Power Behind the Redwood Curtain: A History of Electric Transmission and Natural Gas Infrastructure in Humboldt County

By Arne Jacobson
Revised December 2025

Image of 115 kV and 60 kV transmission lines descending into the Humboldt Bay area at a location along Kneeland Road in Humboldt County. Photograph taken October 1, 2022.

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Revisions and Corrections
(as of December 2, 2025)

This version of the document includes several revisions to correct and/or update information included in the first version of this report, published September 2025. The primary corrections include the following:

1) The reported value for the rated generation capacity of the Junction City hydropower system was updated in Footnote 4 on Page 2. In the original version of the report, the rated capacity of the hydropower system after expansion was reported to be 30 MW, but this was incorrect. Literature sources indicate that the capacity was increased from 1.5 MW to about 2.0 MW (rather than 30 MW).
2) Additional content was added to the subsection titled, "*Shasta County to Humboldt Transmission via Northern Corridor*" on page 9. The new content was drawn from MacDonald (1930), and it relates to the upgrade of the 30 kV line from Junction City to Eureka to 60 kV.
3) The expected capacity of the new transmission infrastructure approved by CAISO to support offshore wind has been updated on Page 29. This new infrastructure was originally described as having, "… sufficient capacity (up to 4.5 GW) to enable a full buildout of wind farms in the Humboldt WEA." In practice, while the electrical conductors on the lines may have capacity at this scale, the new 500 kV substation will have lower capacity. While the exact capacity of the substation has not been announced, the initial design is expected to be on the order of 1.6 GW. The substation will be designed to enable upgrading to facilitate expansion of the transmission infrastructure's capacity in the future.

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Introduction

The energy infrastructure that serves Humboldt County, California, has deep ties to the timber industry. Nearly all of the existing electrical transmission lines and substations, along with the county's primary supply of natural gas, were established between 1946 and 1966. This was a period of rapid expansion of timber extraction in Humboldt County that occurred in response to demand for forest products in the U.S. during the post-World War II economic boom. Today, in 2025, key elements of the County's energy system are aging and fragile.

This article provides an overview of the history of development of energy infrastructure in Humboldt County, with a focus on electric transmission lines, electric substations, and natural gas pipelines.[1] This history confirms that the current architecture of the electrical and natural gas system serving Humboldt County was established over the two decades following World War II, a period involving rapid growth of the timber industry in Humboldt County. Since the mid-1960s, the region has seen a decline in industrial activity and a stagnation in energy demand, and investments in the electric and natural gas systems have focused primarily on maintaining rather than expanding the system.

In 2024, the California Independent System Operator (CAISO) approved a plan to build transmission infrastructure to support the development of large-scale offshore wind in the Humboldt Wind Energy Area (CAISO, 2024). If developed, this infrastructure would represent the largest financial investment in energy infrastructure ever made to serve the region, surpassing the investments made in the post-WW II period. In addition to supporting offshore wind development, the system, as proposed, would bring electric system capacity and reliability benefits to the Humboldt Bay region. However, development of this new transmission infrastructure is not certain to happen. Identifying a site for a substation and rights-of-way for the transmission lines and obtaining permits for the projects involves significant challenges. When considering development of this potential new infrastructure, it is helpful to understand how it fits within the history of the electric system that serves Humboldt County.

Early Use of Electric Power in Humboldt County

The first known use of electric power in a commercial setting in Humboldt County occurred in 1883 at the Excelsior Mill[2] on Tuluwat Island, which was also known at the time as Gunther Island (Weekly Times Telephone, 1883; Villa, 1963; Herbert and Root, 2012, Root, et al., 2013). Electric power use was subsequently introduced in Eureka (1885), Arcata (1895), Fortuna (1896), Ferndale (1896), and other towns in the region (MacDonald, 1930; Villa, 1963; Root, et

[1] EIA, 2024a provides an introduction to the U.S. electrical grid. EIA, 2024b has an overview of U.S. natural gas infrastructure. Links: EIA, 2024a: https://www.eia.gov/energyexplained/electricity/delivery-to-consumers.php. EIA, 2024b: https://www.eia.gov/energyexplained/natural-gas/natural-gas-pipelines.php

[2] The Excelsior Mill was owned by Joseph Russ I and partners. At the time, Russ was one of the wealthiest people in Humboldt County, with business interests in forestry, ranching, mercantile trade, real estate, and banking (Van Kirk, 2013). In April 1886 Russ was indicted for alleged involvement in a land fraud operation involving over 50,000 acres of old-growth timber land obtained illegally through a scheme related to the Timber and Stone Act of 1878. Russ was never tried or convicted, and he died in October 1886 (Shepherd, 2015; Van Kirk, 2015; King, 2023).

al., 2013; Buesch, 2019). In the early 1900s, companies including Arcata Light and Power, North Mountain Power, Eureka Lighting Company, Fortuna Lighting Company, and Ferndale Electric Light Company served communities in the County (MacDonald, 1930; Buesch, 2019; Herbert and Root, 2012; Root, et al., 2013; HTS, 1905b; HTS, 1910; Villa, 1963).[3] Primary generation sources included fuel oil and biomass-fed steam power plants and hydroelectric plants (MacDonald, 1930; Herbert and Root, 2012; Root, et al., 2013). The first extended transmission line in the region was established by North Mountain Power to deliver power to Eureka at 30 kilovolts (kV) from a 1.5 megawatt (MW) hydroelectric plant[4] on Canyon Creek near Junction City in Trinity County, California (BLA, 1904; HTS, 1905a; HTS, 1906; HTS, 1909; MacDonald, 1930; Herbert and Root, 2012; Root, et al., 2013). The right-of-way that was established by this transmission line is still in use today.

In the first few decades of the 20th Century, ownership of companies providing electric and gas services gradually consolidated, and by 1927 Pacific Gas and Electric Company (PG&E) was the primary provider of these services in Humboldt County (BLA, 1927; MacDonald, 1930; Herbert and Root, 2012; Root, et al., 2013). During the 1930s and 1940s, electric distribution infrastructure expanded in the region, including upgrades to existing systems and extensions to connect outlying areas in towns ranging from Holmes in the southern part of the county to Orick and Fieldbrook in the north (BLA, 1930a; BLA, 1930b; Petaluma Argus Courier, 1940). Following discovery of natural gas on Tompkins Hill by the Texas Company (i.e. Texaco) in 1937, the mix of available fuels increased in the region. PG&E announced plans to build a pipeline from Tompkins Hill to Eureka in 1940 to make the gas available (BLA, 1938; BLA, 1940b; Healdsburg Tribune, 1940).

Post-War Infrastructure Expansion

The post-World War II economic boom led to a rapid expansion in the demand for lumber and other building materials. Humboldt County's forest industry responded by increasing production from about 400 million board feet per year in 1945 to 1,570 million board feet per year in 1959 (Fig. 1). To achieve this increase, timber processing facilities and the labor force had to grow accordingly, and this, in turn, led to a growth in demand for electric and thermal energy services. According to a speech by PG&E President N.R. Sutherland at the dedication of a power plant in 1956, electricity consumption in Humboldt County grew by more than 600%, from 44 million kWh/year to almost 300 million kWh/year, in the decade following the war (HTS, 1956d).

[3]The abbreviation HTS is used to denote the Humboldt Times Standard. Note that the Humboldt Times Standard, the Humboldt Times, and the Times Standard are different ways of referring to the same newspaper.

[4] The generation capacity of the Junction City hydropower plant was increased over time (BLA, 1930a; MacDonald, 1930; BLA, 1940a; HTS, 1966b). In 1930, it reportedly had a capacity of 2,641 horsepower (about 2 MW) (MacDonald, 1930). When it was retired in 1966, the capacity was reported to be 1.8 MW (HTS, 1966b). The plant was damaged in the 1964 flood and was decommissioned in 1966 (HTS, 1966b; Herbert and Root, 2012). Note that Herbert and Root (2012) indicate that the hydropower system at Junction City was expanded to a capacity of 30 MW, but this seems inconsistent with the physical parameters of the site and does not match the reported values in MacDonald (1930) or HTS (1966b).

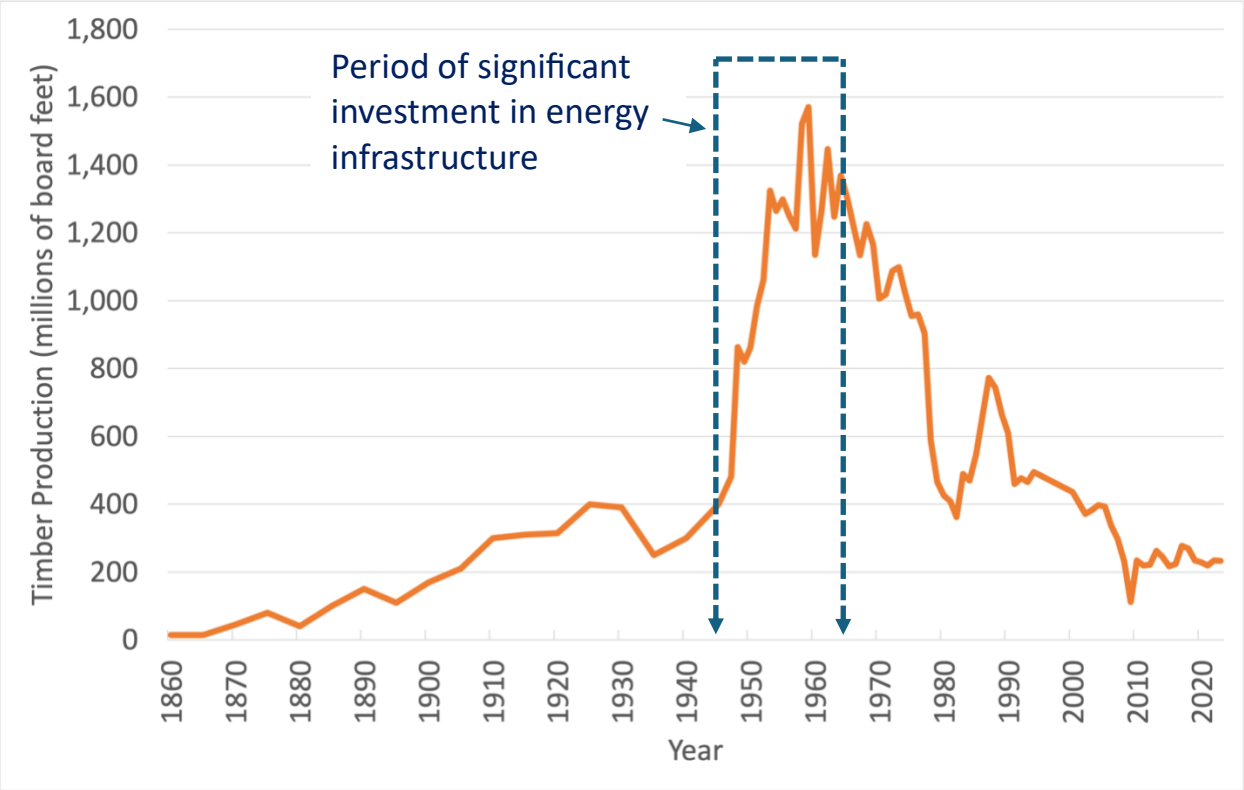

Figure 1. Timber production in Humboldt County, 1860 to 2023 (Data sources: Vaux, 1955; Waddell and Bassett, 1996; Morgan, et al., 2004; BBER, 2024 [Note: data from 1860 to 1945 are estimated from a graph in Vaux, 1955]). As indicated in the graph, the period from 1946 to 1966 involved significant investments by PG&E in the region's energy infrastructure.

