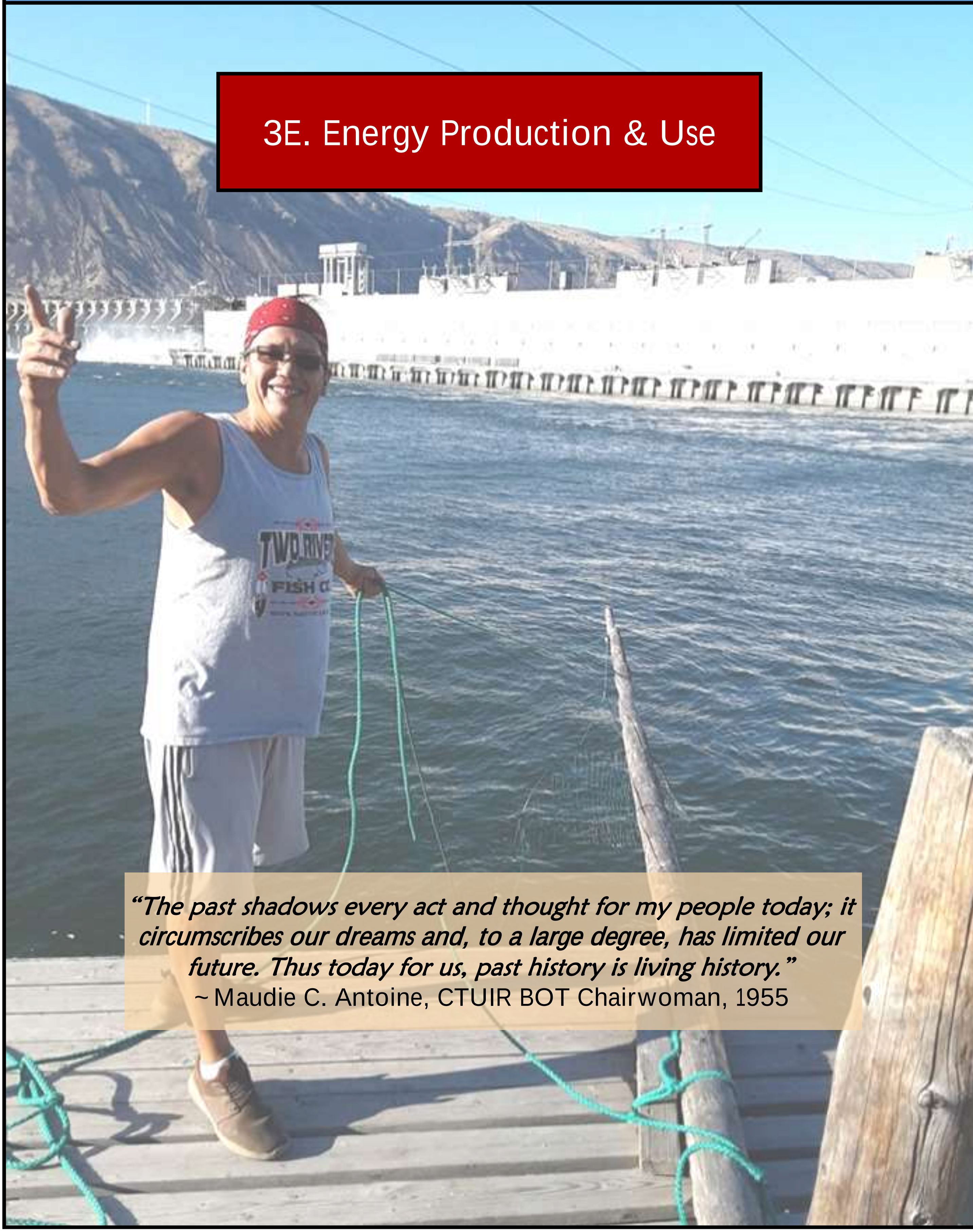
Chapter 3 : *Šapátunx̣wit* ~ Impacts and Adaptation Goals

3E. Energy Production & Use



"The past shadows every act and thought for my people today; it circumscribes our dreams and, to a large degree, has limited our future. Thus today for us, past history is living history."
~ Maudie C. Antoine, CTUIR BOT Chairwoman, 1955

Climate Impacts for **Energy Generation & Transmission**

"Dams were constructed on the Columbia River during the Depression era, creating jobs for non-Indians and promising to provide cheap electricity. Promises were made to the Columbia River Tribes that the concrete walls across the Columbia River would not have a negative impact on the salmon, and, if they did, that hatcheries would be built to mitigate for those impacts (Tovey et al, 2006)."

Modern Indigenous food systems are largely reliant on modern energy, but also suffer harm, as generating facilities invariably cause incidental damage to First Foods. Transmission lines bisect Tribal lands, often restricting Treaty Rights access and creating challenges for migrating wildlife. Energy networks are vulnerable to multiple climate impacts, and are linked to wildfire ignition. Electricity interruptions threaten community safety and stability, amid reductions in generating capacity, and increased maintenance costs to public infrastructure.

1. Shifted Hydropower Generation Potential Due to Changing Hydrology

Energy generated from hydroelectric facilities will face a constriction in the amount of power they are able to generate from seasonal water supplies due to shifting hydrologic patterns.

