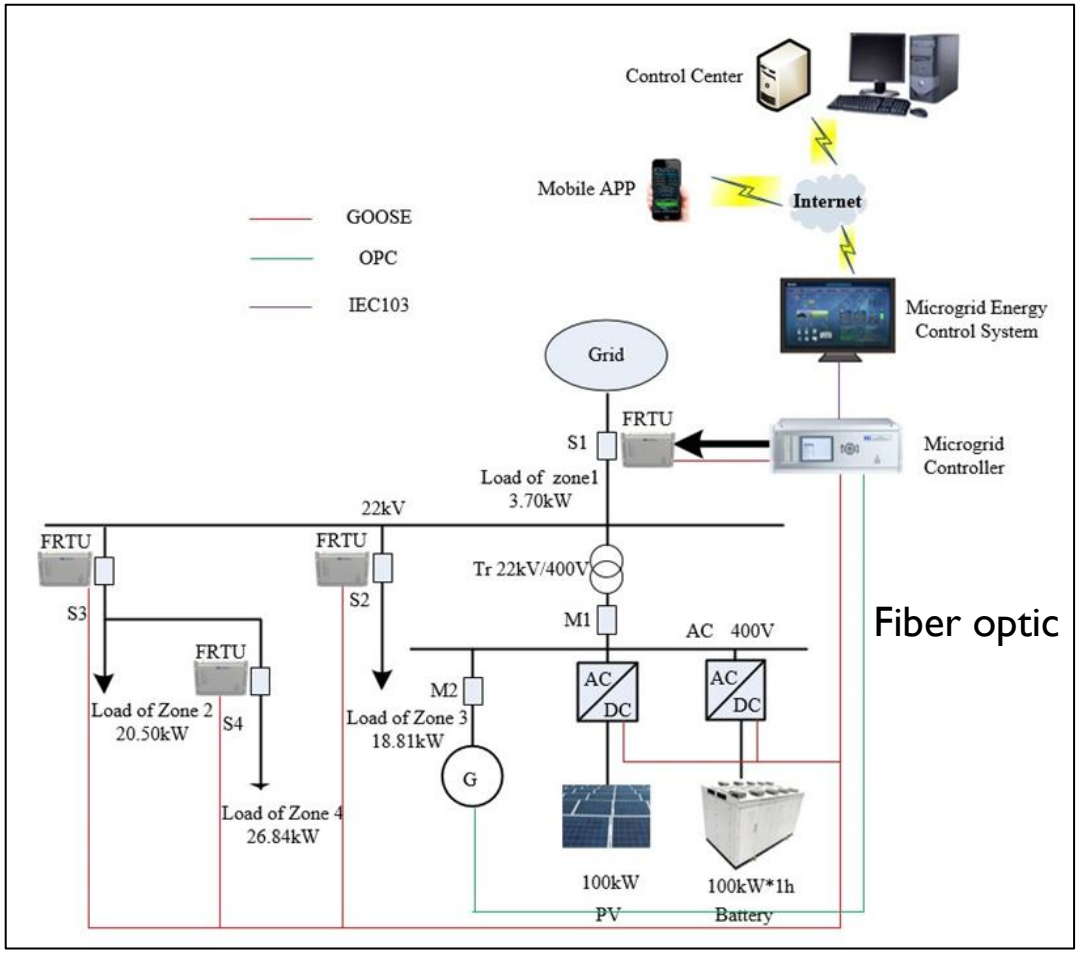
รูปที่ 1.6 ลักษณะกำลังไฟฟ้าที่ผลิตจากระบบโฟโตโวลตาอิก

BATTERY STORAGE

- Lithium Ion Battery
- Capacity = 100 kWh
- Max output power = 100 kW
- PF = ± 0.90