The rapid post-war growth in demand for electricity created a challenge, and PG&E initially struggled to supply sufficient power. This led to stopgap investments in generation sources during the late 1940s, including expansion of an existing power plant in Eureka (Station B) from 12.5 to 17.5 MW[5] and deployment of a 5 MW steam-based generator in a salvaged marine vessel named the *Donbass III* that PG&E had acquired in an auction in 1946 (BLA, 1946a; BLA, 1946c; BLA, 1947a; Evans, 2019; Herbert and Root, 2012; Root, et al., 2013). These measures were taken in parallel with investments in longer-term solutions involving expansion of the transmission and generation capacity in the region (Herbert and Root, 2012; Root, et al., 2013). See Figure 2 for an image of the Station B power plant and Figure 3 for an image of the *Donbass III*.

[5] An article by Dan Villa, who served as PG&E's general manager for the Humboldt region, indicates that the expanded generation capacity of Station B was 14.5 MW (rather than 17.5 MW, as indicated in the Blue Lake Advocate article from June 15, 1946) (Villa, 1963; BLA, 1946a). Elsewhere in this report, the 14.5 MW figure is used.

Figure 2. Aerial photograph of PG&E's Station B power plant on the Eureka waterfront. The 14.5 MW power plant includes the tall white exhaust stack. It was located on the same parcel as the Hammond Bayside Lumber Mill, which is just behind and to the left of the power plant in this image. Source: Photo ID 2001.01.1079, Shuster Aerial Photograph Collection, Cal Poly Humboldt Library. Photo date: September 23, 1948.

Figure 3. Aerial photograph of the Donbass III, the vessel that served as a 5 MW power plant from 1947 to 1958. The Donbass III is the half vessel facing away from shore in the left side of the image. A white arrow indicates its location. Source: Photo ID 2001.01.2277, Shuster Aerial Photograph Collection, Cal Poly Humboldt Library. Photo date: August 15, 1957.

Between 1946 and 1966, PG&E made substantial investments in the region's energy infrastructure, including (i) developing two new 115 kV transmission lines between Eureka and PG&E's electrical system in the Redding area (HTS, 1952e; Villa, 1963), (ii) building 160 MW of new generation infrastructure at Buhne Point, just south of Eureka, consisting of two 50-MW natural gas fired steam turbines and a 60 MW boiling water reactor nuclear power plant (HTS, 1956d; BLA, 1956b; BLA, 1958a; BLA, 1958c; BLA, 1961a; BLA, 1963; Herbert and Root, 2012; Root, et al., 2013), (iii) constructing numerous new power lines and substations to connect towns and lumber processing facilities across the region, and (iv) installing a 163-mile natural gas pipeline from Corning, in the Upper Sacramento Valley, to Eureka to deliver fuel for the gas-fired power plants, timber processing facilities, residential use, and other applications (HTS, 1956d; BLA, 1956c; BLA, 1957a; BLA, 1958a).

See Figure 4 for an image of the first natural gas fueled unit at Buhne Point while it was under construction in 1955. As shown in Table 1, nearly all the existing PG&E substations in the region

were established during the period from 1946 to 1966.[6] This buildout involved the largest investment made to date in Humboldt County's energy infrastructure, and it established the architecture of the regional electrical system that is still in place today (Figure 5).

Figure 4. Aerial photograph of Fields Landing (foreground), Buhne Point (middle center), and the community of King Salmon (middle left). The first unit of PG&E's natural gas power plant at Buhne Point, indicated by the white oval, was under construction when the photograph was taken. Source: Photo ID 2001.01.2227, Shuster Aerial Photograph Collection, Cal Poly Humboldt Library. Photo date: March 24, 1955.

[6] In a few cases, the listed substations were constructed at or near sites that had existing electrical facilities dating back to the early years of the 20th century.

Table 1. PG&E Substations in Humboldt County and Approximate Year of Establishment. [7]

Substation Name	Year Est.	Max. Voltage[8]	Year Est. Source
Arcata	1946	60 kV*	BLA, 1946b
Big Lagoon	1954	60 kV*	HTS, 1954b; BLA, 1954c
Blue Lake	1949	60 kV*	BLA, 1949a
Bridgeville	1954	115 kV*	BLA, 1954b
Carlotta	1952	60 kV	HTS, 1952f; BLA, 1952d
Eel River (Ferndale)	1956	60 kV*	HTS, 1956a
Eureka A (significant upgrade)	1959[9]	60 kV	HTS, 1959
Eureka E	1953	60 kV*	HTS, 1953b
Fairhaven	1966	60 kV*	BLA, 1965b; HTS 1966a
Fort Seward[10]	1948	60 kV	BLA, 1948
Fruitland	1952	60 kV*	HTS, 1952f; BLA, 1952d
Garberville	1947	60 kV*	ST, 1947
Harris (Eureka)	1960	60 kV	HTS, 1960
Hoopa	1958	60 kV*	BLA, 1958b
Humboldt (Eureka)	1950	115 kV*	HTS, 1953b
Humboldt Bay	1956	115 kV	BLA, 1956b
Janes Creek (Arcata)	1957	60 kV*	BLA, 1956a; HTS, 1957
Maple Creek	Before 1948	60 kV*	BLA, 1948
Newburg (Fortuna)	1955	60 kV*	HTS, 1955
Orick	1952	60 kV*	HTS 1952a; BLA, 1952b
Rio Dell	1952	60 kV	HTS, 1952f; BLA, 1952d
Rio Dell Tap[11]	1952	60 kV	HTS, 1952f; BLA, 1952d
Russ Ranch (Redwood Creek)[12]	1952	60 kV	HTS, 1952f; BLA, 1952d
Trinidad[13]	Before 1954	60 kV*	HTS, 1954b; BLA, 1954c
Ultra Power (Blue Lake)	1985	60 kV	LCT, 1984; Zoellick, 2005
Willow Creek	1949	60 kV*	BLA, 1949b

[7] The year each substation was established is based on news articles from the listed sources. In some cases the year the substation was commissioned may vary slightly from the listed date (e.g. by one year) due to imprecision of information in the news articles. Substations established between 1946 and 1966 have grey cell backgrounds, and the one established in the 1980s has a blue background.

[8] Maximum voltages listed are based on values in the Homeland Infrastructure Foundation Level Database (HIFLD) as of December 2024 (HILFD, 2024). In cases where information about transmission line and substation voltages is included in the sources cited in Table 1 (these are marked by a *), the references indicate that these values have not changed since the respective dates of establishment. Given the architecture of the system, the available information confirms that the voltages of the other substations also have not changed. Note that power line voltage ratings are not precise, and references to ratings of 110 kV and 115 kV can be considered to be equal.

[9] The Eureka A Substation was originally developed decades before the 1959 upgrades. For example, there is a reference to a Western States Gas and Electric substation at the site in an article published in 1921 (HTS, 1921).

[10] Fort Seward received electricity in 1948, but BLA (1948) does not mention the substation explicitly. A lumber mill began operating at Fort Seward in 1948 (HTS, 1956b), which is consistent with the need for a substation.

[11] This listing assumes that the Rio Dell Tap was installed at the same time as the Rio Dell substation.

[12] The Russ Ranch Substation was referred to as the Redwood Creek Substation in news articles from 1952 (HTS, 1952d; HTS, 1952f; BLA, 1952d).

[13] The Trinidad substation was installed at some point before 12/2/1954. Based on its relationship to other regional electricity infrastructure, it is very likely that it was built between 1949 and 1954.

