

QUALITY ASSESSMENT OF PUERTO RICO HURRICANE MITIGATION

TEAM 2

LAKSHMI

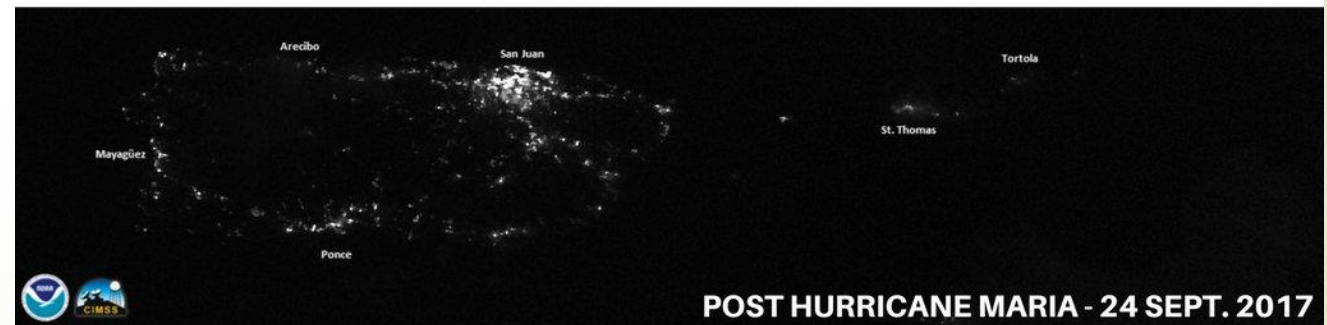
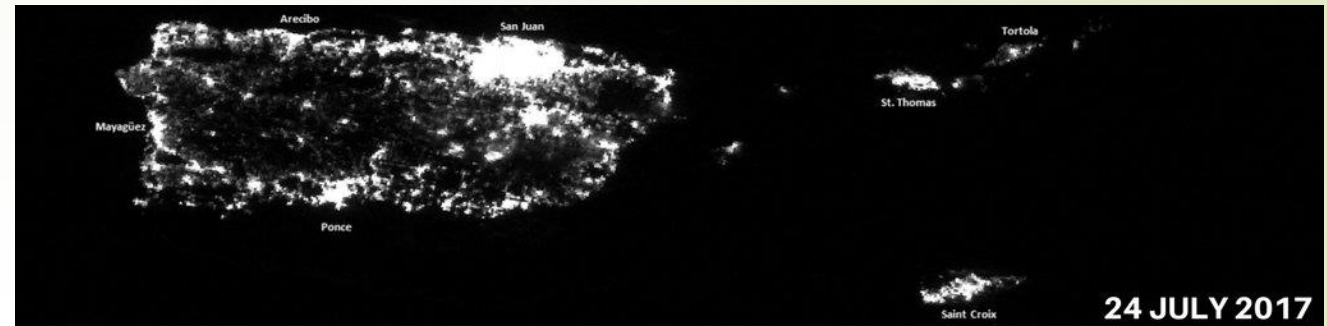
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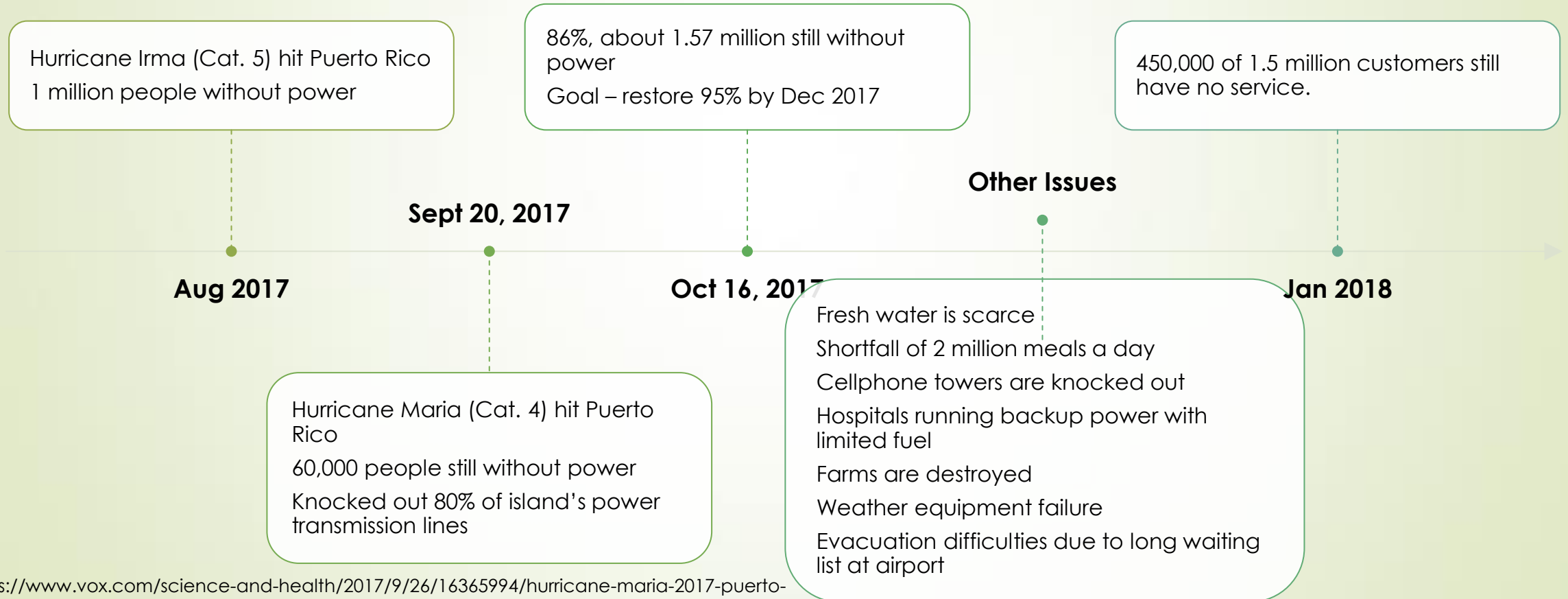
Project Background