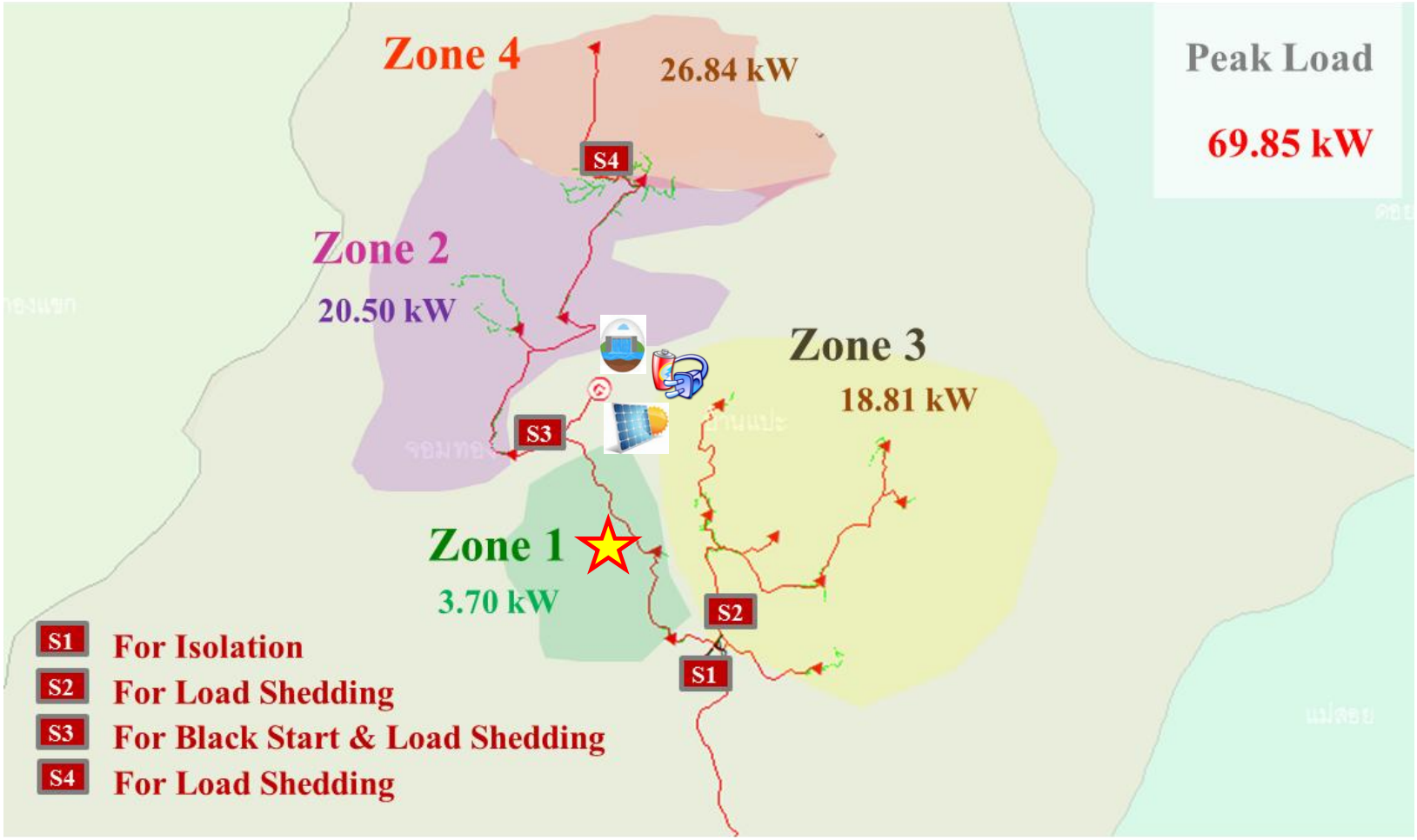


MICROGRID CONTROLLER

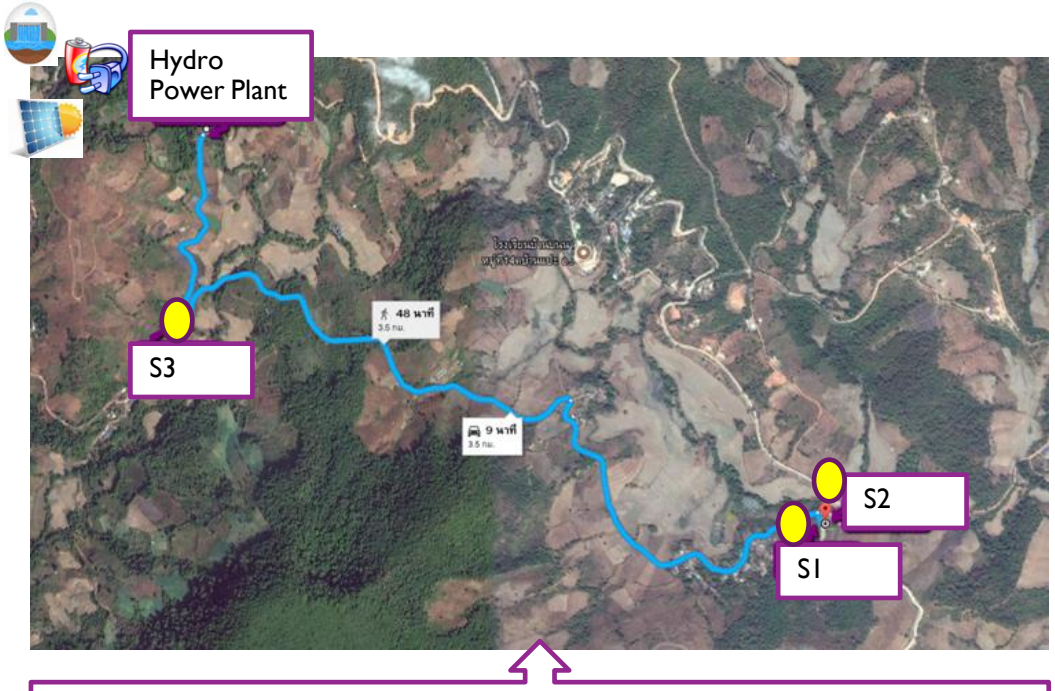


- NR Product
- Model PCS9617MG

