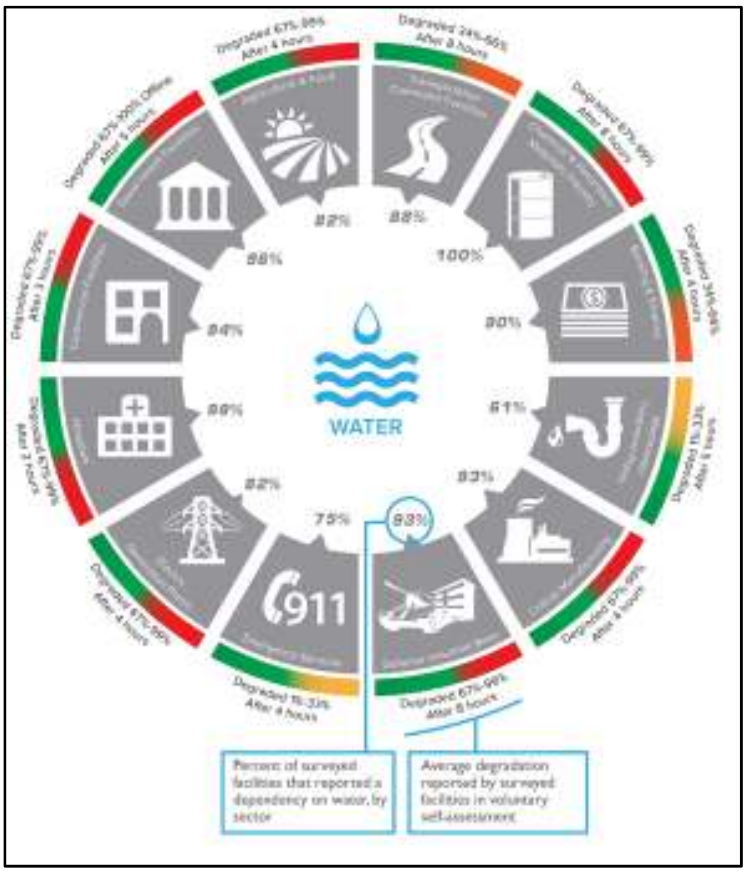
POWER ANALYTICS™

Power Engineering Professional Services

Case Study – Fairfax Water

Client Profile:
Fairfax Water is Virginia's largest water utility and one of the twenty-five largest water utilities in the country. Nearly two million people in the Northern Virginia communities of Fairfax, Loudoun, Prince William, Fort Belvoir, Herndon, Dulles, Vienna, Alexandria, Falls Church, and Fairfax City depend on Fairfax Water for superior drinking water. Power Analytics was requested to assist with the power flow modeling aspect of this project by Instant Access Networks, LLC (IAN). IAN is a veteran-owned small business that provides critical infrastructure protection consulting.



Scope of Work:
Investigate solutions to prevent prolonged power outages at Fairfax Water that could be caused by man-made or naturally occurring Electromagnetic Pulse (EMP) threats. This work was requested by the Defense Threat Reduction Agency (DTRA), a division of the Department of Homeland Security. During our investigation, we also considered all other power outage vulnerabilities that could impact this highly critical infrastructure. Our investigation revealed solutions that can, and should, be applied across the entire Water/Waste Water industry.

"The dependence of military bases on outside water supply mirrors the dependence of 87 percent of the American public on piped water supplies."
National Infrastructure Advisory Council (NIAC), Water Report, June 2016, page 10