- In this presentation, we will try to determine what were the components for Cost of Poor Quality and Assess the Disaster Mitigation process.



Project Background

Puerto Rico Is A Man-Made Disaster



<https://www.vox.com/science-and-health/2017/9/26/16365994/hurricane-maria-2017-puerto-rico-san-juan-humanitarian-disaster-electricity-fuel-flights-facts>

<https://www.pbs.org/newshour/show/heres-why-restoring-power-in-puerto-rico-is-taking-so-long>

Electrical grid

Power plant	Capacity	Energy source	Ownership	Owner	Operator	Location
<i>Costa Sur</i>	990 MW	heavy fuel oil	publicly owned	PREPA	PREPA	Guayanilla
<i>Aguirre Thermoelectric</i> ^[18]	900 MW	diesel oil	publicly owned	PREPA	PREPA	Salinas
<i>Palo Seco</i>	602 MW	heavy fuel oil	publicly owned	PREPA	PREPA	Cataño
<i>Aguirre Combined Cycle</i> ^[18]	592 MW	heavy fuel oil	publicly owned	PREPA	PREPA	Salinas
<i>EcoEléctrica</i> ^[19]	510 MW	natural gas	private	Gas Natural Fenosa, International Power	Gas Natural Fenosa	Peñuelas
<i>San Juan Combined Cycle</i> ^[23]	464 MW	diesel oil	publicly owned	PREPA	PREPA	San Juan
<i>AES Puerto Rico</i> ^[17]	454 MW	coal	private	AES Corporation	AES Corporation	Guayama
<i>San Juan Thermoelectric</i> ^[23]	400 MW	heavy fuel oil	publicly owned	PREPA	PREPA	San Juan
<i>Cambalache</i>	247 MW	diesel oil	publicly owned	PREPA	PREPA	Arecibo
<i>Santa Isabel Wind Farm</i> ^[26]	75 MW	wind power	private	Pattern Energy ^[27]	Pattern Energy	Santa Isabel
<i>Oriana Solar Farm</i> ^[20]	45 MW (58MW _{DC})	solar power	private	Sonnedix	Sonnedix	Isabela
<i>San Fermin Solar Farm</i> ^{[24][25]}	27 MW	solar power	private	Uriel Renewables and Coqui Power	Uriel Renewables and Coqui Power	Loiza
<i>Punta Lima</i>	26 MW	wind power	private	Sovereign Bank ^[21]	Gestamp Wind	Naguabo
<i>AES Ilumina</i> ^[16]	24 MW	solar power	private	AES Corporation	AES Corporation	Guayama
<i>Salinas Solar Park</i> ^[22]	16 MW	solar power	private	Sonnedix	Sonnedix	Salinas
<i>Windmar Ponce</i> ^[28]	4.5 MW	solar power	private	Windmar Renewable Energy	Windmar Renewable Energy	Ponce