SINGLE LINE DIAGRAM AND SWITCHES

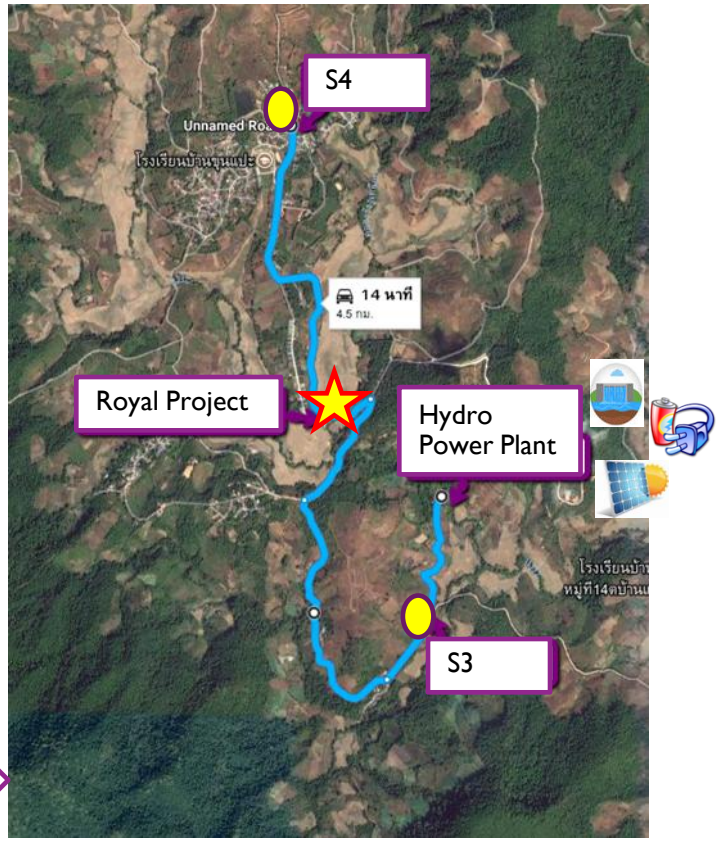


COMMUNICATION

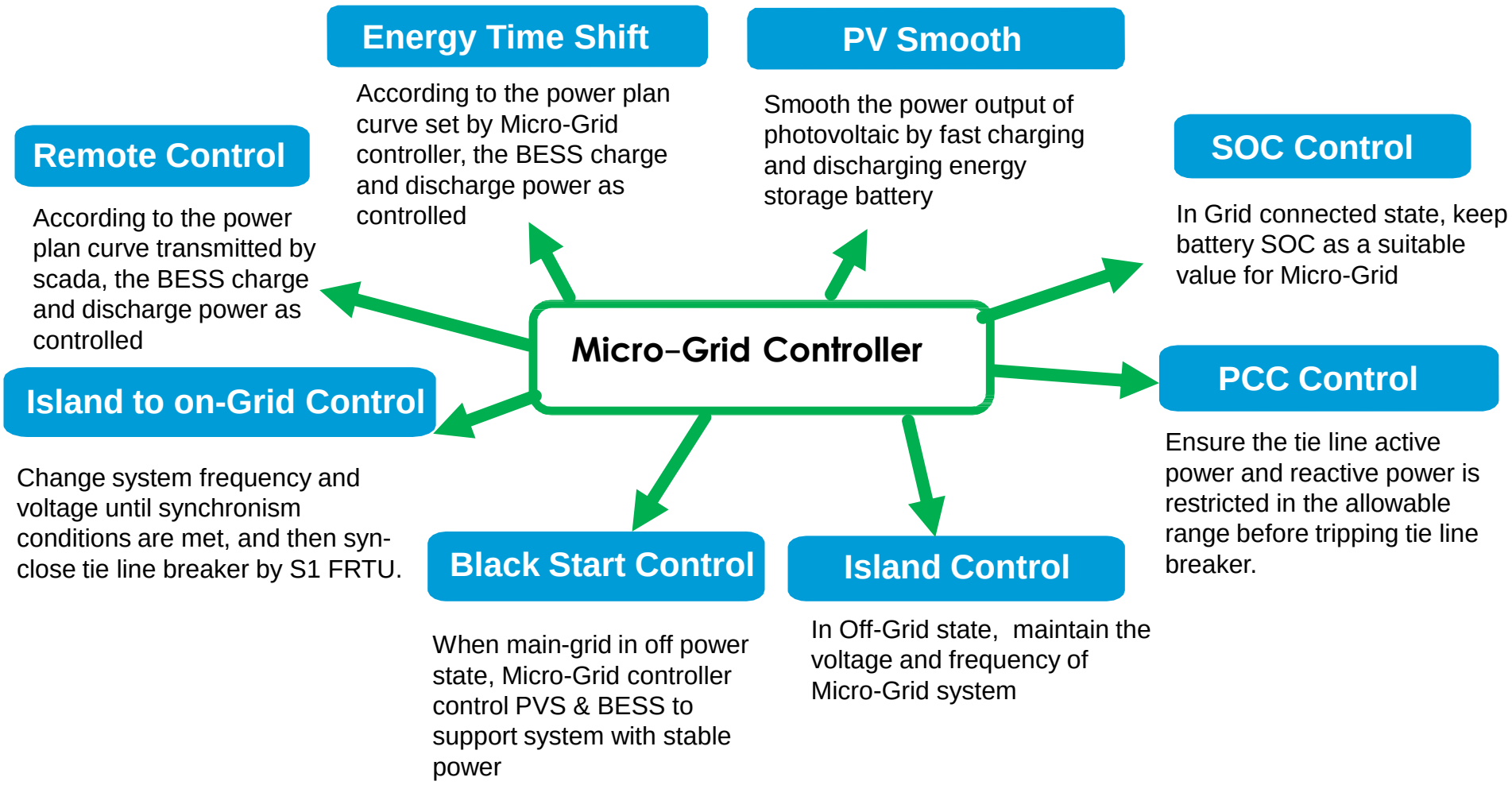