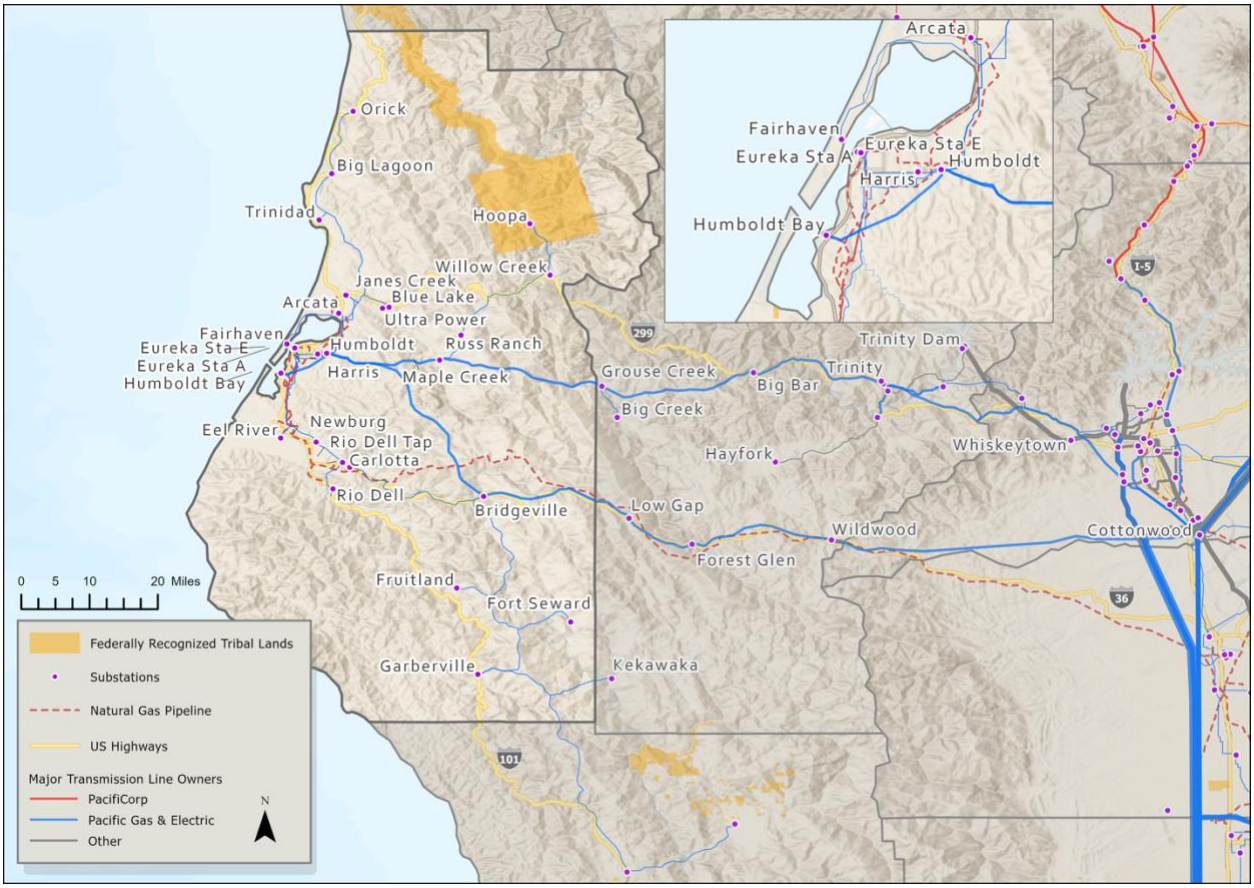

Figure 5. Map of electric transmission infrastructure and natural gas pipelines serving Humboldt County. The inset map shows energy infrastructure in the immediate Humboldt Bay region. The thickness of the lines that represent transmission lines provides an indication of their voltage rating, and therefore their capacity to transmit power. The thinnest transmission lines shown are 60 kV (e.g. the line from Bridgeville going south toward Garberville), and then the next thickest are 115 kV (e.g. Humboldt to Cottonwood via Bridgeville). The thicker lines in the I-5 corridor to the east include 230 kV and 500 kV lines, with the thickest being 500 kV. Source: *Map created by Tanner Etherton.*

The buildout of the electrical infrastructure in the region can be divided into several categories, including (i) generation facilities, (ii) transmission infrastructure to connect Humboldt to the wider electrical grid, (iii) transmission and distribution infrastructure to deliver power to industries and communities in the region, (iv) fuel supply infrastructure (i.e. natural gas pipelines), and (v) facilities and human capacity to expand services in the region.

Development of Electricity Generation Capacity in Humboldt Region

As noted above, development of new generation capacity in the 1950s and 60s involved adding two natural gas fired steam turbines and one nuclear fueled unit, for a total of 160 MW of new capacity. During this period, several older units in Eureka were retired, including the 14.5 MW Station B power plant (retired in 1956), the 5 MW generator on the *Donbass III* vessel (retired in 1958), and the 1.8 MW Junction City hydropower facility (closed in 1964; retired in 1966) (HTS,

1966b; Herbert and Root, 2012).[14] Considering additions and retirements, the net gain in regional generation capacity in the two decades following World War II was nearly 140 MW.

Transmission Lines Connecting Humboldt to the Wider Grid

Humboldt County is connected to the wider electrical grid via four transmission lines. Two operate at 115 kV and serve as the primary connections for the region, while two others operate at 60 kV and are designed primarily to serve small communities to the east and south of Humboldt Bay (Fig. 5).[15]

Shasta County to Humboldt Transmission via Northern Corridor

The northernmost 115 kV transmission line connects Humboldt to PG&E's Cottonwood substation in the Redding area using a corridor originally established by North Mountain Power in 1904-05 to connect the Junction City hydropower plant on Canyon Creek to Eureka. This corridor follows Hwy 299 for a portion of its route, and it is currently occupied by the 115 kV line and a 60 kV line that helps serve communities along the route (HIFLD, 2024). The original line in this corridor, from Junction City to Eureka, was rated at 30 kV (BLA, 1904; HTS, 1905a). Sometime between 1915 and 1920, the Junction City hydropower plant, which was operated at the time by Western States Gas and Electric Company, was connected to the network of another company, Northern California Power System (NCPS), at Weaverville, about 12 miles to the east of Junction City. Weaverville was electrically connected to Redding, so the Junction City to Weaverville line linked Eureka to Shasta County and the wider electrical system. When the connection was made, the transmission line between Junction City and Eureka was upgraded to 60 kV to match the voltage of NCPS's network at Weaverville (BLA, 1921; MacDonald, 1930; Root and Herbert, 2013). In 1927, PG&E purchased Western States Gas and Electric, including the Junction City hydropower system and the 60 kV line (BLA, 1927; MacDonald, 1930). PG&E expanded transmission capacity in the corridor multiple times over several decades, including rerouting sections to reduce the risk of outages caused by winter storms (BLA, 1930a; BLA, 1932; Press Democrat, 1951). In 1948, PG&E added the 115 kV line to the corridor, substantially increasing capacity to deliver power to the Humboldt Bay region (BLA, 1949a; Villa, 1963).

Shasta County to Humboldt Transmission via Southern Corridor

In 1952, PG&E added a second 115 kV line connecting Humboldt to the Cottonwood Substation. This line, which runs through a corridor that is about 20-25 miles to the south of the original 115 kV line discussed above, follows Highway 36 for much of its route. Around the same time,

[14] According to Villa (1963), Station B was retired in 1960 rather than in 1956 as per Herbert and Root (2012). Additionally, according to Root, et al. (2013), the Junction City hydroelectric plant was decommissioned in 1960. However, a P. G. and E. Progress article indicates that the hydro plant was still in operation in 1961 (P. G. and E. Progress, 1961), and HTS (1966b) and Herbert and Root (2012) confirm 1966 as the decommissioning date.

[15] Electric transmission lines are often divided into two categories, including bulk transmission lines, which are higher capacity lines that carry large amounts of power over long distances, and sub-transmission lines, which connect the bulk transmission system to local electric distribution systems. In California, bulk transmission lines generally have voltages larger than 200 kV, while sub-transmission lines usually fall below this voltage threshold (Aspen Environmental Group, n.d.). Using these definitions, all the transmission lines serving Humboldt County can be considered sub-transmission lines. For simplicity, the term "transmission" is used throughout this document to refer to both bulk transmission and sub-transmission infrastructure.

PG&E also added 115 kV substations in the Mitchell Heights area on the northeast side of Eureka (Humboldt Substation, 1950) and near Bridgeville (1954)[16] (P. G. and E. Progress, 1952; HTS, 1953b; BLA, 1954b). The Humboldt Substation serves as the connection point for both 115 kV lines connecting Humboldt to Cottonwood, and it can be considered the primary hub for the electrical system in the region. The Bridgeville Substation provides a connection point between the southern 115 kV line and a 60 kV transmission line that runs south to Garberville and other points to the south, connecting Humboldt to the electrical system in Mendocino County (BLA, 1954a; HTS, 1954a).[17] The addition of the southern 115 kV line and the associated regional interconnection points improved power reliability in the region, as it provided a redundant pathway for power flow between PG&E's bulk electrical grid network, via the Cottonwood Substation, and the Humboldt Bay region. As a result, when one of the power lines went down during a winter storm, mudslide, or another event, there was a backup line that could maintain the connection (BLA, 1950a; BLA, 1952a; HTS, 1952a; HTS, 1952d). Dan Villa, PG&E Humboldt Division Manager, noted this in a 1952 news article interview, saying, "We believe this new southerly route will give greater reliability during the difficult winter months, because it has good accessibility and different exposure" (BLA, 1952c). The project involved considerable effort, with as many as 272 workers on the job at the peak period of construction. The workers were housed in multiple locations along the route, including construction camps at Booth Run, Bridgeville, Cobbs, Forest Glen, Wildwood, and Duncan Creek (BLA, 1952d; HTS, 1952e).

Transmission Lines Serving Southern Humboldt County

Garberville was initially connected to the wider grid in 1947 from the south via a 60 kV line from Willits in Mendocino County (Sebastopol Times, 1947; Geyserville Press, 1948). A few years later, when the Bridgeville Substation was installed in 1954, a 60 kV line was added connecting Garberville to Bridgeville (HTS, 1954a; BLA, 1954b). This connected southern Humboldt from both sides (north and south) and created a linkage, albeit one with limited capacity, between Mendocino County and Humboldt County. Additional southern Humboldt areas were served from branches along the 60 kV power corridor via the Fruitland and Fort Seward substations and expansion of 12 kV distribution infrastructure to communities such as Briceland, Honeydew, and Petrolia (BLA, 1952d; HTS, 1952f; HTS, 1953a; HTS, 1955). In recent years, about 70 years after the original buildout of the electrical infrastructure serving southern Humboldt County, transmission and distribution capacity constraints were identified as a factor limiting the ability of new commercial and public sector customers to receive electrical service, thereby hampering economic development and public service provision in the region (Burns, 2022).

Transmission Lines Serving Communities Throughout the Humboldt Region

Electrical infrastructure expansion during the period from 1946 to 1966 included development of multiple substations and 60 kV transmission lines to support delivery of power to timber

[16] The Humboldt Substation was established in 1950 and expanded in 1953 (HTS, 1953b). The Bridgeville Substation was installed in 1954 (BLA, 1954b). It eventually displaced a small, nearby substation at Swains Flat, which had provided power to several communities in the area (HTS, 1952f; BLA, 1959). The Swains Flat substation, which reportedly had 1.5 MW of throughput capacity, was installed in 1952 (HTS, 1952f; BLA, 1952d).