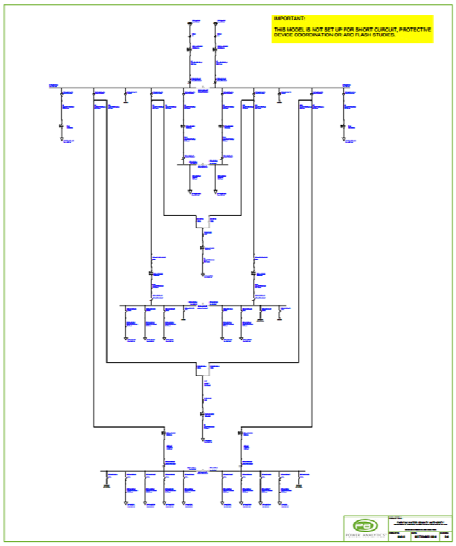
Mission Critical Challenge:
Most water utilities, like Fairfax Water, are primarily dependent upon their local electric utility for power, with many having backup power resources (diesel or natural gas generators) that could provide power for 48-72 hours. And, some water utilities have less, or no, backup power. Those utilities that do have backup power are dependent on fuel deliveries, which may or may not be available during a severe, widespread power outage. During a significant EMP, or other prolonged, outage event, water and wastewater utilities would be unlikely to receive adequate fuel supplies and, therefore, would be unable to provide basic water services. The health and financial impacts of an idled water/wastewater facility would be financially and physically devastating to all of that entity's customers. For Fairfax Water, these customers include several critical military facilities, including Ft. Belvoir. Because Fairfax receives extremely low cost, reliable power from Dominion's Virginia Power, Fairfax has not felt economically justified in provisioning backup power beyond its current backup power timeframe of 12 hours.

Power Analytics Case Study – Fairfax Water
Critical Infrastructure Protection

Process and Analysis:
With the in-depth support and assistance of Fairfax Water personnel, the Power Analytics team completed an initial inventory of the existing power infrastructure of Fairfax Water's main water production plant, and created a base-line power model on the computer. This power model was created using the Power Analytics Paladin® DesignBase™ software. The team also reviewed Fairfax Water's electric power bills and associated 15-minute interval data. Mr. Wayne Barr, senior electrical engineer at Fairfax Water, Mr. Chuck Manto, CEO of Instant Access Networks (IAN), and Mr. Dave Geary of Power Analytics worked to discover opportunities to blend the integration of alternative, renewable, and other energy resources (such as a microgrid) with other planned Fairfax Water plant upgrades. The team also discussed the potential of linking to a neighboring entity, called Covanta, which already has on-site power generation that could be used by Fairfax Water during an emergency.

"An electromagnetic attack (of any type) has the potential to degrade or shut down portions of the electric power grid important to the Department of Defense. A key task of this contract is to demonstrate … EMP-protected critical infrastructure and microgrids at civilian institutions that need to operate in island mode during a prolonged power outage."
Defense Threat Reduction Agency press release, June 24, 2016

The team's preliminary investigation convinced Fairfax Water that it is necessary and possible to create an economically-viable EMP-protected microgrid to avoid a prolonged shutdown of services to the critical load customers of Fairfax Water. The Power Analytics team suggested a multi-phase, step-by-step, planning approach to reach this ultimate solution. First, the most critical controls of Fairfax Water would be addressed. Then, follow-on steps would be taken to work systematically across Fairfax Water's operations so that maximum energy savings, and other resources, could be used to help fund the EMP/cyber-protected microgrid system.



The ultimate solution is intended to be a system of microgrids that would be able to instantly move into island mode during an EMP, or other, major power outage event. The microgrid would be in communication with its component parts and with the various operational elements of Fairfax Water to provide comprehensive situational awareness, command, and control of all systems during the outage event.

Solution:
The Power Analytics team built a first-stage / high-level computer power model of the Fairfax Water Treatment Plant using the Paladin® DesignBase™ software. The model simulated and analyzed the facility's 3-phase power flow conditions. At this initial stage, the model is limited to the infrastructure shown in the overall plant one-line diagram above. As this one-line diagram shows, grid power is supplied to the facility by means of a dual 230kV line arrangement from Virginia Power. Voltage is stepped down to 13.2 kV via two 22.5MVA transformers that, in turn, feed switchgear FSC-SG01 (double-ended / 15kV rated). The FSC-SG01, in turn, supplies power to the various loads at Fairfax Water.

Value Provided:
The power model becomes a living tool to be used by power system electrical engineers to simulate power system operational scenarios, as various alternative and renewable energy resource solutions are identified and hypothetically placed and connected at various locations within the system. This model is used to help make system alteration plans and decisions in a multi-phased microgrid development process. This power model can be used to simulate, plan for, and avoid, any and all high-impact threats that could lead to prolonged outages.

For more information or to request a demonstration, contact
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