Fiber optic route S1 S2 S3 to Hydro power plant

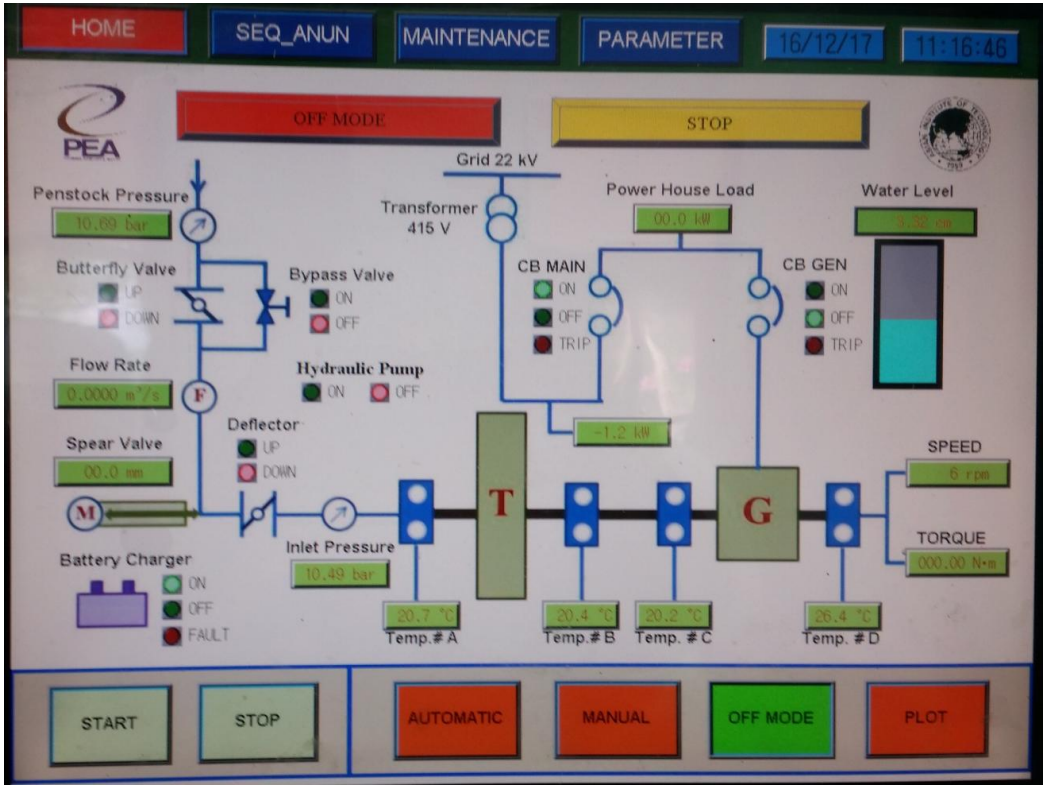
Fiber optic route S3 S4 to Hydro power plant