[17] There is also a 60 kV line that runs from Bridgeville to the Humboldt Bay Substation (est. 1956), the site of the power plants at Buhne Point, via Carlotta (1952) and Fortuna (Newburg Sub, 1955).

mills, communities, and other sources of demand. In this section, the buildout of this infrastructure is summarized by geographic area. The locations of the substations and references in newspaper articles indicate that industrial facilities with high power demand, such as timber mills, received high priority during the buildout. For example, in reference to expansion of electrical infrastructure in the Blue Lake area in 1949, George Works, Humboldt Division Manager of PG&E at the time, said that "This work… assures adequate power facilities for the expanded sawmill operations and increased population in this area…" (BLA, 1949a).

Eureka Area

Eureka's transition to its current electrical system configuration began in 1950 with the commissioning of the Humboldt Substation in Mitchell Heights (Figure 6). The Humboldt Substation was expanded in 1953 through the addition of transformers and other equipment to support connection to the new 115 kV line from Cottonwood Substation via the Bridgeville Substation (HTS, 1953b). This was followed by development of the Eureka E Substation (1953) and the Harris Substation (1960), along with significant upgrades to the pre-existing Eureka A Substation in 1959 (HTS, 1953b; HTS, 1959; HTS, 1960). Prior to development of these four substations, the electrical system in Eureka was built around multiple power plants, including Station B, located near the intersection of Waterfront Drive and West 14th Street, the *Donbass III* power plant, and the Junction City hydropower system, which originally connected to the Eureka power network at the current site of Blue Ox Millworks (Herbert and Root, 2012; Root, et al., 2013). Notably, the Eureka E and Eureka A Substations are located near the former site of Station B, while the Harris Substation was installed to support expansion of demand in Eureka in the Henderson area.

Figure 6. Aerial photograph showing Mitchell Heights and Eureka in October 1949. The location of the Humboldt Substation, which was under construction, is indicated with a white oval. Source: Photo ID 2001.01.2178, Shuster Aerial Photograph Collection, Cal Poly Humboldt Library. Photo date: October 17, 1949.

Arcata and Blue Lake

In 1946, the capacity of the electrical system serving the town of Arcata was expanded through construction of a 7-mile 60 kV transmission line that connected Arcata to Eureka. The new line created a direct linkage between the transmission system that delivered hydropower from the Junction City hydroelectric plant and the electric distribution system serving Arcata. Prior to installation of the new 60 kV line, Arcata was electrically connected to Eureka via three 12 kV distribution lines that originated at the Station B power plant in Eureka (BLA, 1946b). This new power line was one of PG&E's first post-World War II investments in the region, marking the beginning of the post-war electrical system expansion.

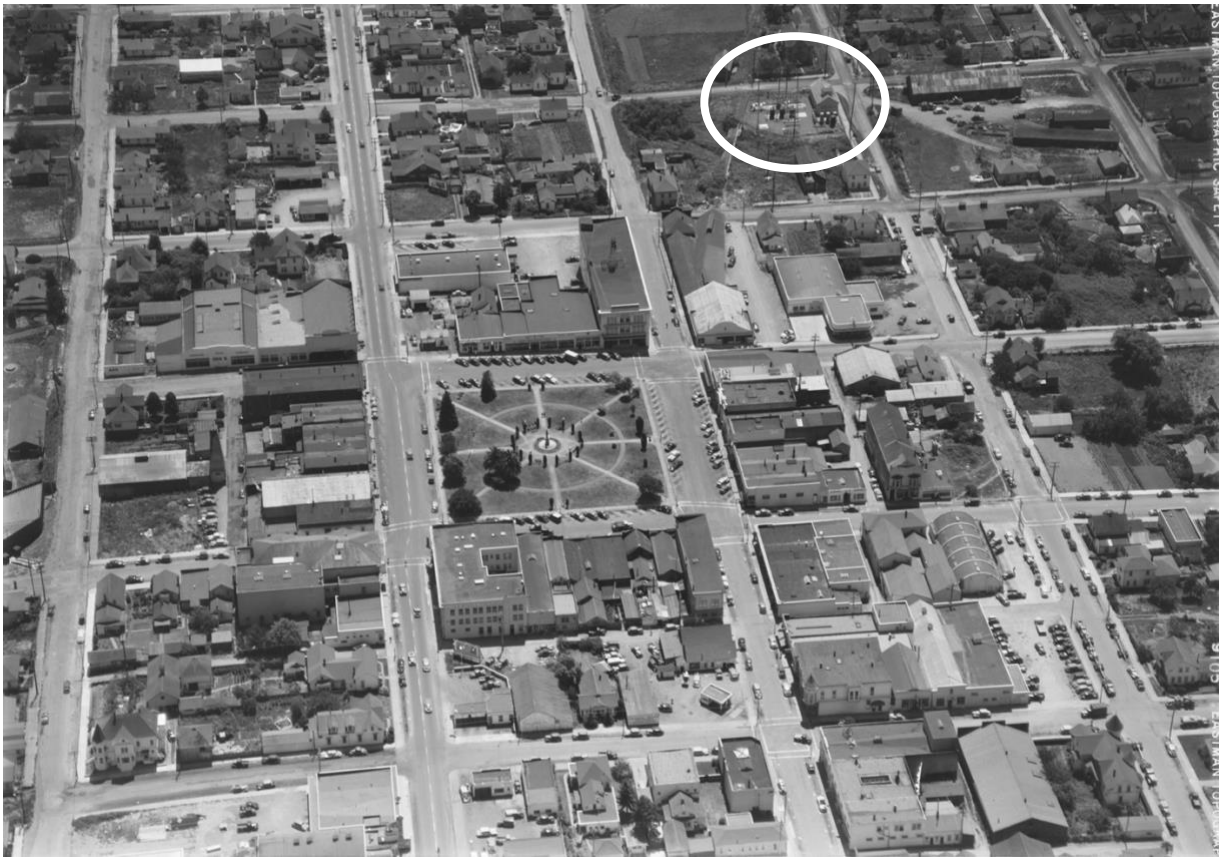

Figure 7. Aerial photograph showing the Arcata plaza and surrounding areas in 1947. The location of the Arcata Substation is indicated with a white oval. Source: *Photo ID 2001.01.0679, Shuster Aerial Photograph Collection, Cal Poly Humboldt Library. Photo date: July 12, 1947.*

A few years later, in 1949, PG&E upgraded service to Blue Lake and Korbel, both located in the Mad River Valley, by building a 7.5 mile 60 kV line from the Arcata Junction[18] to Blue Lake and constructing a new substation in Blue Lake. The capacity of the 60 kV line from Eureka to the Arcata Junction and the capacity of the Arcata Substation were increased at the same time through reconductoring[19] and installation of larger transformers, respectively. Blue Lake had previously been connected to Arcata with a 12 kV distribution line (BLA, 1949a).

Fortuna and Surrounding Area

In 1952, as PG&E was completing construction of the 115 kV transmission line from Cottonwood to Eureka via Bridgeville on Highway 36, it also extended its 60 kV line network and installed several new substations at Swain's Flat (1.5 MW capacity), Carlotta (3 MW capacity), and Rio Dell (5 MW capacity) (HTS, 1952f). At the same time, as mentioned above, a 60 kV line was

[18] The Arcata Junction is a point in the electrical system just south of Arcata where multiple 60 kV transmission lines intersect.

[19] Reconductoring involves replacing the electrical conductors in a transmission or distribution line with new ones. In some cases the new conductors are higher capacity or are otherwise improved compared to the existing conductors.

extended from Swain's Flat, near Bridgeville, to Garberville in southern Humboldt County (HTS, 1952f; HTS 1953a). In 1954 and 1955, PG&E installed 60 kV infrastructure connecting Eureka (Station E Substation) to Fortuna and then Bridgeville via Carlotta. The infrastructure expansion included a connection to the Newberg Substation, which serves Fortuna, in 1955 (HTS, 1954a; HTS, 1955). The Eel River Substation (7.5 MW capacity) was completed in 1956, improving service to Ferndale, Fernbridge, Loleta, and surrounding areas. The Eel River Substation was connected via a 60 kV power line extension that originated at a junction on the transmission line connecting Eureka with the Newberg Substation (HTS, 1956a).

Trinidad, Big Lagoon, and Orick

Several communities to the north of Humboldt Bay are served by a 60 kV transmission line that originates at the Humboldt Substation, passes through electrical junctions near Arcata (Arcata Junction) and Essex Lane (Essex Junction), and is delivered to customers through the Trinidad, Big Lagoon, and Orick substations. As noted above, a branch circuit from this line extends from Essex Junction to serve Blue Lake and other communities in the Mad River Valley (HIFLD, 2024).

The 60 kV transmission circuit that continues to serve Trinidad, Big Lagoon, and Orick was originally built in the late 1940s and early 1950s. Communities in the area, including Fieldbrook, Trinidad, and Orick, had electrical service prior to this period, but their connections were via 12 kV lines that extended from Arcata (People's World, 1937; Petaluma Argus Courier, 1940). The Orick substation was commissioned in March 1952, an event that involved considerable fanfare. According to news accounts, the celebration included a parade, folk dancing, axe throwing and log bucking competitions, a community dinner, and other activities (HTS, 1952c; BLA, 1952b). The substation at Big Lagoon went into service in 1954. It was installed near the site of a newly constructed lumber mill owned by the Hammond Lumber Company, and the primary purpose of the substation was to provide power to the mill (HTS, 1954b; BLA, 1954c). See Figure 8.

