

Venezuela Blackouts: Draft Situation Assessment and Implications

By Thomas S. Popik, March 14, 2019

Executive Summary

A cascading collapse hit the Venezuelan electric grid at approximately 5pm Caracas time on March 7, 2019. Electricity was lost in 22 of 23 Venezuelan states. Power restoration beginning on March 8 has been plagued with four rounds of apparent load loss; blackout pockets still persist. There has been a pattern of severe blackouts since government takeover of electric utilities in 2007. Overloaded and hard-to-replace grid equipment is failing. Widespread and long-term blackouts over coming weeks and months could cause further stress on Venezuela's economic, social, and political systems. Millions of refugees could migrate to Columbia, Panama, and other Central American countries, destabilizing these societies. Some refugees may eventually make their way to the U.S.-Mexico border to request asylum.

Situation Assessment

Monitoring services constantly probe the worldwide internet using tools such as Ping and Traceroute. Probe response is a good proxy for both power grid conditions and telecommunication network status. The IODA service has tracked the Venezuelan internet during the current blackout. An IODA graph of active probing from March 7 onwards shows the initial grid collapse and four load losses during power restoration. As grid equipment fails under continuing stress, it is progressively harder to reliably restore power. Damaged generator turbines and transformers can take a year or more to replace.

The Venezuela electric grid is of modern design but poorly maintained. Approximately half of generation capacity is hydroelectric, with the remainder being natural gas and oil-fired. Long-distance 765kV transmission lines bring power generated in the eastern highlands to western population centers. On March 7, 2019 a system disturbance interrupted power flow, causing a cascading collapse. The proximate cause of this disturbance is not publicly known. A previous large blackout hit in October 2018.

A single generation facility, the 10.2 GW Guri Dam, accounts for one-third of generation capacity and reportedly 80% of electricity produced. The March 7 cascading collapse may have damaged one or more of the 21 turbines at the Guri Dam. It is well documented in technical literature that unexpected load rejection at hydroelectric facilities shortens turbine life and sometimes causes catastrophic failure. For example, load rejection at the Sayano–Shushenskaya power station in Russia in August 2009 caused a turbine failure and subsequent large explosion in the generator hall. Seventy-five people died, and this 6.4 GW facility of 10 turbines was totally offline for six months, with full restoration taking years.

Repairs to the Venezuelan electric grid require long-lead time equipment that must be imported. Skilled engineers and technicians have left Venezuela. Loss of electric power is affecting other infrastructures, including water supply and sanitation systems; their continued loss during blackouts may result in epidemics. Power loss has halted oil production, damaged aluminum manufacturing, and will reduce foreign currency necessary for repair of damaged electric grid equipment. Power losses also interrupt reliable natural gas transmission for electricity generation. With these infrastructure and economic challenges, it is likely that Venezuelan blackouts will persist and power restoration will be uncertain.