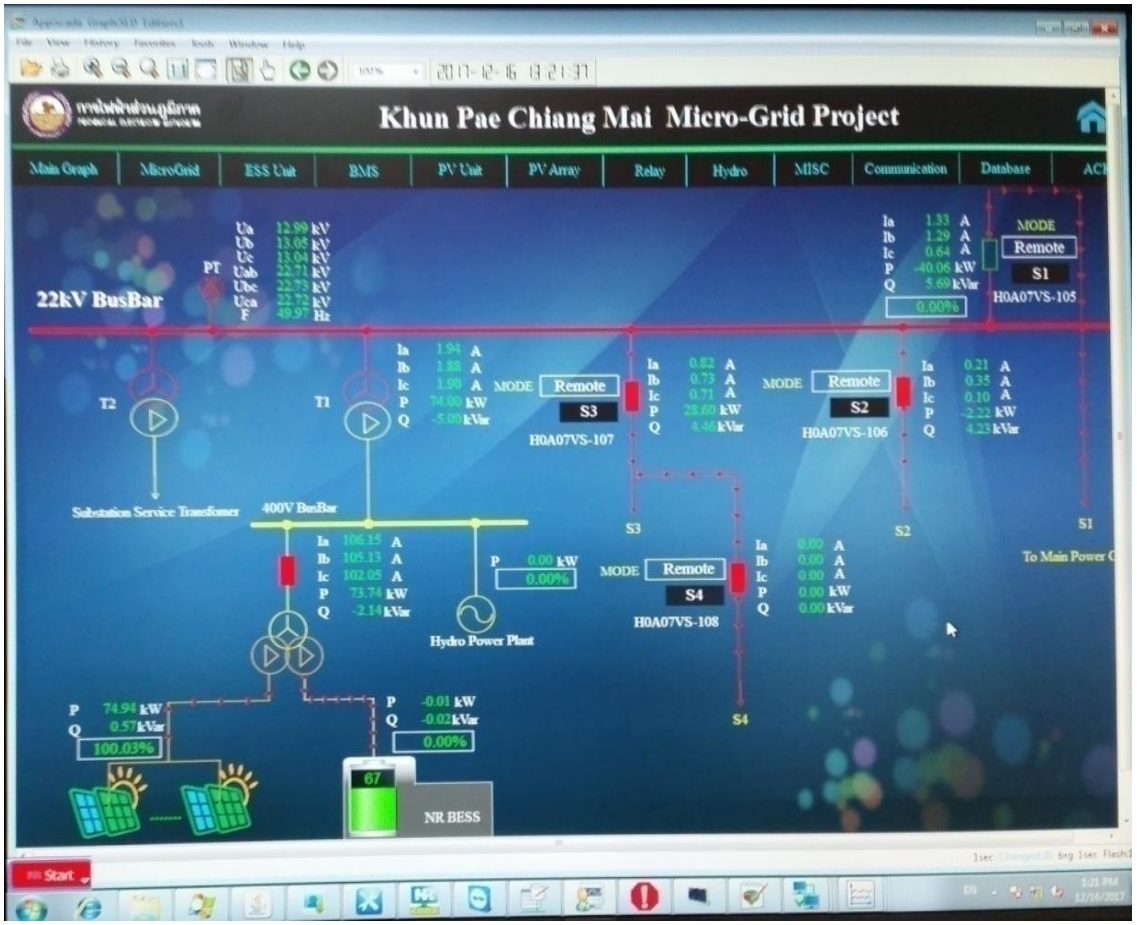
MICRO GRID CONTROLLER 8 MAIN FUNCTIONS

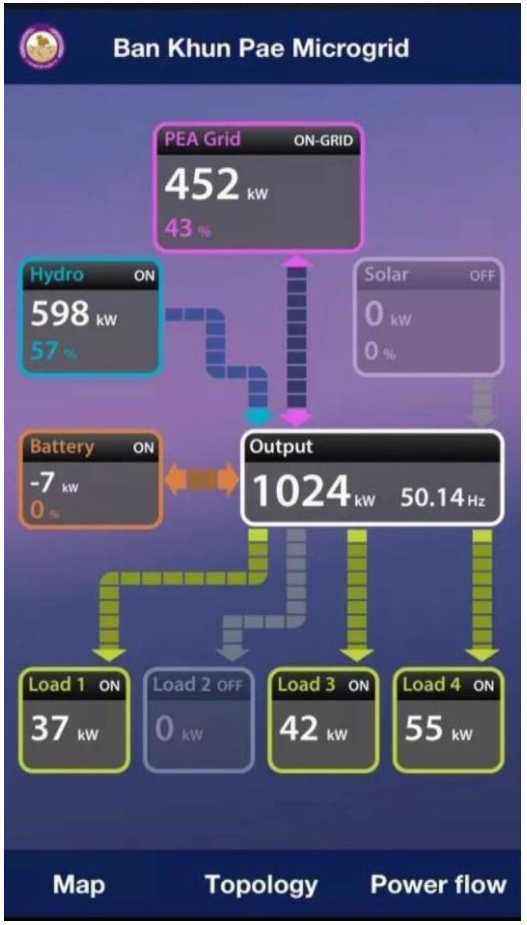


EXAMPLE OF HMI (HYDRO POWER PLANT)