Hawaii ↴

Solar power ↴

Wind power ↴

Biomass ↴

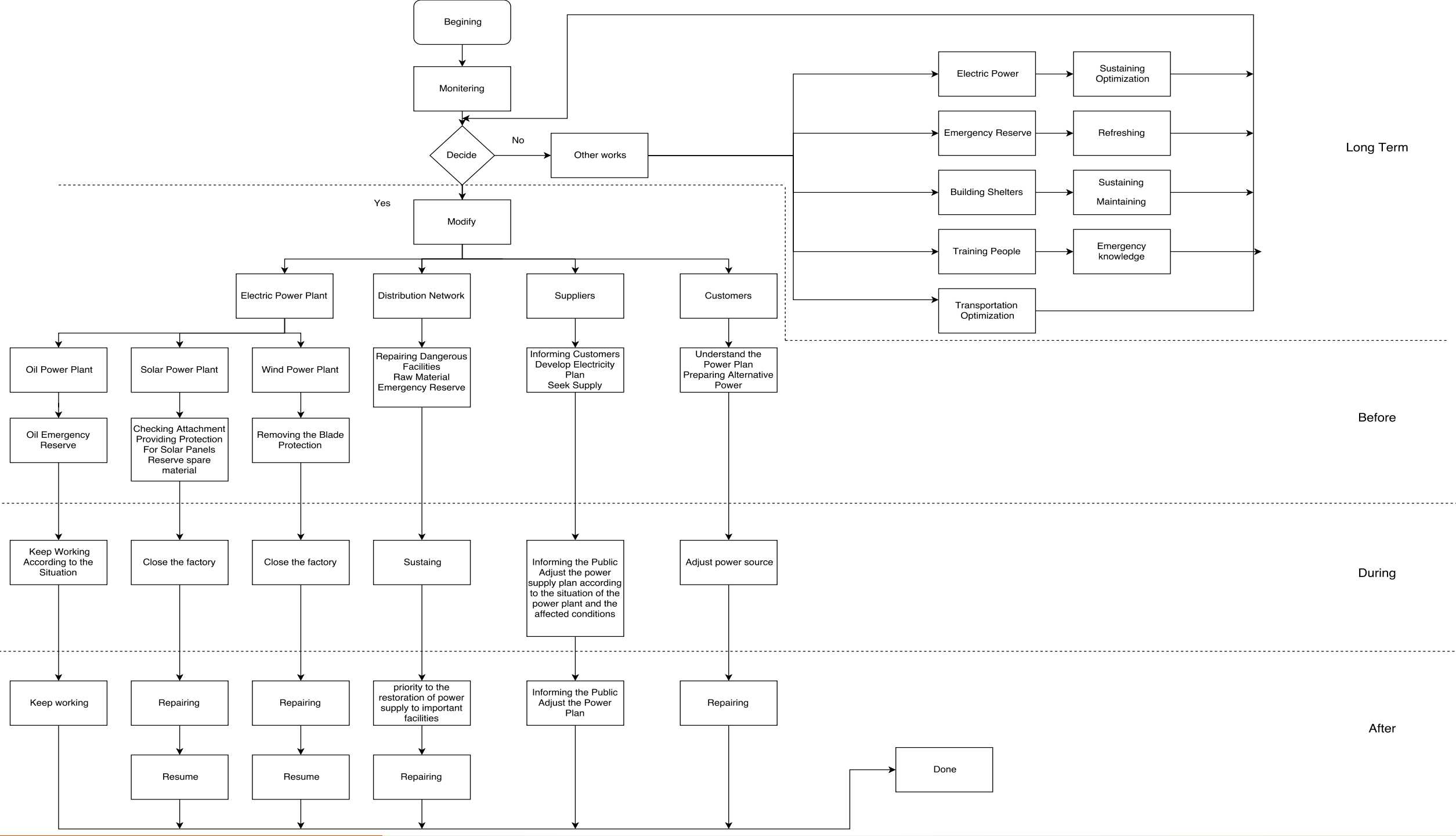
Coal ↴

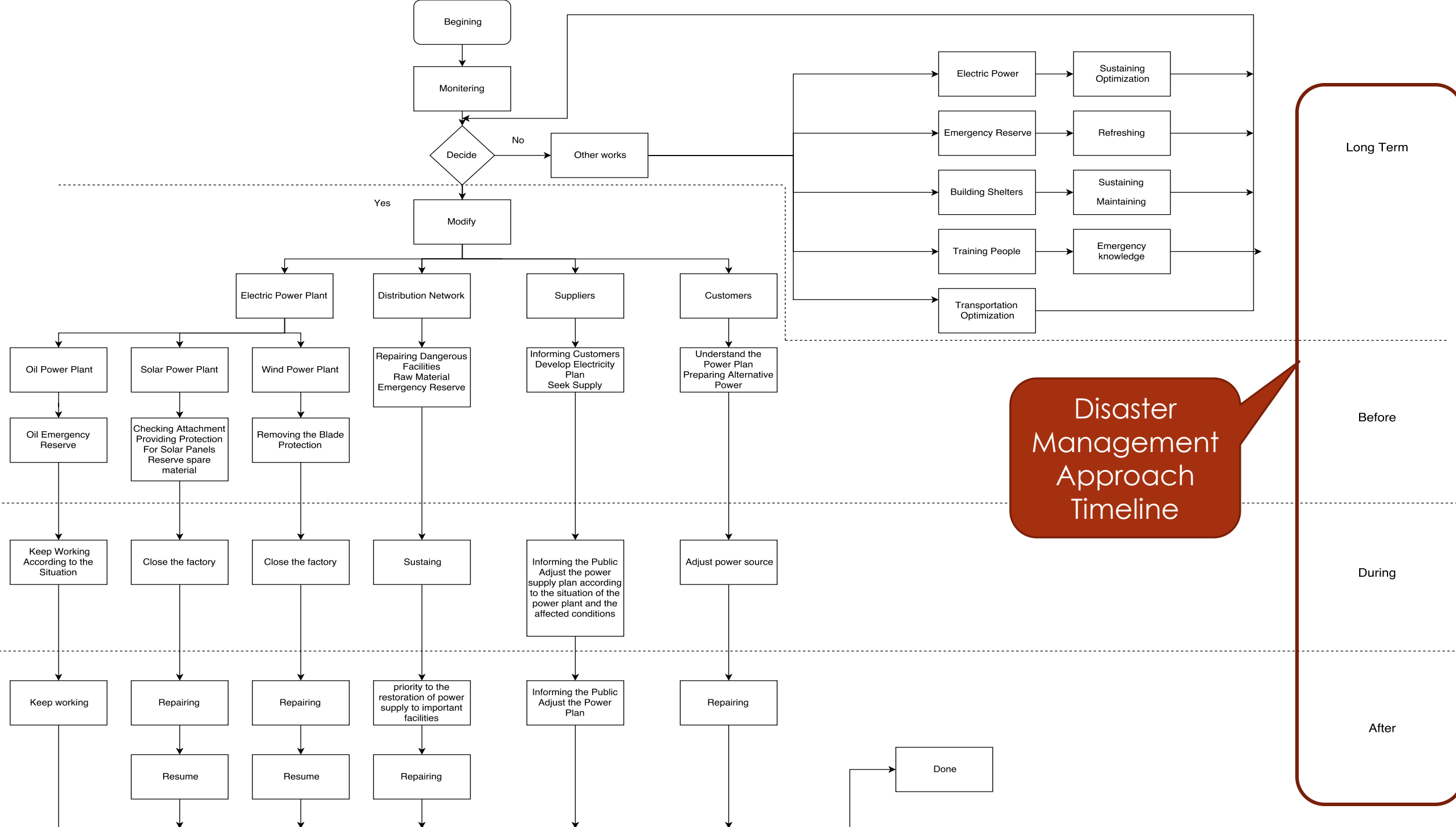
Wave power ↴

Algae fuel ↴



Flowchart





Disaster Management Approach Timeline

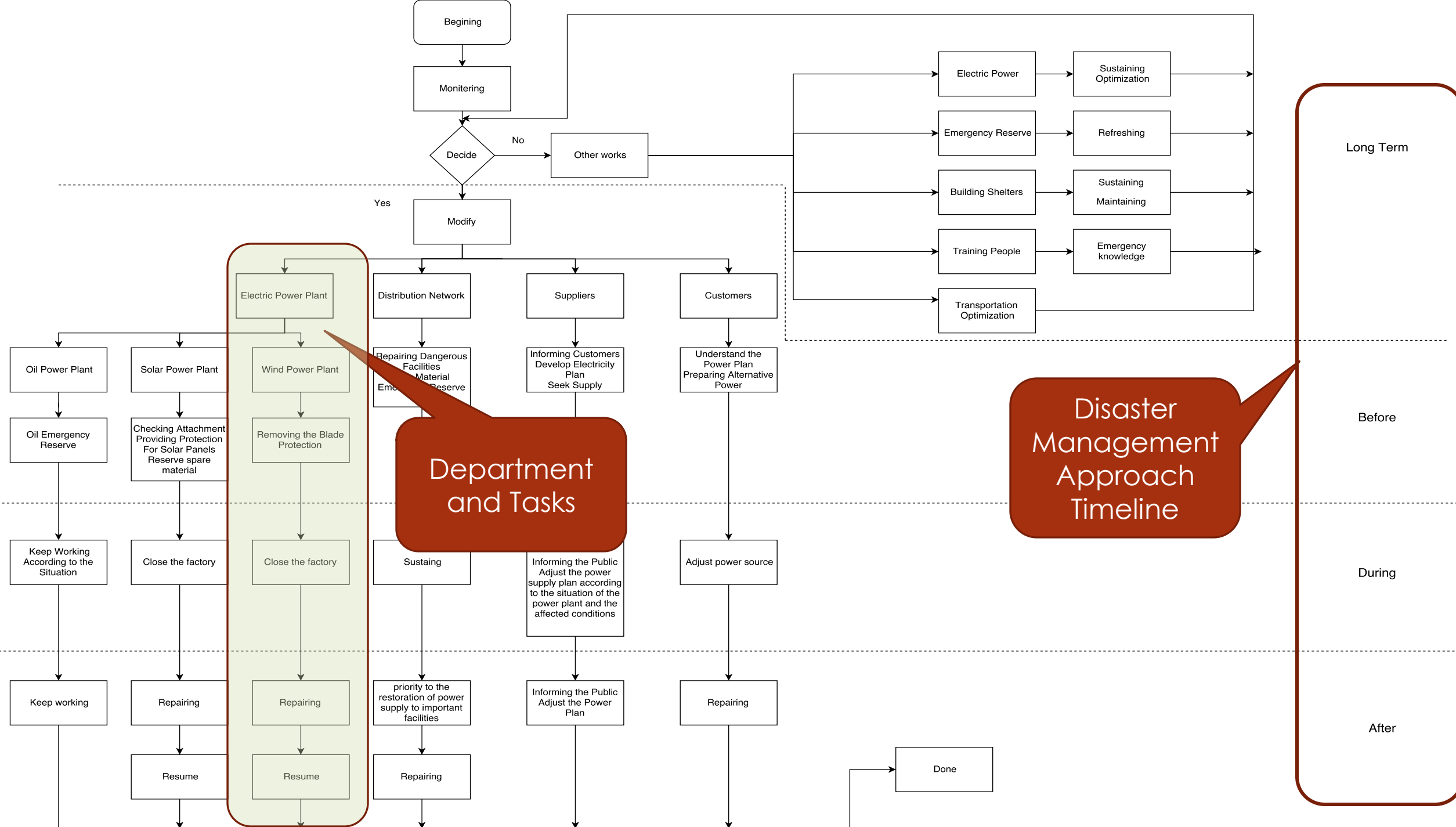
Long Term

Before

During

After

Done



Department and Tasks

Disaster Management Approach Timeline

Long Term

Before

During

After

COPQ

Process	Internal Failure	External Failure	Appraisal	Prevention	Hidden Quality Cost
Fuel generators	Generators fail Bad quality of fuel Not suitable for moving Not suitable for the residents daily use	No knowledge to use them(control generators) Noisy	Stability Motor power	Education Sustaining	Bad delivery Rust Theft Increase in price Due to demand