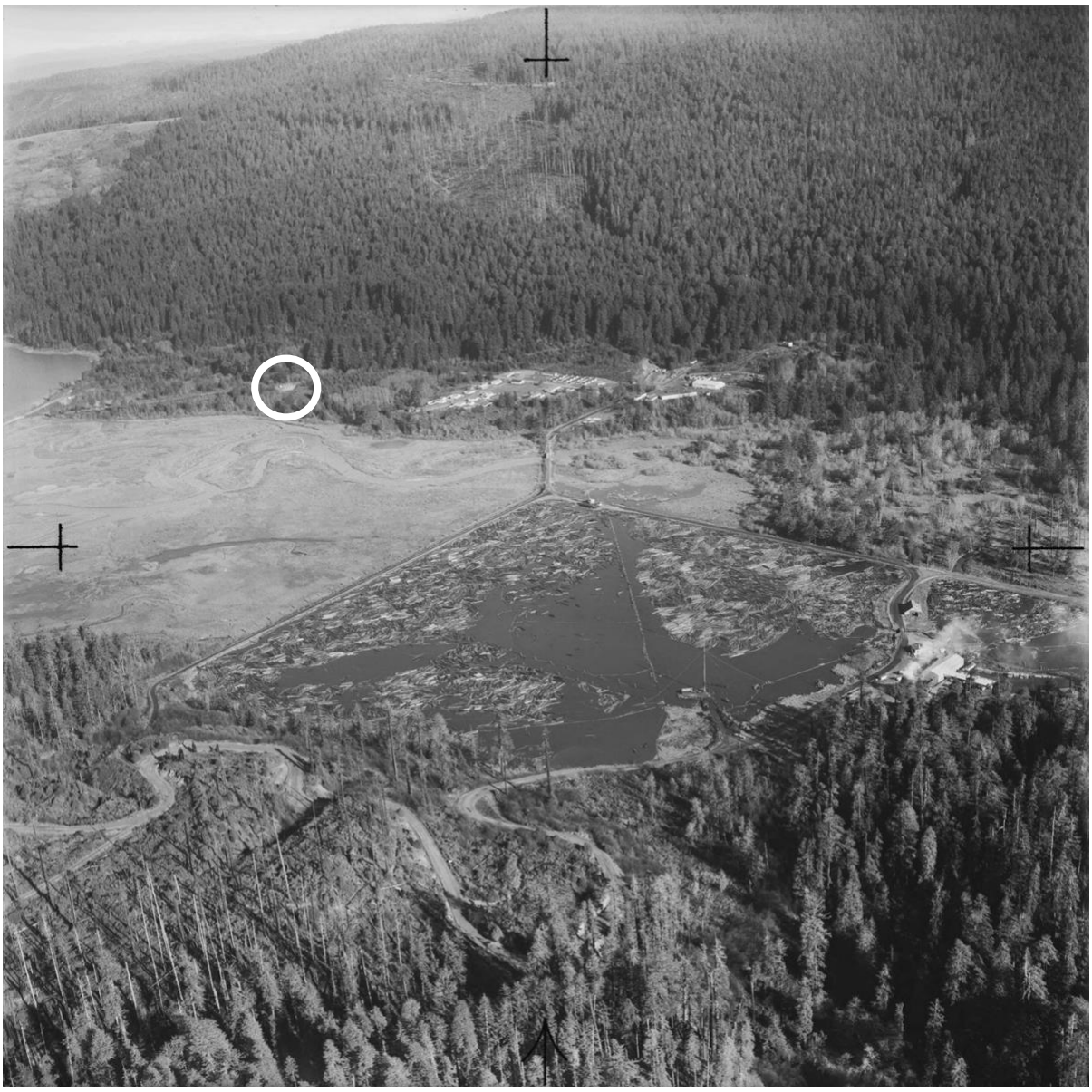

Figure 8. Aerial photograph showing forest land and the log pond, lumber mill, and associated facilities at Big Lagoon. The location of the Big Lagoon Substation, which had been completed recently at the time of the photo, is indicated with a white oval. Source: *Photo ID 2001.01.2418, Shuster Aerial Photograph Collection, Cal Poly Humboldt Library. Photo date: December 28, 1955.*

Finding news articles that document the installation of the Trinidad Substation has proved difficult, but it is likely that it was connected to the 60 kV transmission line sometime between 1949 and 1954. Articles documenting the Big Lagoon substation commissioning note that the area had previously been served by a 12 kV line from Trinidad, indicating that the Trinidad Substation must have been built before 1954 (HTS, 1954b; BLA, 1954c). The 60 kV line that reaches Essex Junction before dividing into circuits was put into service in the late 1940s (BLA, 1946b; BLA, 1949a). These two circuits deliver power to (i) the Blue Lake Substation and (ii) the

Trinidad, Big Lagoon, and Orick Substations. The circuit that serves Trinidad, Big Lagoon, and Orick continues to experience frequent and sometimes extended outages, in some cases due to storms in the winter months (e.g., Kemp, 2023; Kemp, 2024).

Maple Creek, Willow Creek, Hoopa Valley, and Surrounding Areas
Portions of the Trinity River and Klamath River valleys are served by a 60 kV circuit that starts at the Humboldt Substation and runs through the Maple Creek Substation *en route* to Willow Creek, the Hoopa Valley, and other communities in the Trinity River and middle Klamath River valleys. Substations serving this area include the Maple Creek, Russ Ranch, Willow Creek, and Hoopa Substations (HIFLD, 2024). This infrastructure dates back to the late 1940s.

In 1945, just after the end of World War II, members of the Trinity Valley communities of Willow Creek, Salyer, and Burnt Ranch began advocating for PG&E to extend electrical service to the region (BLA, 1945). The installation of the Maple Creek Substation, during or prior to 1948, provided key foundational infrastructure (BLA, 1948). The Maple Creek Substation is situated along the transmission corridor that includes the northerly 115 kV transmission line that connects the Humboldt Bay region to the Shasta region and a 60 kV line that serves communities along the route. In 1947, PG&E began construction on a project to deliver electric service to the Willow Creek area (BLA, 1947b). Construction of a 60 kV transmission line from Maple Creek to Willow Creek was completed in 1949, and the Willow Creek Substation was commissioned in the same year (BLA, 1949b). Through this infrastructure and associated 12 kV distribution lines, PG&E served forest industry facilities and communities along the Trinity River from Willow Creek going upstream to Del Loma, downstream to the Hoopa Valley Indian Reservation, and to the communities of Weitchpec and Orleans along the Klamath River (BLA, 1947b; BLA, 1948; BLA 1949a; BLA, 1949b). In addition, a 12 kV distribution line running from the Willow Creek Substation to Redwood Valley[20] (via Berry Summit) was installed in the same corridor as the 60 kV transmission line from Maple Creek (BLA, 1948; BLA, 1949b; BLA, 1949b). A branch of the 12 kV circuit also extended up Horse Mountain to a US Forest Service radio transmitter (BLA, 1949a). Construction of these facilities involved a significant workforce, including a crew of 50 people based in Willow Creek and another group of 25 in a work camp along the transmission route at a point that was, "…two miles from Redwood Creek midway between Maple Creek and Berry Summit…"[21] (BLA, 1949a).

During the first few years of operation, the Maple Creek to Willow Creek 60 kV transmission line experienced a number of outages related to winter weather. To address this, several measures were taken in 1952. According to Dan Villa, PG&E's Humboldt Region division manager at the time, this involved, "…doing everything humanly possible to protect the line from the ravages of winter. … Our crews right now are widening the right-of-way clearing, removing all 'danger' trees that might fall or be blown onto the lines, rebuilding the 30 pole-structures, and strengthening the actual line itself to withstand the heaviest ice and snow loads" (HTS, 1952d).

[20] The Redwood Valley is an area that can be accessed from Highway 299 via Chezem Road.
[21] Although the description in the cited news article is not precise, the work camp site may have been on a ranch owned by the Russ family along Snow Camp Road.

During the same period, PG&E also expanded the capacity of the Maple Creek Substation and installed a new 3 MW substation at a site along Snow Camp Road on property owned by the Russ family (HTS, 1952f; BLA, 1952d). In news articles published in the 1950s, the substation was referred to as the Redwood Creek Substation, but it is now known as the Russ Ranch Substation. It currently serves two customer accounts on a single property (i.e. the Russ Ranch, located on Snow Camp Road in Humboldt County) (PG&E, 2021b). The property is owned by descendants of Joseph Russ I (Van Kirk, 2013).

In 1958, a substation was commissioned on the Hoopa Valley Indian Reservation, and a 60 kV transmission line was extended from Willow Creek to the Hoopa Substation (BLA, 1958b). This infrastructure expanded the level of service in the area, replacing the 12 kV line that had been installed about a decade prior (BLA, 1947b; BLA, 1948). The Hoopa Substation served the Hoopa Valley along with communities on the Klamath River in and around Weitchpec and Orleans (BLA, 1958b). Weitchpec sits at the confluence of the Klamath and Trinity Rivers, and the area is now part of the Yurok Indian Reservation. Orleans is upstream of Weitchpec on the Klamath River, and the area is within the ancestral territory of the Karuk people. The distribution infrastructure from the Willow Creek Substation serving communities up to Del Loma was also expanded in 1958 through the addition of a second 12 kV line (BLA, 1958b).

To this day, the electrical infrastructure serving areas around Willow Creek and the Hoopa Valley experience high outage rates. Distribution circuits associated with the Willow Creek and Hoopa substations are regularly determined to be among the least reliable in Pacific Gas & Electric territory due to frequent and extended outages (PG&E 2014, PG&E 2016, PG&E 2017; PG&E 2019a; PG&E, 2020; PG&E, 2021c). Moreover, the electric distribution network still does not reach some communities in the region, such as Forks of Salmon, which lies to the east of Orleans in the ancestral territory of the Karuk Tribe. Others – including communities on the Yurok Indian Reservation downriver from Weitchpec along Highway 169 – were first connected as recently as 2018 (Zoellick, 2020; Sandoval, 2018).

Samoa and Fairhaven

Electric service to the lumber mills and communities of the heavily industrialized Samoa Peninsula, which sits to the west of Eureka across Humboldt Bay, was expanded in 1965 and 1966 through installation of two 60 kV transmission lines and construction of the Fairhaven Substation (HTS, 1965; HTS, 1966a). The transmission lines shared a single set of metal lattice towers. The towers were designed to accommodate 115 kV transmission lines, but they have been operated at 60 kV from the time of installation to the present day (HTS, 1965; HTS 1966a; HIFLD, 2024). The 60 kV transmission lines to the Samoa Peninsula originate at the Arcata Junction, run along the north side of Arcata Bay, and then head southwest along the peninsula to the Fairhaven Substation. After installation was complete, two 12 kV submarine cables that ran under the channel between Eureka and the Samoa Peninsula were decommissioned (HTS, 1966a). Removing the cables reportedly eliminated a barrier to deepening the Humboldt Bay navigation channel (HTS, 1966a). Figure 9 shows an image of the Samoa Peninsula in 1955, a decade prior to the expansion of PG&E's electrical infrastructure to the area.

