

There's No Place Like Home

“This is Oz Franklin live on 137.5, reporting from Toto Park at the site of the bicentennial Over the Rainbow Festival in Emerald City, Kansas. Located a hundred miles south of Topeka, our city is home to over 200,000 residents and the Flying Monkeys baseball team. We have come far in 200 years. Since 2020, the population has increased, agricultural and mining methods have become advanced, and power grids more resilient. Our laid-back lifestyle is enhanced by technological advances in infrastructure. The economy is boosted by abundant mineral resources, a strong labor force, healthy retail trade, ample electrical power, plenty of water, and a central location. And now, a special report from Weather Wizard.”

“A severe system brings tornados to Nebraska, Kansas, and Oklahoma. A tornado watch is in effect until 10:00pm in Woodson County, Kansas. This includes Emerald City. The winds have now reached 275 and climbing! To anybody in the line of these dangerous tornados, take shelter now!”

“I'm Edward Fury the fifth, aka EF-5. I just tore through Butler and Greenwood Counties at 35 mph with winds over 250. It was great! I threw trees into power lines, snapped poles, twisted transmission towers, and leveled substations. I destroyed homes and scared the daylights out of a bunch of people. You'd be amazed at the number of scarecrows I destroyed. Electrocutation, fires, explosions it'll take months to repair all the destruction I've caused. You're next Woodson County!”

“I know you cause massive destruction to homes, property, infrastructure, and traditional power grids. However, 200 years ago, when our city was destroyed by a tornado like you, we decided to gather our best engineering minds to come up with a solution for a resilient power grid. Our engineers followed the design process and analyzed tradeoffs. They created *risk assessment* tables to compare traditional grids with Emerald City's grid.”

Traditional Power System Risk Assessment and Tradeoffs					
List of Possible Failures	Associated Risk(s)	Severity	Probability	Risk Score <small>Found by combining impact and probability on the risk matrix</small>	Method(s) to Manage the Risk
T1 A power source destroyed	-Major power disruption -Economy disrupted -City ceases to function	Catastrophic	Medium	Extreme (11)	-Increase microgrid system -Use smart system Tradeoff: Cost and time
T2 Transmission tower destroyed	-Partial power disruption	Marginal	Medium	Medium (5)	-Microlattice Tradeoff: Cost and time
T3 Substation destroyed	-Limited power disruption	Marginal	High	High (7)	-Domes Tradeoff: Cost and time
T4 Tree falls on power line	-Minor power disruption -Wires snapped -Poles knocked down	Negligible	High	Medium (3)	-Inertia cable -Microlattice Tradeoff: Cost and time
T5 Debris	-Shorts to power lines -Limits access to service/repair	Critical	High	High (9)	-Maintaining surrounding vegetation -Update structural integrity -Debris plow Tradeoff: Cost and time

Emerald City Power System Risk Assessment

List of Possible Failures	Associated Risk(s)	Severity	Probability	Risk Score	Method(s) to Manage the Risk
EC1 A power source destroyed	-Major power disruption -Economy disrupted -City ceases to function	Marginal	Low	Medium (4)	Continuous improvement
EC2 Transmission tower destroyed	-Partial power disruption	Marginal	Low	Medium (4)	
EC3 Substation destroyed	-Limited power disruption	Negligible	Low	Low (1)	
EC4 Tree falls on power line	-Inertia cable failure	Negligible	Low	Low (1)	
EC5 Debris	-Shorts to power lines	Marginal	Medium	Medium (5)	