Build /repair/ Robust shelters/houses	Bad quality of building High cost Too hard to sustain No convenience for their other usages	Too hard to go there flooding	Structural stability (to withstand wind- and water-loads) Reinforcement and shielding of walls, roofs, doors and windows HVAC facilities Sanitary facilities	Sustaining Maintaining	Labor Raw material cost Equipments
Electrical grid (distribution network/substation)	Radial or Network Reconfiguration Cable quality Laying line way Grid base station	Overload Generator breaks Fluctuating voltage frequency	Safety Reliability Economical Adaptability Coordination		Animal Human Natural
Solar Farm	Bad attachment of solar panels Bad design of solar panel for wind stand Bad location of solar farm	Out of sustaining Lack of raw material	Structural stability (to withstand wind-loads)	Sustaining	
Long term (months) private power source (wind & solar) (when fuel is shortage or high price)	High price Not enough power supply Structural stability (to withstand wind- and water- loads)	Out of sustaining Lack of raw material	Safety Reliability Economical Structural stability (to withstand wind- and water- loads)	Sustaining	
Upgrade power plant system (reduce outdated power supply)	Conflict between US businesses and the federal government				


LIST OF CONCERN FROM COPQ

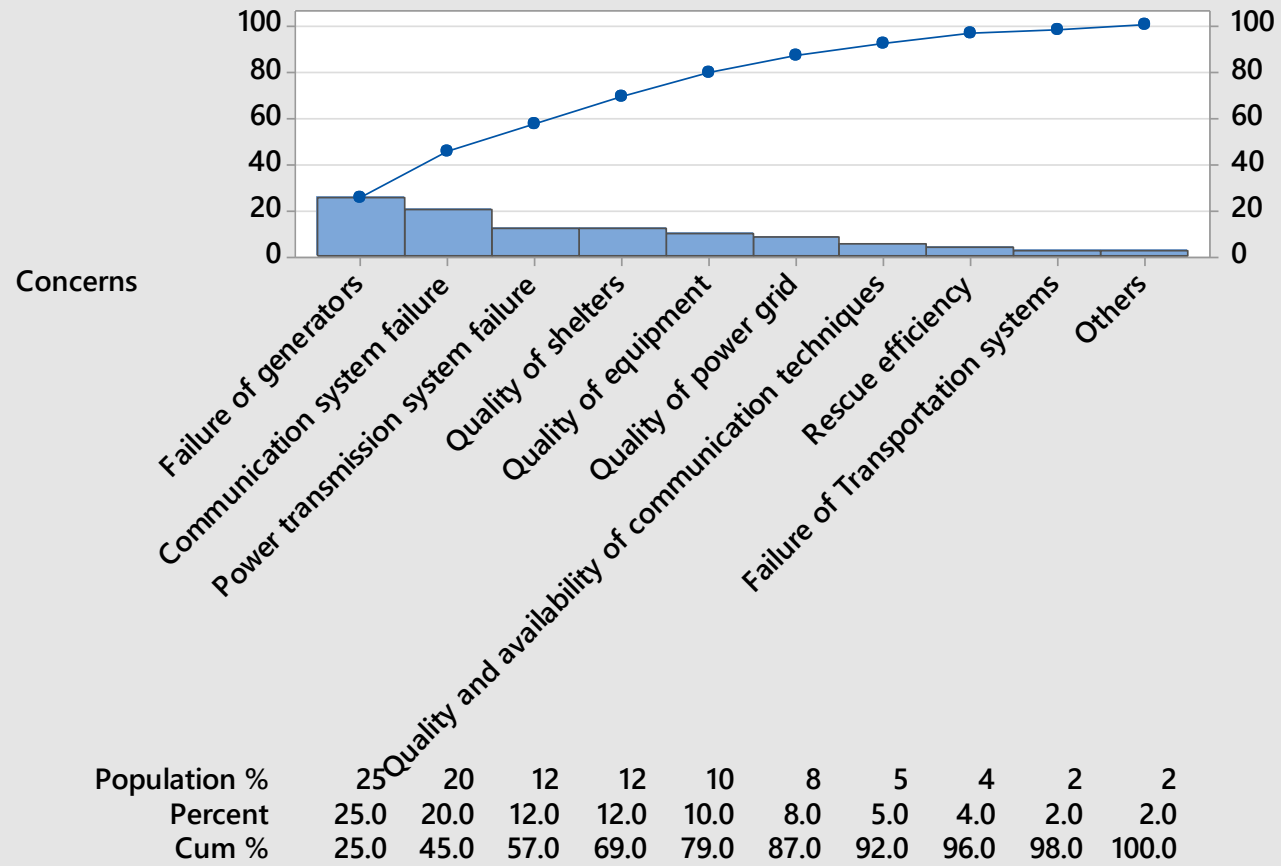
- ▶ Failure of generators
- ▶ Communication system failure
- ▶ Power transmission system failure
- ▶ Rescue efficiency
- ▶ Quality of equipment