Regional and U.S. Implications

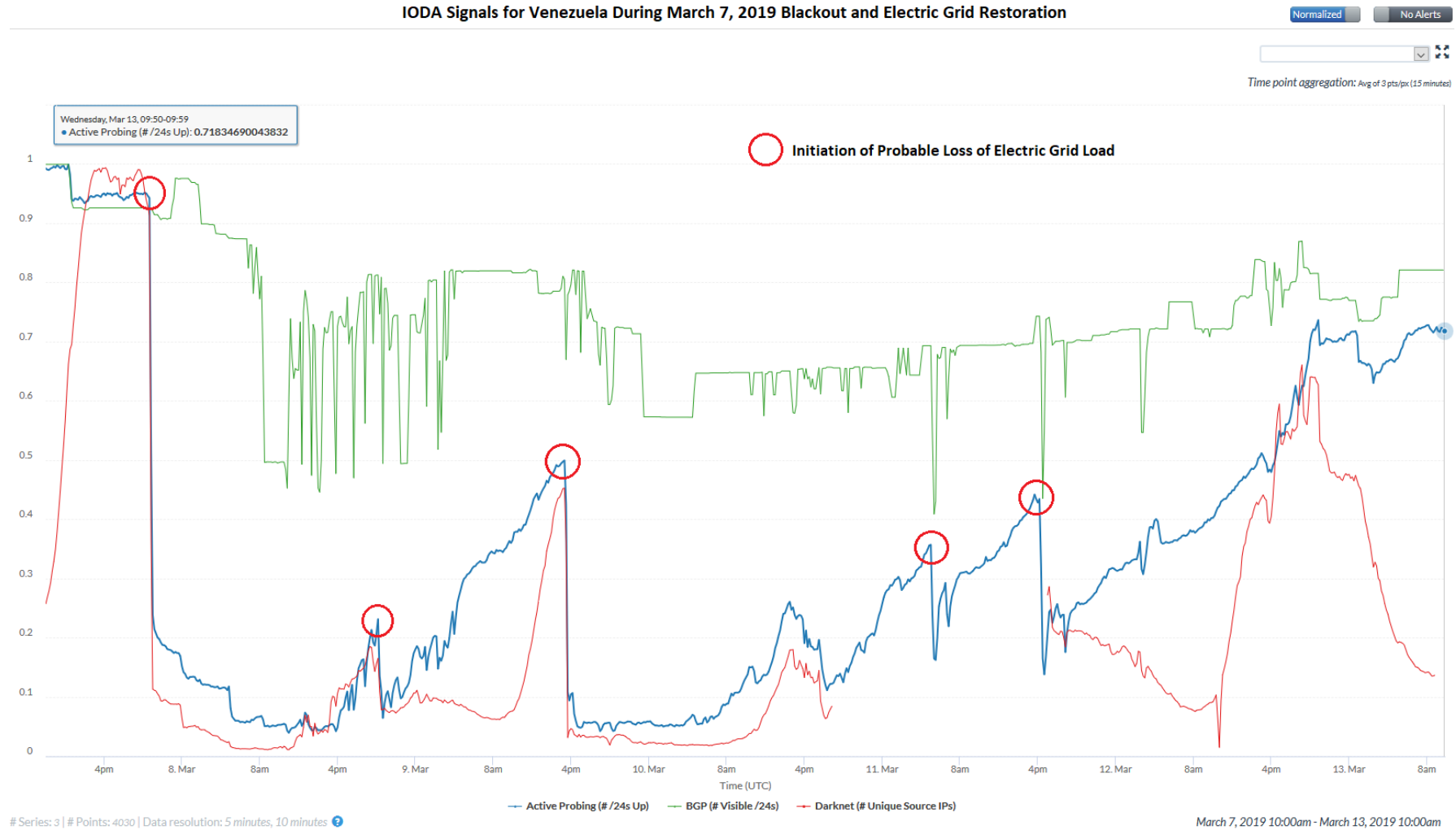
The population of Venezuela is 33 million, with 90% living in urban centers. Effective humanitarian aid during a long-term blackout would be a massive logistical undertaking; the population of Puerto Rico before the Hurricane Maria blackout was only 3.3 million. If a long-term blackout hits Venezuela, millions will become refugees. The most likely migration path will be westward toward the Columbian border. The population of Columbia is 50 million and the population of northward Panama is 4.2 million. Disproportionately large migrations to Central American countries could cause political and economic instability. Asylum attempts at the U.S.-Mexico border may eventually increase as a result.

*Thomas S. Popik is president of the [Foundation for Resilient Societies](#).
Analysis and opinions expressed are his own.*

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IODA Signals for Venezuela During March 7, 2019 Blackout and Electric Grid Restoration



Source: Caida Internet Outage Detection and Analysis (IODA) at <https://ioda.caida.org/ioda/dashboard>; Title and load loss initiations annotated by author.

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