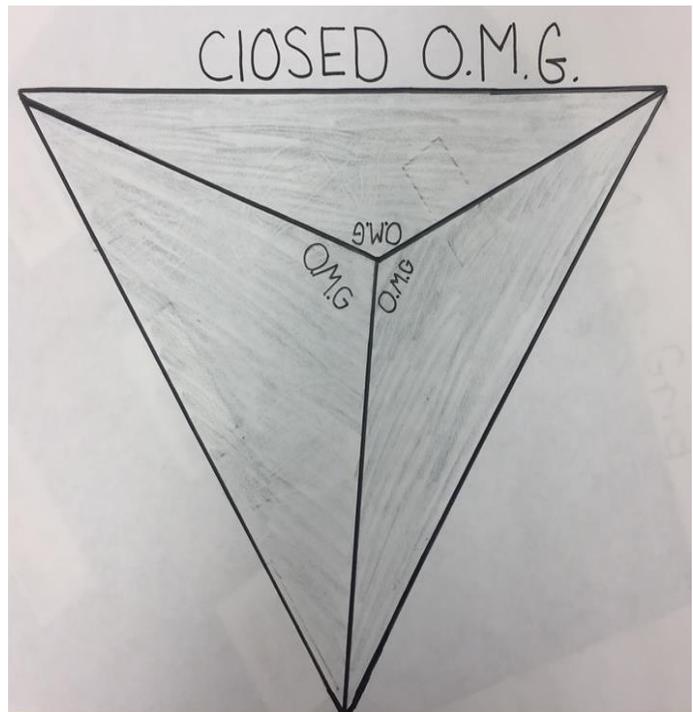
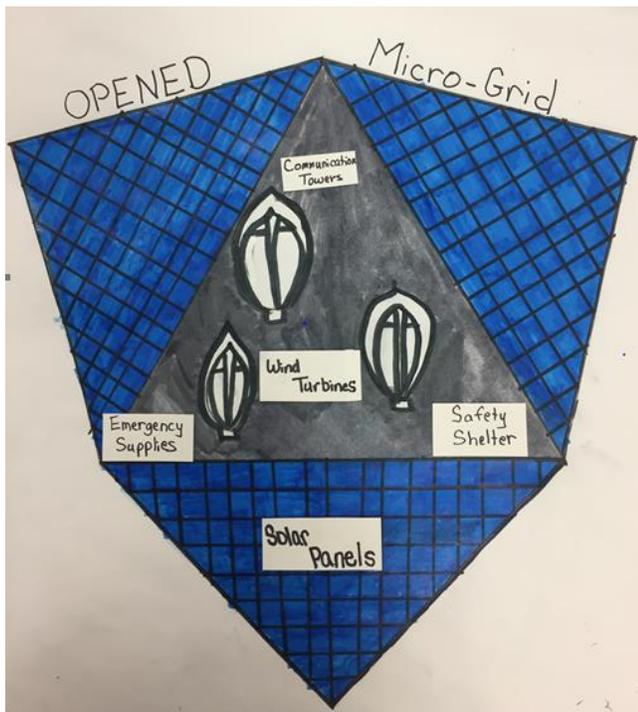
Risk Ranking Table

		Severity			
		NEGLIGIBLE <small>Not likely to have a major effect</small>	MARGINAL <small>Has an effect</small>	CRITICAL <small>Will affect the majority of citizens</small>	CATASTROPHIC <small>Could result in disaster. WILL affect the whole city</small>
Probability	LOW	LOW (1) EC3 EC4	MEDIUM (4) EC1 EC2	MEDIUM (6)	HIGH (10)
	MEDIUM	LOW (2)	MEDIUM (5) T2 (Moved to Medium 4) EC5	HIGH (8)	EXTREME (11) T1 (Moved to Medium 4)
	HIGH	MEDIUM (3) T4 (Moved to Low 1)	HIGH (7) T3 (Moved to Low 1)	HIGH (9) T5 (Moved to Medium 5)	EXTREME (12)

Explanation of Risk Ranking		
LOW	MEDIUM	LOW-mitigate as time allows MEDIUM-start mitigation efforts
HIGH		HIGH-prioritize mitigation efforts
EXTREME		EXTREME- address immediately