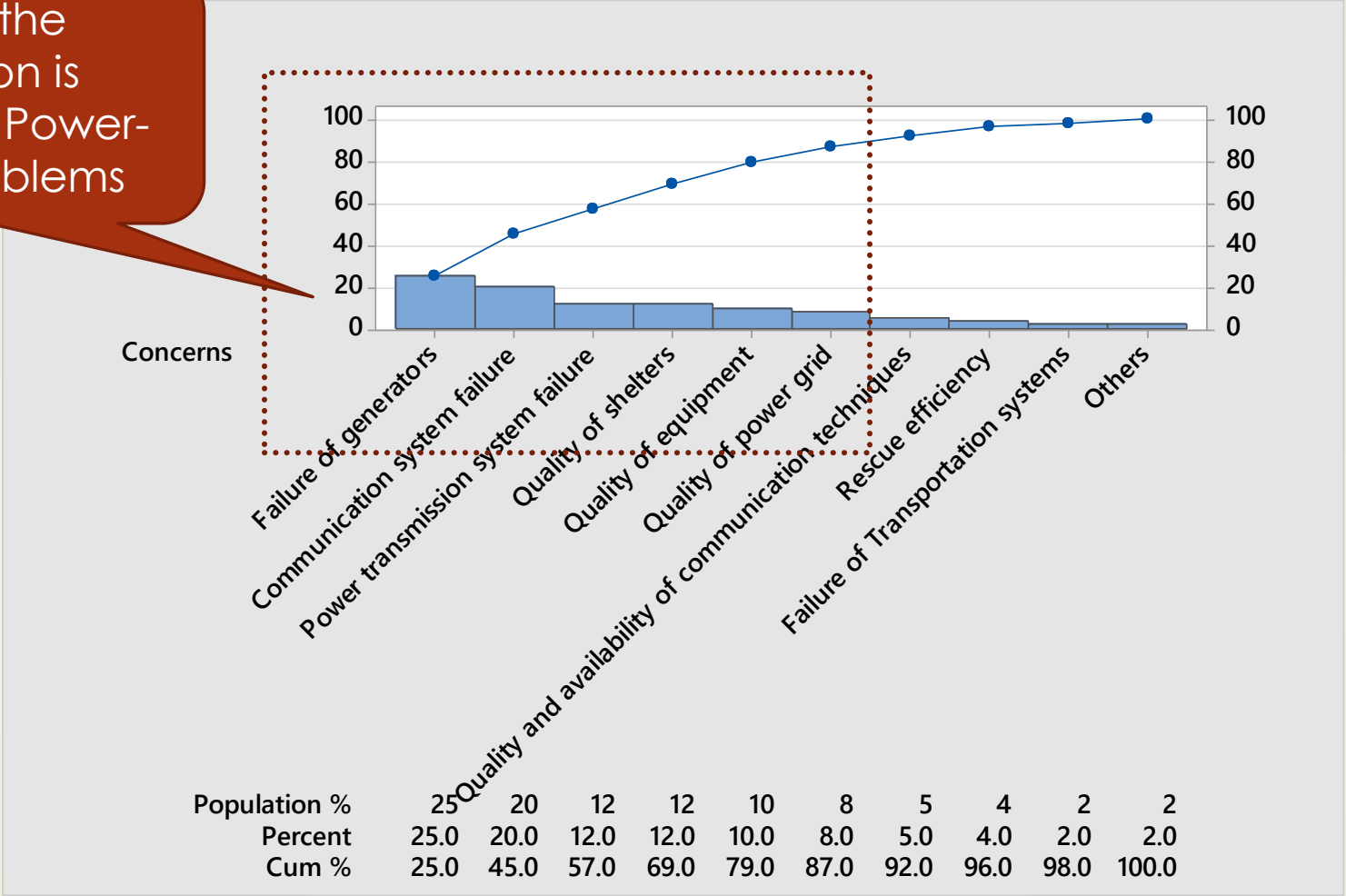
LIST OF CONCERN FROM COPQ (Cont.)