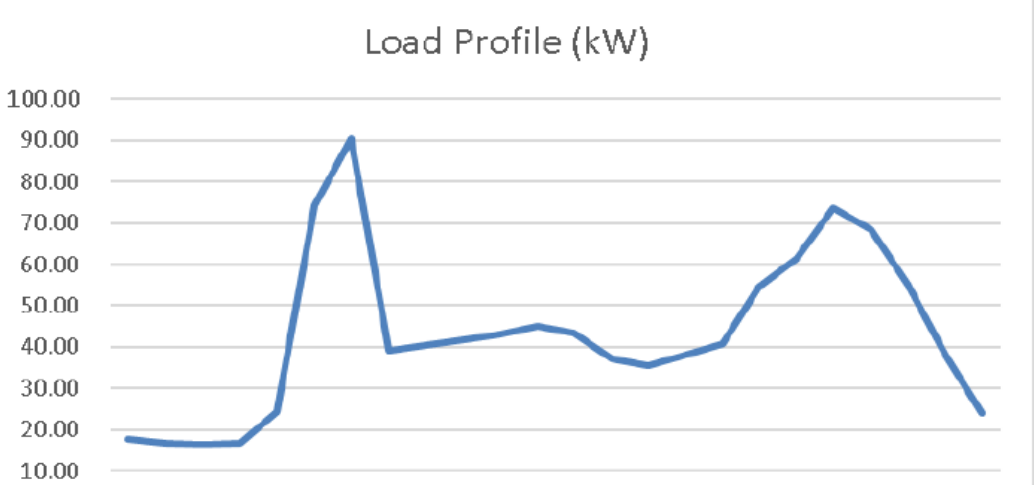


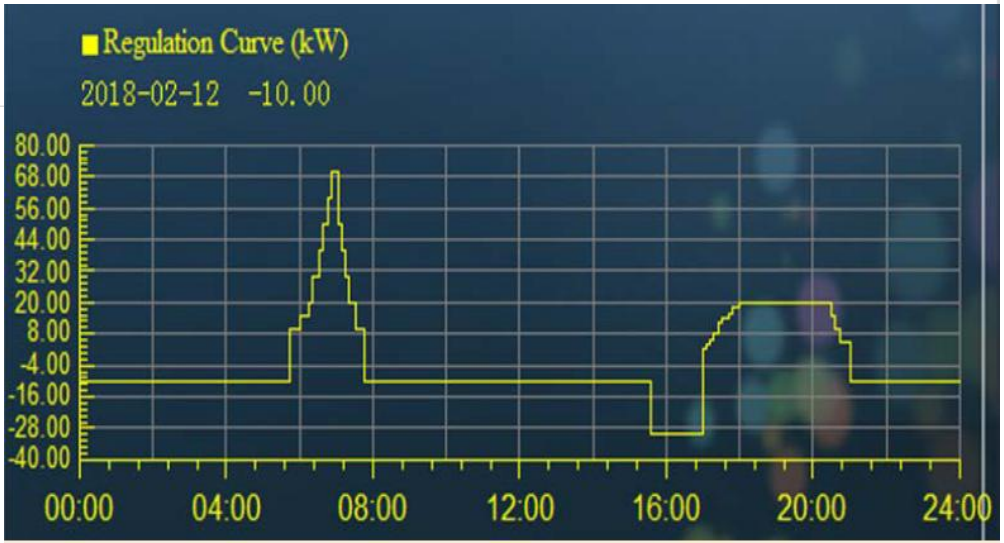
EXAMPLE OF HMI (MICRO GRID CONTROLLER)





