

Adapting to Rising Tides



Energy Infrastructure Vulnerability and Risk Profile

The electricity infrastructure in the ART project area consists of power plants, substations, and transmission and distribution lines. Most of the infrastructure is owned and operated by PG&E, although several substations are owned by other private entities. There are two power plants, an oil-powered peaking plant owned by Dynegy and a natural gas and diesel-powered peaking and reserve plant owned and operated by Northern California Power Agency. Transmission lines are high voltage power lines that run underground and overhead and carry electricity from where it is generated to substations, where power is transformed to a lower voltage and then carried by overhead and underground distribution lines to residences and businesses. Exposure analysis was performed for power plants and substations, as GIS data were available for these assets.

Key Issues

Electronic and mechanical equipment in power plants and substations is sensitive to water, and these facilities may be forced to shut down in the event of flooding, which would result in a loss of power for neighborhoods served by affected substations. Flooding of peaking and reserve plants is less likely to disrupt neighborhoods since they generally are not the principal source of power, although they could be important if plants elsewhere are shut down. Some services areas may be connected to more than one substation, in which case load may be transferred from one station to the other, minimizing consequences. Underground transmission and distribution lines are unlikely to be affected by sea level rise unless flooding results in erosion and scouring where they are buried. Likewise, overhead lines may not be directly affected by flooding, although high winds and strong currents during storm events could down power lines, causing service disruptions and in some cases structure fires, which would be particularly threatening if floodwaters block emergency responder access.

Vulnerabilities

Timing

- The two power plants in the ART project area are susceptible to damage from wind wave flooding as soon as mid-century, and deeper storm flooding by end-of-century.
- Most of the substations in the ART project area are exposed to wind waves during storm events by mid-century; by end-of-century, nearly all are exposed to storm event flooding.

Physical and Functional Qualities

- The equipment in power plants and substations is sensitive to water. Salt water, in particular, may cause corrosion, especially if the plant or station has not been shut down in advance of flooding.
- Below ground electrical or mechanical equipment may be sensitive to groundwater intrusion.
- Structures and equipment may be damaged during a seismic event if liquefaction potential increases due to higher groundwater.
- Power poles and lines may become more susceptible to knock down by high winds when additionally exposed to strong currents or prolonged flooding.

Consequences

Scale

- Substations that are damaged or need to be shut down will not be able to provide power to the neighborhoods in their service area.
- If power plants must be shut down or are damaged at a time of peak demand or when reserve sources are needed, the insufficient power generation could affect the entire region.

People

- Disruptions to substations could result in loss of power, with consequences for residents and those who work in the affected areas.
- Power plants and substations contain hazardous materials which, if in contact with floodwaters, could potentially harm people and contaminate their property if.

Economy

- The disruption of power could result in business closures, with corresponding losses in productivity, revenues, and income.

Ecosystem Services

- Power plants and substations contain hazardous materials that could harm the health of wetland habitats and sensitive species if floodwaters carry them into the Bay or nearshore areas.

Vulnerabilities

Information

- There is insufficient information about the location and depth of underground transmission and distribution lines to determine their vulnerability.
- Information was not available regarding the possibilities of load sharing among substations, or if electricity companies plan for or have the operational capacity to load share in the event of shutdowns.

Management Control

- Existing operations and maintenance plans of power plants and substations may not include well-coordinated shutdown plans to be implemented in the event of an emergency.