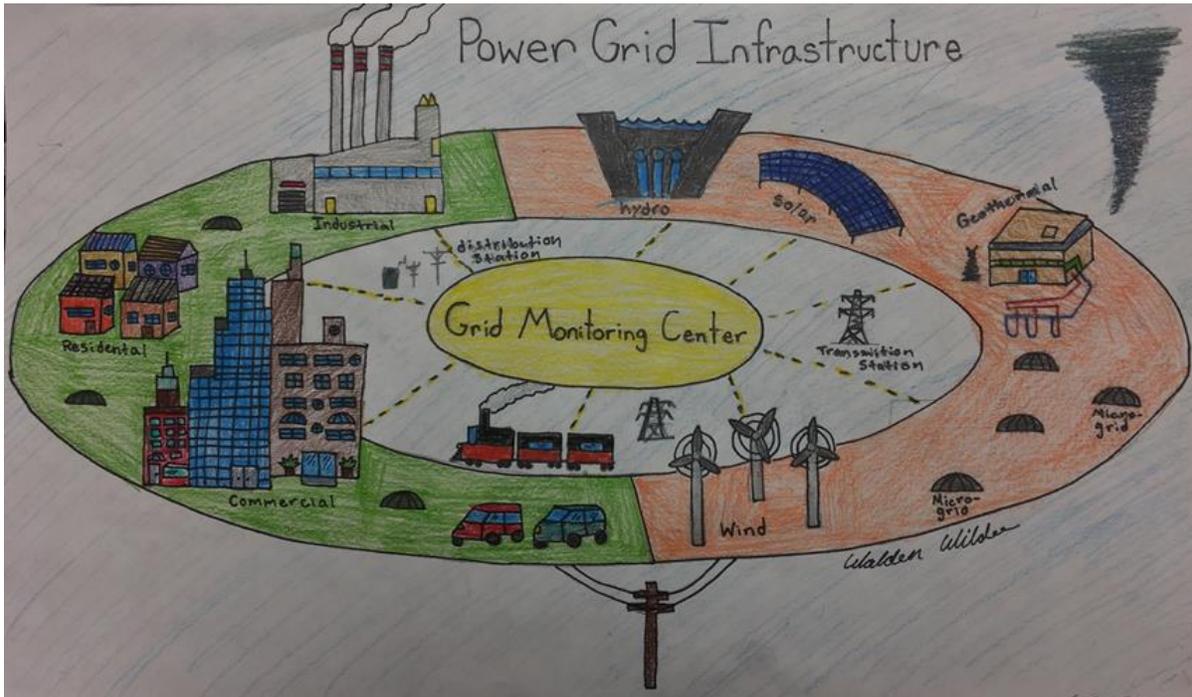
EMERALD CITY

“With the Opening Micro-Grid (OMG) and the Power Line Inertia Cable (PLIC), our city is more resilient than ever! The generators are incorporated into abandoned missile siloes. Each consists of solar panels, Darrieus wind turbines, and batteries. When the doors open, the wind turbine rises, and the solar panels are exposed to sunlight. When closed, the turbine telescopes down and the solar panels, batteries, and turbines are protected from storms and tornados! Computer engineers included smart-sensors in the power grid to detect abnormalities such as over-heating. The PLIC protects power lines when hit by debris by unwinding to prevent damage. Mechanical and electrical engineers incorporated the technology of a retractable extension cord. Fluid engineers designed electro-hydraulics to raise and lower OMG doors, wind turbines, and solar panels. The hydraulics system uses self-contained actuators operated by electrical power to improve mechanical safety and reliability.”



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“You got me there! So, I’ll just destroy the main power, power poles, towers, substations, and your grid command center.”



“So you think. The geothermal plant is protected by a dome, wind farm turbines fold down, and solar panels flip and lay flat for protection. The back of the solar panels are protected by a layer of micro carbon fiber. Microlattice and recycled plastics combine to make our power poles and towers strong yet flexible. Plus, substations are located underground where you can’t touch them!”

“Well, I’m a fifth generation tornado, and we’ve been notorious for destroying infrastructure throughout the flat lands in Tornado Alley. Cities have been paralyzed, flow of goods and services disrupted, and access to emergency services stopped. People got sick and couldn’t receive emergency care, especially the young and the elderly. I caused vegetation damage, debris, immense chaos, and long term economic and psychological effects.”

“That was before structural and materials engineers incorporated the technology of the resilient power grid into the rest of the infrastructure by using Microlattice, underground protection, and domes. Civil engineers enhanced the transportation system by infusing asphalt roadways with binders, such as shredded tires. This makes them flexible and durable. With the roads preserved, disruption of the flow of goods and services is minimized. The delay of city services like law enforcement, fire department, and waste management, is reduced. The city functions smoothly because of safety services. For example, Transportation Monitoring Systems detect traffic congestion or storm debris and make adjustments by synchronizing traffic lights. Also, each OMG includes a shelter underneath that stores emergency supplies like medicine, MRE’s, and water. Because shelters are easily accessible by the city-wide Emerald Subway System, citizen safety is increased.”

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“That might be the case, but my tornadic forces can still destroy buildings, scattering their debris and blocking transportation of food, medicine, bottled water, clothes, first aid kits, and diapers.”

“Sorry to disappoint, but we have the Linear Ion Orbital Network (LION) on our side. This city service is a system of underground pneumatic tubes. They transport goods like food, diapers, and water, which are then picked up at above-ground transfer points by drones for delivery. Plus, damage to building infrastructure is greatly reduced due to proper design and construction. Roofs are anchored through the walls to the foundation, and a majority of our buildings use Geodesic domes and cylindrical construction for minimal wind drag. Therefore, debris is greatly reduced!”

“How is your communication infrastructure protected from twisters like me?”

“Micro Communication Towers located on top of the OMG’s wind turbines, are protected as they lower into the ground. Not only are they used to increase cell phone coverage and network capacity in normal times, but also, used during a disaster as coverage till main towers are repaired. Best and worst case scenarios were analyzed. In the best case, if a grid fails, the power will be shared by other grids till repairs can be made. In the worst case, multiple super cell tornadoes develop, debris blocks roads, and emergency services are interrupted. This is rare, but if it does occur, we follow this protocol:

- Warnings are issued via siren, radio, cell phone, etc. to take shelter
- OMG’s, solar panels, and turbines fold down
- Damage is reported by drones, sensors, computers, and the public
- Specialized plows clear debris and work crews arrive
- Safety and Emergency services disperse
- OMGs, PLIC’s, panels, and turbines reset
- Emerald Subway System and LION continue to function
- Emerald Subway System doubles as transport for construction materials
- Repairs begin.”

“What if the inertia reel or Microlattice fails, distribution lines short circuit, or debris and animals damage the reel?”

“That is exactly why we conduct monthly checkups on our power grid. Therefore, Emerald City maintains the benefits of a resilient protected system, quick redeployment, few repairs, and reduced injuries from flying debris. So, move along EF-5.”

“Well folks, this has been quite a day! As dangerous tornados moved throughout the area, the city functioned normally, and our citizens remained safe and happy. OMG’S continued to supply power, communication, and a safe place to go with emergency supplies. The inertia cable helped protect the grid by greatly reducing line failure, shorts, and damage to poles. Without engineering minds, Emerald City would not be what it is today. “There’s no place like home!” This was Oz Franklin. Tune in next time on 137.5.”

Word Count - 1230

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