SOME RESULTS





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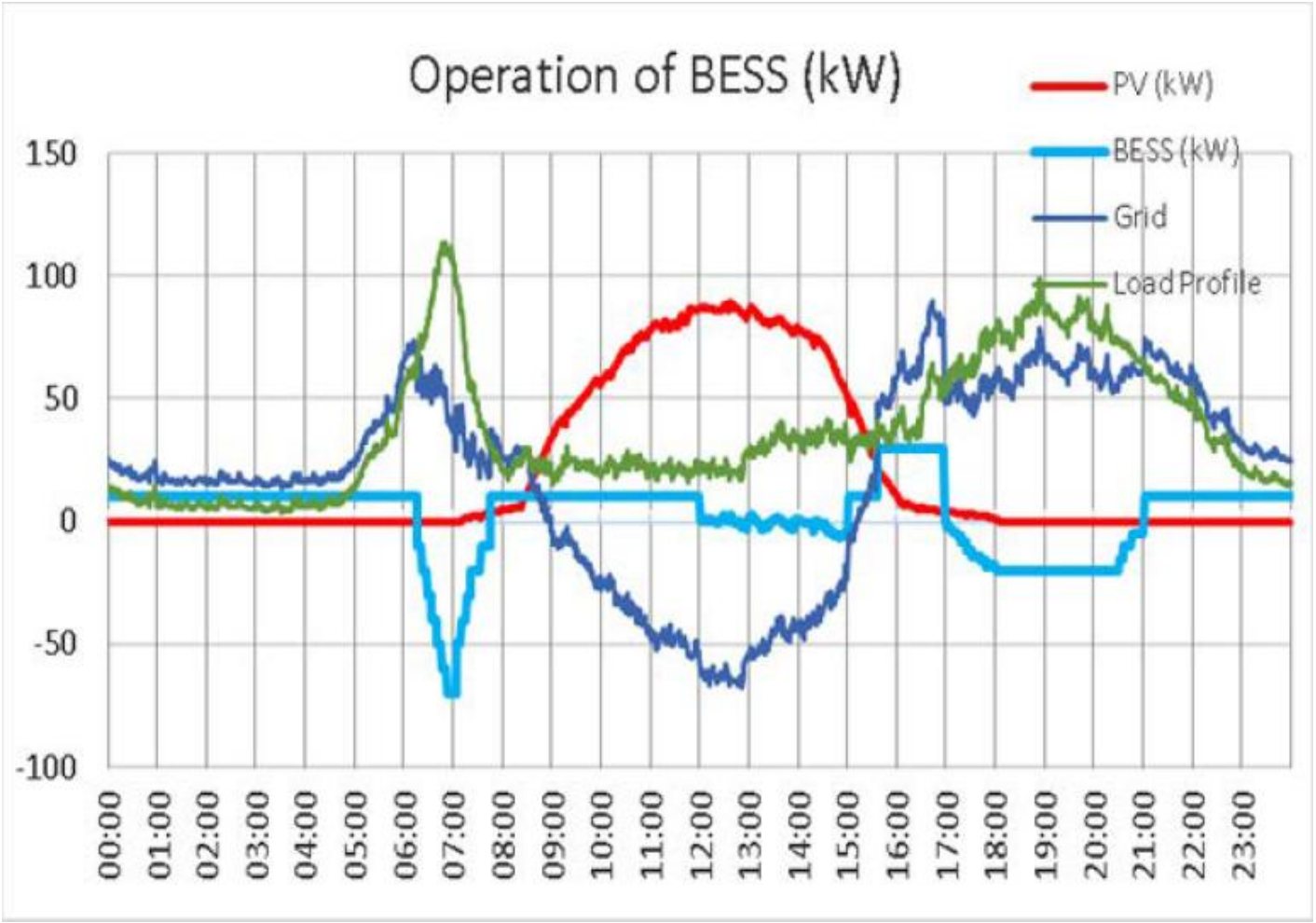