Figure 9. Aerial photograph showing the Hammond Lumber Company Mill and Town of Samoa in 1955. The mill included a power plant, indicated with a white oval, which provided electricity to company-owned facilities. Source: *Photo ID 2001.01.2417, Shuster Aerial Photograph Collection, Cal Poly Humboldt Library. Photo date: December 28, 1955.*

Natural Gas Pipeline Development

During the late 1950s, PG&E also built a 12" pipeline that delivered natural gas from Corning, CA, in the Upper Sacramento Valley, to the Humboldt Bay region. Development of the 163-mile gas pipeline was announced in 1956, initiated in 1957, and completed in 1958, and – for the first time – it linked Humboldt to PG&E's wider natural gas pipeline network. The pipeline, which follows Highway 36 for much of its route (Fig. 5), greatly expanded access to gas in the region at a time when supply from the Tompkins Hill gas field was declining. When it was initially commissioned, the new pipeline could deliver an estimated 21 million cubic feet of gas per day, compared to the little under 8 million cubic feet per day that was available from the Tompkins Hill gas field (HTS, 1956d; BLA, 1956c; BLA, 1957a; BLA, 1958a). While the gas was used for multiple applications in residential, commercial, and industrial settings, PG&E's two 50 MW gas-fired power plant units were among the primary consumers. Once the pipeline was in place, the regional gas network was expanded beyond Eureka, Arcata, and Fortuna to additional areas with industrial facilities, such as Blue Lake and Samoa (BLA, 1961b; BLA, 1961c). At least in the

case of Ferndale, PG&E initially declined to expand the network to an area that was primarily residential, citing the high cost of extending the pipeline network compared to the revenue that would be derived from sales of the gas (BLA, 1961d). As of 2025, the natural gas pipeline from Corning remains Humboldt County's sole connection to the wider natural gas network. It supplies over 90% of the County's gas, including fuel for PG&E's 163 MW Humboldt Bay Generating Station, which is the anchor power plant for the region.[22]

Representatives from PG&E commented on the energy system buildout as it was happening. In 1949, George L. Works, Humboldt Division manager for PG&E, said that, "The company [PG&E] has invested millions of dollars in the Humboldt region during the last several years to increase the power supply and extend service to new applicants. … In its system as a whole, P. G. and E.'s power construction program is America's biggest postwar effort by a single electric utility company. We have made record-setting progress in building war-delayed facilities and fulfilling our responsibilities in the unprecedented growth of California" (BLA, 1949b). In all, between 1946 and 1966, PG&E invested the equivalent of approximately $1 billion in current (2025) dollars to upgrade energy infrastructure serving the Humboldt County region.[23]

PG&E Service Center and Regional Operations Capacity

In addition to the buildout of its physical infrastructure, PG&E invested in its capacity to provide service to the region during the post-World War II expansion. While these investments are not as well documented in news articles and other sources as the development of the physical infrastructure, some information is included. For example, in 1950, PG&E set up a mobile radio communication system to support line repair in the region. According to George Works, PG&E's division manager for Humboldt County at the time, this system would "greatly facilitate power line maintenance" by enabling rapid communication between headquarters and field crews working to make repairs (BLA, 1950b). Subsequently, in 1954, PG&E established a service group at Willow Creek to serve the electrical infrastructure in the Trinity River Valley. Facilities included a warehouse, storage yard, and equipment storage building, while staffing included a 5-person crew and a service agent. At the time, Dan Villa, regional manager for PG&E, commented that, "The growth of forest and milling operations and the development of considerable tourism business in that section have resulted in an increase in customers large enough to justify our expenditures" (BLA, 1954a). In 1965, PG&E expanded its capacity to provide service in the Humboldt Bay region through development of a new service center in the Myrtletown area of Eureka (HTS, 1965). This site, on the northern end of Eureka along Myrtle Avenue, continues to be PG&E's largest service center in Humboldt County.

[22] In 2021, total gas consumption for Humboldt County averaged 8.8 million cubic feet per day according to data from the California Energy Commission. Production from the Tompkins Hill gas field averaged 0.68 million cubic feet per day, or about 8% of the total (CEC, 2024a; CalGEM, 2022).

[23] Dollar amounts were derived from the following articles: BLA, 1956b; BLA, 1957b; BLA, 1958b; BLA, 1958c; HTS, 1960; HTS, 1962; BLA, 1963; BLA, 1965a; BLA, 1965b. The amounts were converted to $USD 2025 values using the CPI Inflation Calculator website: https://www.officialdata.org/us/inflation/.

1966 to the Present: Maintenance, Decommissioning, and Modest Upgrades

In the decades following the rapid system expansion from 1946 to 1966, investment in electrical infrastructure expansion was much more limited. During this period, there were investments in maintenance, equipment and generation station replacement, nuclear power plant decommissioning, and – in recent years – measures to reduce transmission and distribution system vulnerability to wildfire. However, there were few major infrastructure additions and the overall architecture of the electrical system did not change. This period also involved modest population growth, at a rate of 0.4% annually, from about 105,000 people in 1960 to about 134,00 in 2023 (US Census Bureau, 1960; US Census Bureau, 2025). At the same time, timber production dropped dramatically from its peak of 1,570 million board feet per year in 1959 to 233 million board feet per year in 2023 (Waddell and Bassett, 1996; BBER, 2024).

In the mid-1960s, following commissioning of PG&E's nuclear unit at Buhne Point, the installed generation capacity managed by PG&E to deliver electric service to Humboldt County totaled about 163 MW, consisting of the two 50-MW natural gas power plants and the 60-MW nuclear power plant at Buhne Point, along with the 1.8 MW hydroelectric system in Junction City. About 60 years later, in 2025, utility-scale power plants in the region have a combined generation capacity of approximately 200 MW. The bulk of this installed capacity, 163 MW, is associated with PG&E's natural gas fired Humboldt Bay Generating Station (HBGS), which is located at Buhne Point on the same site as the previously mentioned power plants (CEC, 2024b). The balance of the energy generation capacity is in the form of independently owned biomass, hydroelectric, and solar photovoltaic generation facilities.[24] While the installed generation capacity has risen and fallen modestly over the years with retirements and additions, the total capacity serving the region has not changed substantially in six decades.

Following the retirement of the Junction City hydroelectric plant in 1966, the next major change involved the closure of the 60-MW nuclear unit of the Humboldt Bay Generating Station. The nuclear unit shut down to enable a seismic retrofit in 1976. It did not restart, in part because an active seismic fault was identified near the plant in the months following the shutdown (Herbert and Root, 2012; HTS, 1977). When the nuclear unit went offline, PG&E brought in two 15-MW combustion turbine generators to partially fill the gap in generation capacity (Herbert and Root, 2012). Although PG&E had plans to complete the seismic retrofit for the nuclear unit, new regulations that were put in place following the Three Mile Island nuclear accident in 1979 created additional challenges, and the unit never came back online (Herbert and Root, 2012). PG&E decided to decommission the nuclear unit in 1983, but the process was not completed until 2021 (Herbert and Root, 2012; HTS, 2021). The cost of decommissioning exceeded $1.1

[24] Utility-scale generation facilities in the region as of 2025 include Humboldt Redwood Company's biomass generation plant in Scotia (32.5 MW, although some of the power is used onsite), a small hydropower plant in Trinity County (Matthews Dam at Ruth Lake: 2 MW), and the Redwood Coast Energy Authority's solar photovoltaic (PV) and battery storage microgrid (2.2 MW solar PV, 2.3 MW (8.9 MWh) battery) (Zoellick, 2005; Schatz Energy Research Center, 2025). Two additional solar PV projects, including the North Coast Highway Solar Project (~2 MW, near Hydesville, CA) and Foster Clean Power, which is a hybrid solar PV and battery storage project in the Arcata Bottoms involving up to 7 MW of solar and 2.5 MW of battery storage, are expected to come online in 2025 (RCEA, 2025b).

billion, which is more than five times the inflation adjusted cost of building the plant (BLA, 1963; CPUC, 2023).

In 1978, President Carter signed the Public Utility Regulatory Policies Act (PURPA), which laid the foundation for enabling independent power producers (IPPs) to operate power plants and sell electricity to utilities, thereby ending monopoly control of electric generation by utilities. Although it took several years for the system to be established, by the early 1980s IPPs across the U.S. began operating power plants using resources ranging from natural gas fuel to solar, wind, and biomass power (Hirsh, 2002). In Humboldt County, an implication of the new system ushered in by PURPA was that independently owned power plants fueled with wood waste from the timber industry could sell power to PG&E. Prior to PURPA, multiple timber mills in Humboldt County operated onsite co-generation power plants fueled by sawdust, wood chips, and other forms of wood waste to serve their own needs for electricity and heat. These included biomass fueled co-generation power plants in Scotia (Pacific Lumber Company, 32.5 MW) and on the Samoa Peninsula (Stockton-Pacific Samoa Pulp Mill, 20 MW) (Zoellick, 2005). During the 1980s, the framework created by PURPA made it possible for these types of plants to sell excess power to PG&E. Additionally, in 1985 Ultrapower III, a 14-MW biomass power plant, came online in Blue Lake.[25] The following year, a 15-MW biomass power plant was established on the Samoa Peninsula near Fairhaven. Several additional small hydropower plants, including units at Matthews Dam at Ruth Lake (2 MW, 1983), the Baker Creek project (1.5 MW, 1987), the Mill and Sulphur Creek project (1 MW, 1988), and Kekawaka Creek near Zenia (5 MW, 1989), were established and began delivering power to PG&E (Zoellick, 2005). Today, only a few of the original PURPA-enabled power generation facilities continue to operate. Notably, other forms of renewable power, such as utility scale solar and wind power, have become much less expensive than biopower, thereby outcompeting it in California's dynamic energy market (JPR, 2016; CBEA, 2025).

As shown in Figure 10, electricity consumption has declined in Humboldt County over the past 25 years after peaking in the late 1990s. Natural gas consumption has also dropped over the same time period (CEC, 2024a; CEC, 2025a). The reduction in electricity and gas use is due in part to a reduction in industrial consumption, as lumber mills and other forest industry facilities closed or reduced operations. Population in the county grew slightly during the same period, indicating that the declines in energy use are not caused by a drop in population (FRED, 2025).