- Quality of shelters
 - Quality of power grid
 - Quality and availability of communication techniques
 - No support from US Mainland
- 



Pareto Chart

~ 80% of the population is affected by Power-related problems



Pareto Chart

LIST OF PERSONS TO INTERVIEW

- Government representative
- Electrical company representative
- Police Officer
- Hospitals and Urgent care CEOs
- Experts and Engineers



LIST OF PERSONAL TO INTERVIEW (Cont.)

- Victims
- Other citizens
- Reporters
- Volunteers





QUESTIONS AND ANSWERS

- ▶ Q1. What is the availability of your support team?

Police Officer: We are available 24X7 and willing to extend all support from our side

- ▶ Q2. Are the equipment enough and satisfactory to assist in the extreme conditions?

Experts – We are in short of equipments as it is getting very difficult due to power cut here. We would tend to hopefully receive all equipments by tomorrow morning




➤ Q3. Do you have a plan –B in case of failure?

Police Officer and Experts: We do have another plain if this plan fails

➤ Q4. When will be the power restored? Is there any compensation provided by your company?

Electrical Company representative - We hope power to be restored in three-four days. As the hurricane has hit strong, there has been a lot of devastation. We would discuss with our team, management and come up with our recovery plan at the earliest

- 
- Q5. What is reaction of normal people for power outage for a longer period?

Victims – We are devastated by the power loss. Though we were prepared for the hurricane, it seems much more worse than our preparation

- Q6. Do you have any alternate power sources? Or stand by power supply till power resumes?

Government Representative – Nothing has been arranged yet. We don't think anything will be changing in couple of days. We are trying our best to provide other basic amenities to victims

- Q7. Do you have enough of your basic needs?

Government Representative – As of current requirement we have everything. Also, we are afraid that we may run out of it within a day