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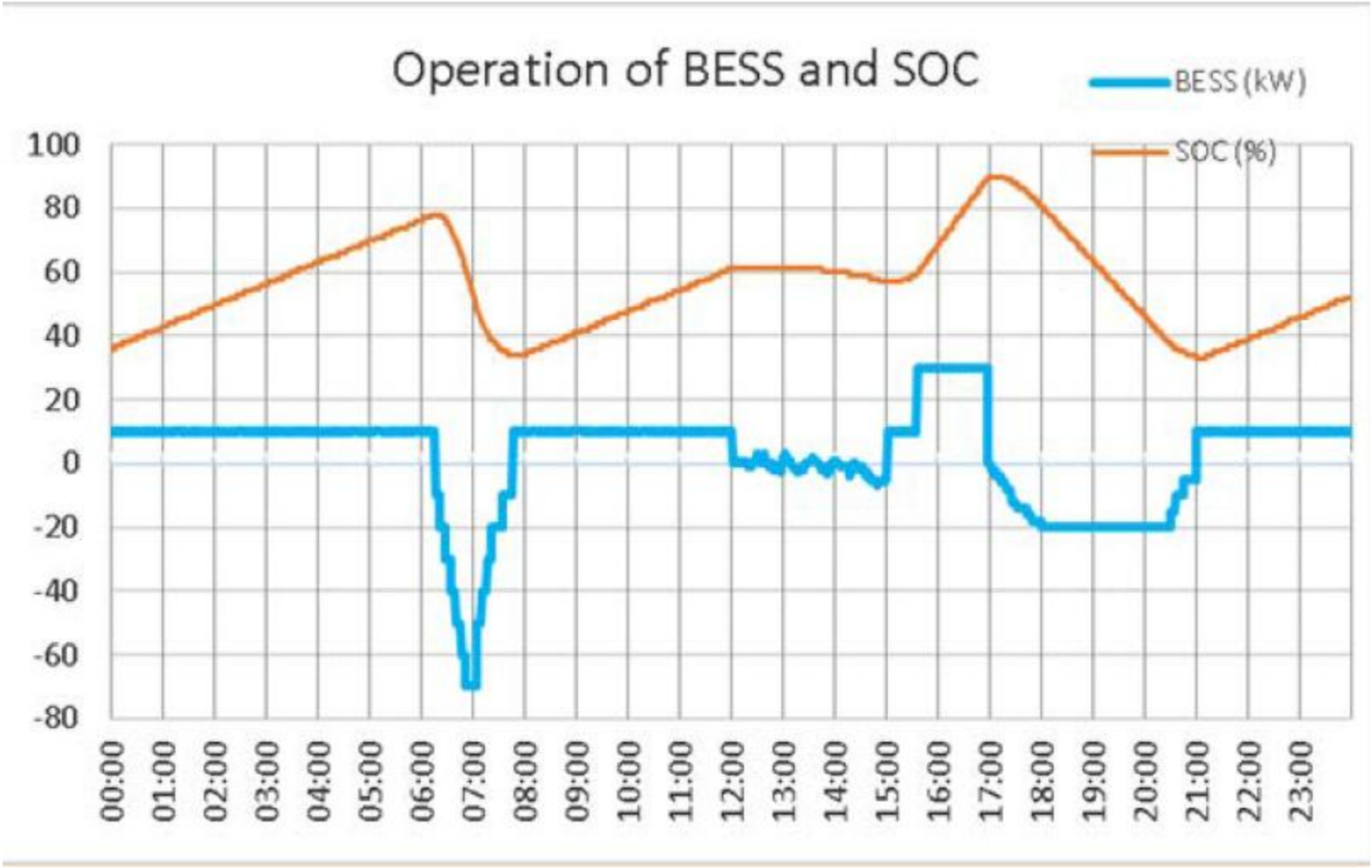
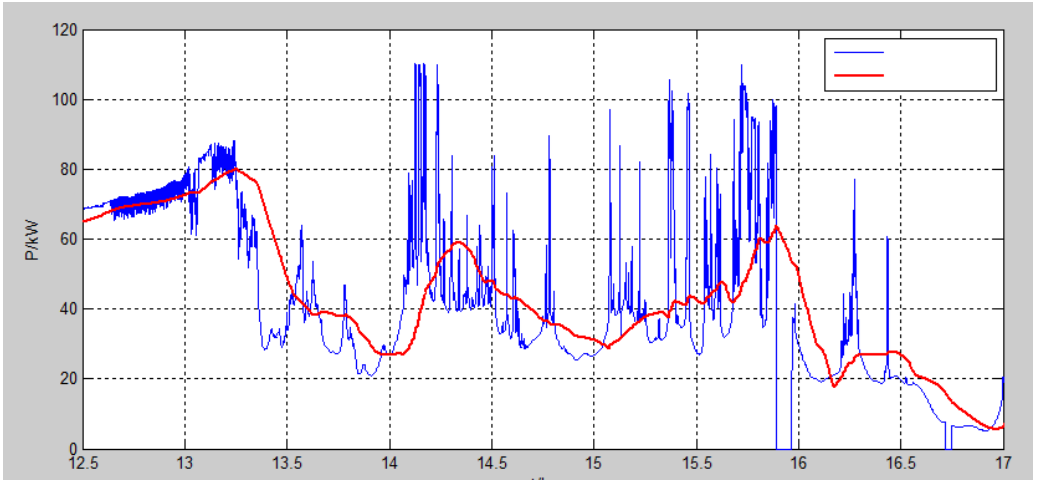


SOME RESULTS

Communication is important !! x2

OPERATION

On grid	Off grid	Transition
SOC Control (prepared for outage) + PV Smoothing (Export surplus energy to grid)	Island control (include load shedding) Black start control	PCC Control (Intentional Islanding) Island to On-grid control



CONCLUSIONS

- A solution for an area that distribution line construction is not possible or not allowed by law
- Local community feed back & acceptance
- System growth
- Micro grid can improve system reliability of remote area
- Key feature of microgrid successfully be implemented
- System operation and maintenance

Thank you for your attention

Q & A