In the context of this declining energy use trend, infrastructure investments, where they are made, would be expected to focus on maintaining the system rather than on capacity expansion. Consistent with this logic, there have not been major changes to transmission infrastructure in the region since the mid 1960s. With the exception of nuclear power plant decommissioning, the largest energy infrastructure investment in the region over the past several decades involved repowering the natural gas fired electric generation infrastructure at Buhne Point. As noted above, in 2010 the 163 MW Humboldt Bay Generating Station came

[25] Ultrapower I and Ultrapower II were biomass plants that were installed during the mid 1980s in Burney, California and Westwood, California, respectively (LCT, 1984).

online in conjunction with retirement of the two original natural gas units (2 x 50 MW) installed at the site. The two 15 MW mobile generation units that had been installed in the 1970s were taken offline at the same time (Herbert and Root, 2012; Root, et al., 2013). A contemporary image of Buhne Point showing the Humboldt Bay Generating Station is shown in Figure 11. There have also been some substation upgrades in the region, such as an overhaul of the Arcata Substation that was completed in 2011 (HTS, 2011). In recent years, PG&E has invested in hardening of transmission infrastructure to reduce vulnerability to wildfire, with measures such as replacing wooden poles with steel (e.g., PG&E, 2021a). Nonetheless, while recent investments have improved and updated key elements of the region's energy system, the layout and capacity of the system have not changed significantly over the past 60 years, and the county remains reliant on electrical and natural gas infrastructure that includes aging equipment.[26]

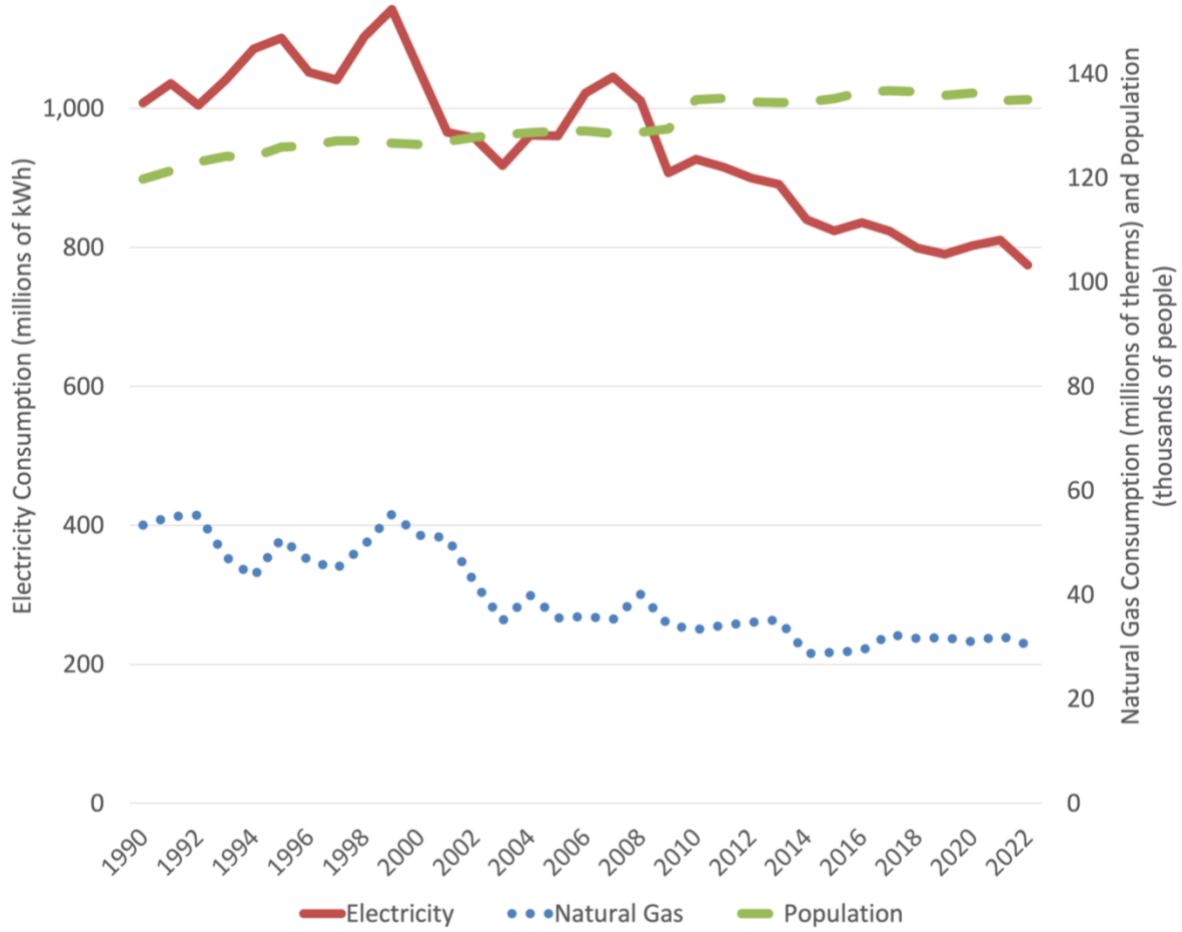

*Figure 10. Electricity consumption, natural gas consumption, and population in Humboldt County, 1990 to 2022 (*Data sources: *CEC, 2024a; CEC, 2025a; FRED, 2025).*

[26] While the expected lifetime of system components varies from one type of equipment to another, infrastructure that is older may result in higher maintenance costs and be more susceptible to faults and/or failure (Kuuskvere and Dengler, 2024). PG&E has accepted responsibility for large wildfire events in California in recent years, and reports have connected wildfire ignition events to faults associated with aging electrical infrastructure owned by PG&E (PG&E, 2019b; PG&E, 2022; Blunt and Gold, 2019; Blunt, 2022).

Figure 11. Aerial photo of the natural gas fired Humboldt Bay Generating Station. The nuclear fuel storage facility is also shown to the left of the power plant near the line of trees overlooking the Humboldt Bay (image from February, 2024).

Although PG&E's transmission and substation architecture has not changed significantly, the region has seen change and innovation in the energy-sector in recent years. In the 1980s, Humboldt County had a thriving market for stand-alone solar power systems. This early solar market was enabled in part by production of cannabis, which helped support economic activity in rural Humboldt County (Doran, 2001; Spies, 2025). Later, in the 1990s and 2000s, Humboldt County continued to have a relatively high rate of rooftop solar adoption for grid-connected systems, although rapid growth of rooftop solar sales elsewhere in the state has since overtaken adoption rates in Humboldt (Zoellick, 2005; PSE, 2025).

The Redwood Coast Energy Authority (RCEA), a local government joint powers authority serving the region, was established in 2003 (RCEA, 2025a). RCEA initially focused on managing energy efficiency programs and engaging in other clean energy projects. In 2017, RCEA expanded its role by becoming a community choice aggregator (CCA), also known as a community choice energy provider. In this role, RCEA is responsible for procuring electricity for participating residential, commercial, and industrial customers in the region. The regional utility, PG&E, remains responsible for managing the transmission and distribution infrastructure through

which the power is delivered, but the procurement of the energy for over 90% of customers in Humboldt County is now managed by RCEA (RCEA, 2023). When procuring electricity, RCEA has prioritized clean and renewable energy (RCEA, 2025a). RCEA is one of 25 CCAs across the state (CEC, 2025b). The first CCA in California, Marin Clean Energy, was established in 2010 (MCE, 2025). When RCEA became a CCA in 2017, it was the sixth in the state (Burns, 2017; Bonson and Brashares, 2017).

Humboldt County is also home to multiple microgrids, including several renewable energy microgrids at the Blue Lake Rancheria Tribe and one at the Redwood Coast Airport. These innovative systems combine onsite electricity generation and storage with a control package that allows the system to toggle back and forth between grid-connected and islanded operational modes. When they are islanded, microgrids operate independently from the rest of the grid. The first microgrid in the region, owned by the Blue Lake Rancheria Tribe and commissioned in 2017, was developed through collaboration between the Rancheria and the Schatz Energy Research Center at Cal Poly Humboldt, Siemens, Idaho National Laboratory, PG&E, and other partners. Major funding for the $6.3 million project was provided by the California Energy Commission and the Blue Lake Rancheria Tribe (Blue Lake Rancheria, 2018; Carter, et al. 2019). This award-winning system has enabled the Rancheria to become an energy resilience hub in the region, providing key services during emergencies that involve grid outages (Schatz Energy Research Center, 2025a). Figure 12 shows the solar array and battery storage elements of the microgrid at the Blue Lake Rancheria, while Figure 13 shows the Rancheria on the evening of December 20, 2022 during a regional power outage caused by an earthquake.

Figure 12. Aerial photograph of the Blue Lake Rancheria Microgrid and other facilities (image from March 2021).

Figure 13. Aerial photograph of the Blue Lake Rancheria during a regional grid outage caused by a 6.4 magnitude earthquake on December 20, 2022. The Rancheria provided services to thousands of people during the event, as it was one of the few facilities in the region that had reliable electricity (Image from December 20, 2022). Earthquake magnitude source: USGS, 2022.

Figure 14 includes an image of the solar array, battery storage, and control system of the Redwood Coast Airport Microgrid (RCAM), which is located at the California Redwood Coast Humboldt County Airport (i.e. the primary airport serving the region). This system was developed through collaboration between the Schatz Energy Research Center, RCEA, PG&E, the County of Humboldt, and other partners. When it came online in 2022, it was the first front-of-meter microgrid in California. As a front-of-meter microgrid, it backs up a segment of the Janes Creek 1103 distribution circuit, which originates at PG&E's Janes Creek substation in Arcata. During normal operations, RCAM is connected to the regional grid. A portion of the solar generated electricity is used to meet onsite electrical demand at the airport, and the rest is delivered to the grid through energy markets managed by the California Independent System Operator. When grid power is not available, which may occur during an emergency or other outages, RCAM automatically switches to islanded operation, providing reliable clean power to over 20 commercial customers within the electrical boundaries of the microgrid, including the California Redwood Coast Humboldt County Airport, the regional Coast Guard station, and multiple others (Schatz Energy Research Center, 2025b; PG&E, 2025).

Figure 14. Aerial photograph of the solar array, battery, and switchgear equipment of the Redwood Coast Airport Microgrid (RCAM). Source: *Photograph by Greyson Adams, August 2023.*

At the regional scale, in 2020 PG&E configured the Humboldt Bay Generating Station and portions of the regional electrical system to operate like a microgrid. This arrangement allows multiple communities in the Humboldt Bay area to remain powered when the transmission lines connecting the area to the Cottonwood Substation are taken offline during Public Safety Power Shutoff events that occur when weather conditions indicate a high risk of wildfire or other emergencies (Burns, 2020).