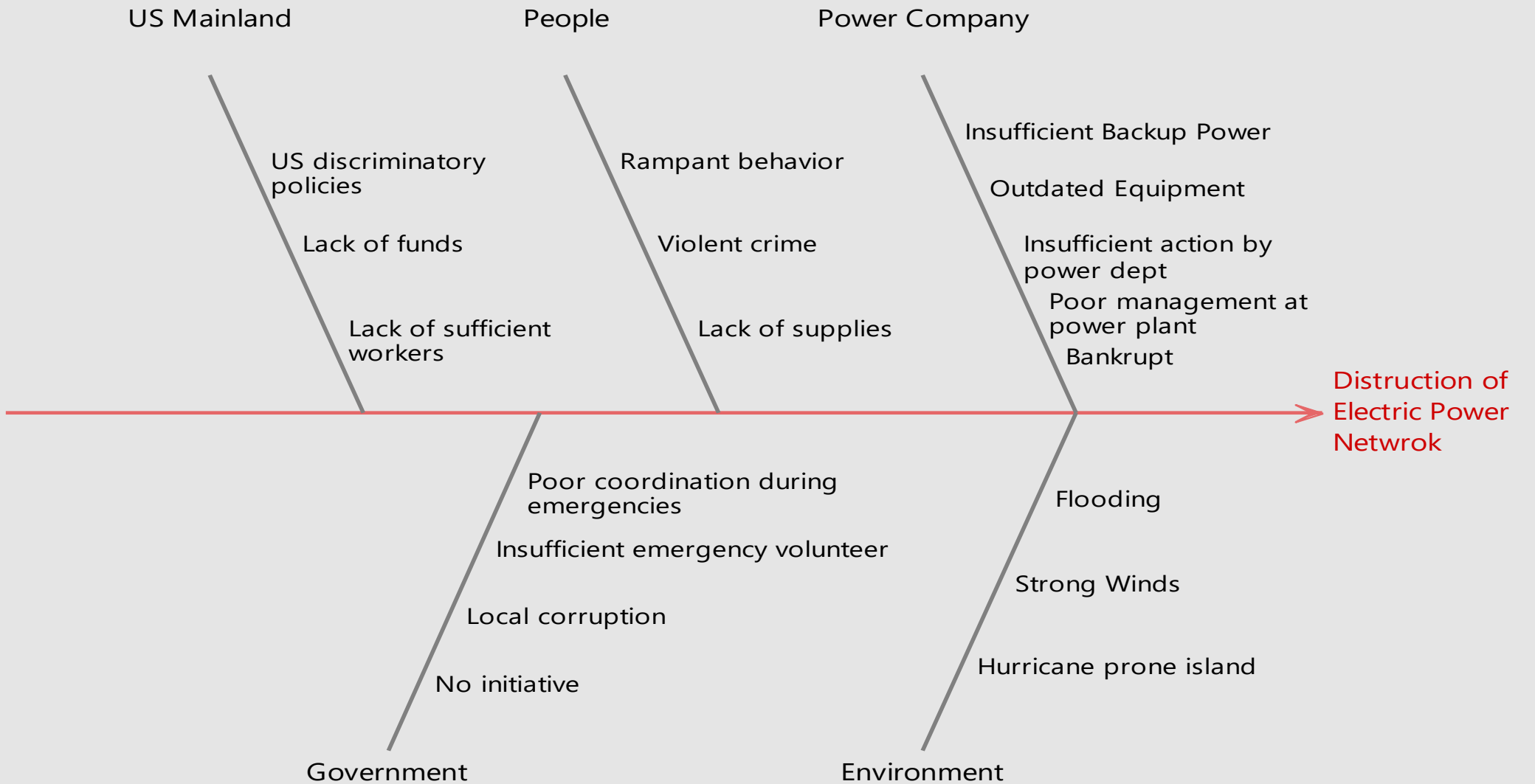
DIAGNOSTIC OF ISSUES

- Insufficient back up power supply
- No enough volunteers at the venue
- Safety of victims made sure
- Outdated equipments
- Delaying in actions taken by the government
- Insufficient actions taken by power plant
- Poor management of power plant



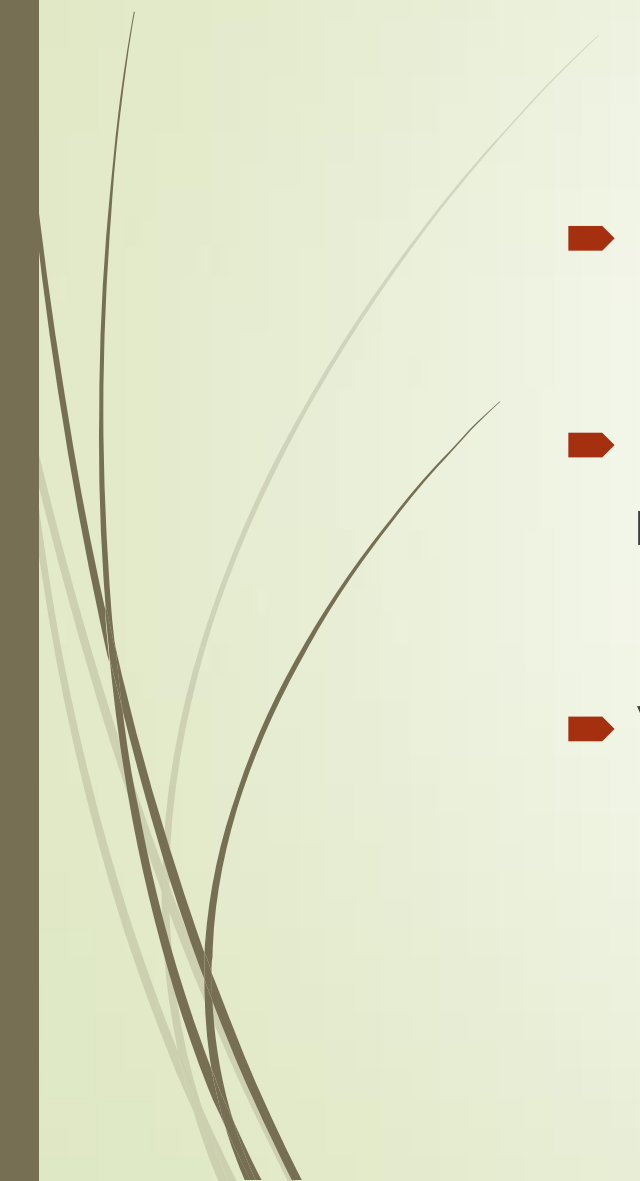


ROOT CAUSE ANALYSIS





RESULTS OF DIAGNOSTICS AND ROOT CAUSE ANALYSIS

- Lack of power disrupts schools, hospitals and offices
 - Lack of funding and support from US mainland restricts reconstruction
 - Violent crimes like break-ins and rampant behavior
- 




SOLUTIONS FOR FIXING QUALITY ISSUES

- Power company organization rebuild to remove corruption and inefficiencies, consider privatization
- Recruitment of more emergency security volunteers
- US should take serious actions to support and provide long term solutions
- Quicker response from internal and US Mainland
- Long term strategies to move residents to safer places and providing them sustainable living conditions




MEASURES TO ASSESS IMPROVEMENTS

- Monitor new equipment and plant
 - Use of control charts to assess plant performance
 - Assess usage of backup power
 - HR measurements and analysis for various teams at power plant and emergency services
- 



MEASURES FOR SUSTAINING SUCH IMPROVEMENTS

- ▶ Train and assess emergency personnel and community
 - ▶ Prepare using mock drills
 - ▶ Procedure to track accountability during crisis
 - ▶ Educate the local community at a regular interval.
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THANK YOU