Potential Investments to Support Offshore Wind

In recent years, offshore wind has emerged as a new potential source of renewable energy generation in the region. The winds offshore from northern California and southern Oregon, specifically along the stretch of coast from just south of Cape Mendocino to just north of Cape Blanco, are among the strongest in the continental United States (Musial, et al., 2016). In 2022, the federal Bureau of Ocean Energy Management (BOEM) held an auction for two lease blocks in a 207 square mile area that is 20-30 miles offshore from Humboldt Bay[27] (DOI, 2022). This deep-water site, which is known as the Humboldt Wind Energy Area (WEA), would require the use of floating offshore wind systems, an emerging technology that has been deployed to date in a few commercial projects in Europe and Asia (Ortega, et al., 2020; GWEC, 2024). The Humboldt WEA could hold an estimated 1.5 to 3 GW of installed wind generation capacity,

[27] The eastern lease area in the Humboldt Wind Energy Area was assigned to RWE Offshore Wind Holdings, LLC (lease # OCS-P 0561), while the western lease area was assigned to California North Floating LLC (lease # OCS-P 0562) (BOEM, 2025). California North Floating LLC is affiliated with Vineyard Offshore, LLC (Vineyard Offshore, 2025).

depending on the size and spacing of the floating wind systems (Cooperman, et al., 2022). Development of offshore wind in the Humboldt WEA would be consistent with climate and clean energy policy of the State of California, including a goal of installing 25 GW of installed capacity along the California Coast by 2045 (CEC, 2024c).

Development of offshore wind at scale on California's north coast would require investment in enabling infrastructure, including a heavy lift port terminal to support assembly and deployment of floating offshore wind systems and onshore electric transmission capacity to allow the wind farms to be connected to the bulk electrical grid (CEC, 2024c). Notably, the potential generation capacity of wind power in the Humboldt WEA (1,500 to 3,000 MW) is on the order of 20 to 30 times greater than the regional Humboldt County electrical load (average ~90 MW) and the export capacity of the existing electrical system (~75 MW) (Cooperman, et al., 2022; CEC, 2025a; Alva, et al., 2022).

To support development of offshore wind, in 2024 the California Independent System Operator (CAISO), which plays a key role in transmission planning within the state, approved a set of projects to enable offshore wind development in the Humboldt WEA (CAISO, 2024a). The first project would involve building a new 500 kV substation in the Humboldt Bay region and a 500 kV transmission line from that substation to the planned Collinsville Substation, which is located to the east of the San Francisco Bay Area near Pittsburg, California. The second project would involve building a new 500 kV transmission line from the new Humboldt region substation to the planned Fern Road Substation, which is located to the east of Redding. Importantly, the approved plan also includes development of a connection, via a phase shifting transformer (PST), between the new 500 kV electrical infrastructure and the existing local 115 kV system in the Humboldt Bay region (CAISO, 2024b). In May 2025, CAISO announced that Viridon Holdings, LLC was selected as the fiscal sponsor to finance, build, own, operate, and maintain both projects (CAISO, 2025a; CAISO, 2025b; CAISO, 2025c). A diagram showing the planned new infrastructure is shown in Figure 15.

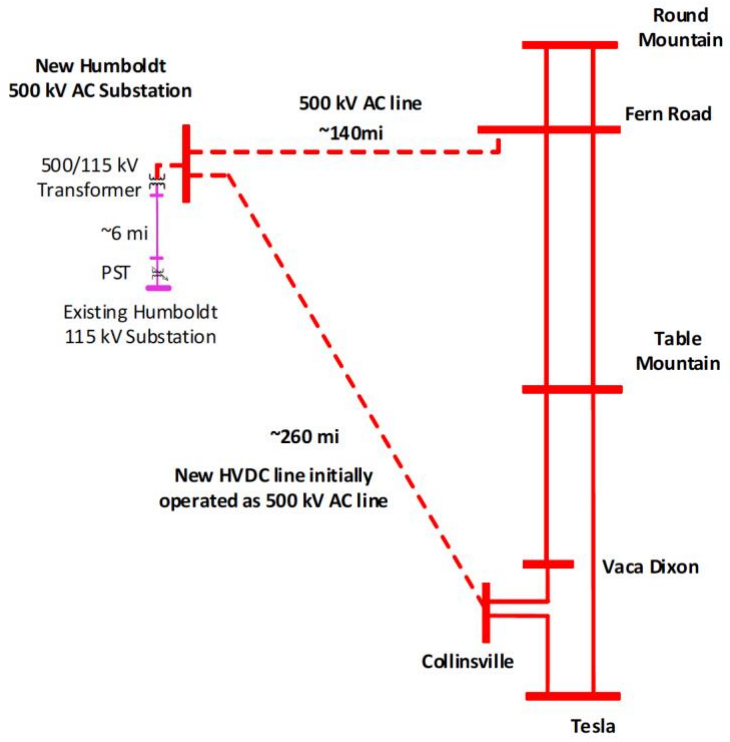

Figure 15. Electrical schematic diagram showing planned 500 kV transmission infrastructure to support offshore wind development in the Humboldt Wind Energy Area. The planned new 500 kV transmission lines are shown as dashed lines, while the connection between the 500 kV infrastructure and the existing local 115 kV Humboldt electrical infrastructure is shown with a thin pink line on the far left side of the diagram. The solid red lines on the right hand side of the figure indicate existing 500 kV transmission lines. The thick, short red lines indicate 500 kV substations. Source: *Image from CAISO, 2024b.*

The planned new transmission infrastructure will initially be designed to support at least 1.6 GW of offshore wind in the Humboldt WEA. The infrastructure will also be designed to enable expansion as additional offshore wind or other generation sources come online (CAISO, 2024b). Importantly, the connection between the new 500 kV infrastructure and the existing local system would significantly increase the capacity and reliability of the electric system in the Humboldt Bay region.[28] The new infrastructure would improve reliability by providing additional

[28] The planned connection between the new 500 kV substation and the existing electrical system is specified to have a capacity of 300 MVA (CAISO, 2024b), which is considerably larger than the capacity of the existing 115 kV transmission lines that connect Humboldt County to PG&E's wider grid system. The increase in capacity and the link to PG&E's 500 kV transmission system at two connection points would improve the reliability of the local system considerably. At the same time, some outlying areas of Humboldt County would not experience significant reliability improvements, as the majority of outage events in those areas are caused by faults that occur on the local circuits (e.g. outages caused by vegetation coming into contact with local distribution lines). For example, communities served by the Hoopa, Willow Creek, and Garberville substations (among others) are unlikely to experience significant reliability improvements following completion of the planned 500 kV infrastructure. Renewable energy microgrids, similar to those installed at the Blue Lake Rancheria and the Redwood Coast Airport

redundant pathways for power flow between Humboldt Bay and the wider electrical grid. CAISO estimates that the new infrastructure may cost approximately $4.2 billion (CAISO, 2024a).[29] If developed, it would represent the first large investment in electrical infrastructure expansion in the region since the 1960s, and it would represent the largest investment ever made in electrical infrastructure in relation to Humboldt County. However, siting, permitting, and building these projects will involve significant challenges. The existing rights-of-way connecting Humboldt County to the wider electrical grid are not wide enough to accommodate the new power lines, and new rights-of-way, likely running parallel to existing rights-of-way for most of the route, would need to be created. Moreover, the expected routes will traverse areas involving numerous landowners, environmentally sensitive habitats, and Native American cultural resource sites (Aspen Environmental Group, 2024). Figure 16 shows the existing 115 kV transmission line that runs from the Cottonwood Substation to the Humboldt Substation via Bridgeville at a location near Cottonwood where it passes under a 500 kV transmission line, thereby giving a sense of the difference in scale between the existing electrical system and the newly planned infrastructure.

While the transmission infrastructure to support offshore wind development has been approved by CAISO, its development is not ensured. Federal policy in relation to offshore wind development changed dramatically with transition from the Biden-Harris administration to the Trump-Vance administration in January 2025. Opposition to offshore wind by the Trump-Vance administration has created uncertainty about the future of wind energy development in the Humboldt WEA (Cart, 2025), and it is possible that CAISO would cancel the transmission projects if offshore wind development seems unlikely to proceed.

but at a somewhat larger scale, have potential to help address reliability issues on circuits serving outlying communities (Schatz Center, 2024).

[29] The cost of connecting the planned 500 kV system to the existing local system is estimated to be $57 million, making it about 1.4% of the total cost of the approved transmission infrastructure (CAISO, 2024a).

Figure 16. Image of the 115 kV transmission line connecting the Cottonwood Substation to the Humboldt Substation via Bridgeville as it passes under a 500 kV line near Cottonwood.

Conclusions

The architecture of the energy infrastructure serving Humboldt County was established in the two decades following World War II, a period involving rapid economic expansion nationwide and a substantial corresponding increase in timber production in Humboldt County. Decades later, the county's electrical and gas infrastructure is aging, energy demand has stagnated, and the circuits serving some communities in the region are among the least reliable in the state. While some investments have been made in Humboldt County's energy infrastructure in the six decades following the post-war buildout, they have focused primarily on maintaining the capacity and architecture of the existing system, hardening some system components, and – in the case of the nuclear unit of the Humboldt Bay power plant – decommissioning. There have been no large investments in expanding the capacity of the electric transmission and natural gas pipeline infrastructure serving the county since the mid 1960s.

A historical review of the development of the county's electrical and natural gas infrastructure indicates that significant investments were made during a time when the state and nation had an interest in a resource in Humboldt County, namely timber from old growth coastal forests, and demand for energy was growing. Now, in the mid 2020s, based on an interest in renewable energy from offshore wind, the State of California is looking to make another large investment

in the electrical infrastructure serving Humboldt County. The proposed new infrastructure to support offshore wind development would be connected to the local system, and – in addition to enabling export of electricity from offshore wind – it would bring significant capacity and reliability benefits to the Humboldt Bay region. If developed, the new transmission infrastructure would represent a once-in-a-generation investment for electrical infrastructure that could support regional economic development in the coming decades. In the absence of offshore wind, substantial near-term investments in the region's energy infrastructure seem unlikely given historic trends in Humboldt County's industrial activity and energy demand.

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