By 2040s hydropower production in summer decreases 13-16% (2.5-4.0% annually); by 2080s hydropower production in summer decreases 18-21% (3.0-3.5% annually) (Hamlet et al 2010) as seen in Figure 3E.1a (page 180).

2. Transmission Interruptions Become More Frequent

Energy transportation will see impacts from aging infrastructure as well as climate change. Moving energy from generation sites to end users depends on a highly integrated network of transmission infrastructure that will be threatened.

Storms and severe weather cause 59% of weather-related outages, 19% by cold weather and ice storms, and **2% by a combination of extreme heat events and wildfires** (Kenward and Raja 2014) **with roughly 800% increase in interruption over the past 26 years,** as seen in Figure 3E.2 (page 183).

3. Energy Facility Operating Costs Increase

Increasing intensity of extreme weather events creates challenges for energy generation facilities, and cost to operate facilities is likely to increase as routine and emergency maintenance is required. These costs are likely to be passed on to taxpayers and utilities customers.

State of Oregon may experience a projected 2-4$/MWh for a Proactive response, 3-4 $/MWh increase for a Reactive response, and a 4-6 $/MWh for No Adaptation response by the end of the century (Fant et al 2018) as seen in Figure 3E.3 (page 185).

1. Shifted Hydropower Generation Potential Due to Changing Hydrology

Hydropower is a large source of electricity within the Pacific Northwest (PNW), accounting for approximately 70% of electrical energy generation in the PNW, with several generating dams located along the Columbia River. This type of energy source relies on the flow of the river to spin turbines, which generate electricity. Thus the hydrology of the river dictates the amount of electricity that can be generated at any time. Because climate change will alter Pacific Northwest hydrology, hydroelectric generating potential will also be affected.

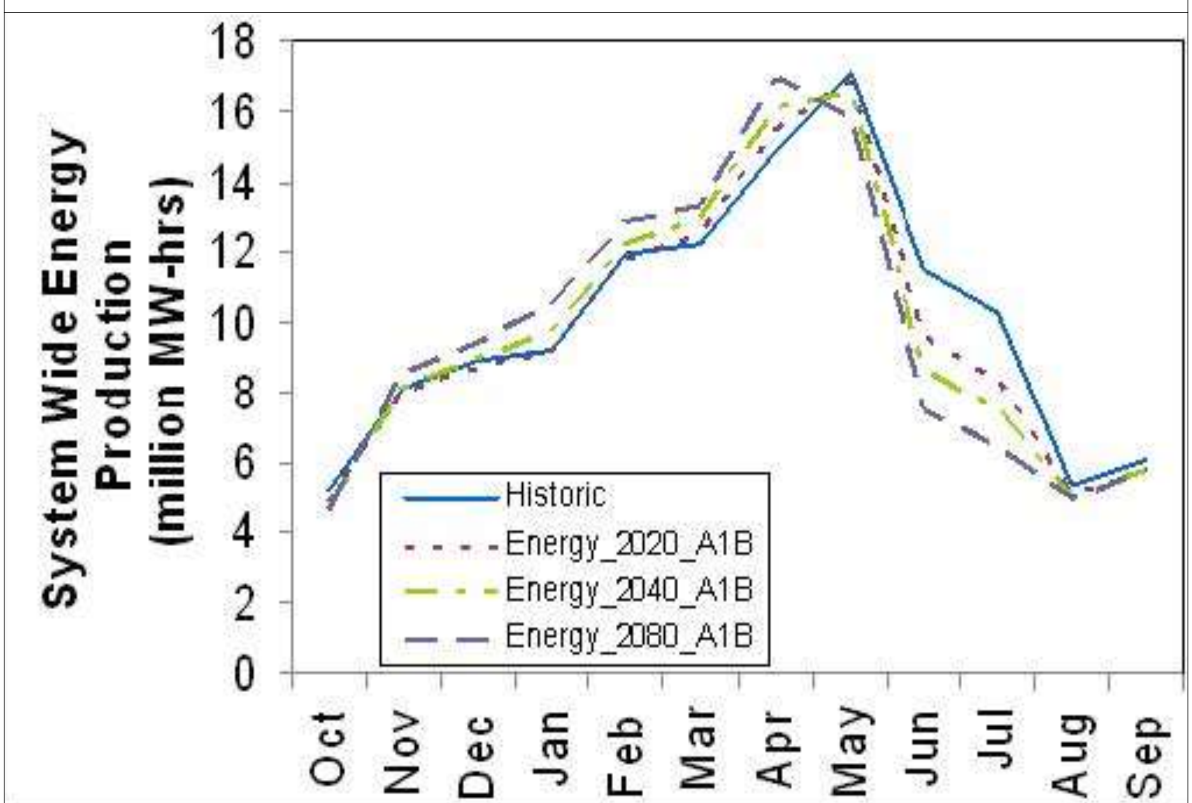
Figure 3E.1 illustrates how this changing hydrology is likely to shift the energy generating potential of dams along the Columbia River, for an A1B scenario.

- The graph shows the historic and projected hydroelectric generating potential in million megawatt hours (MWh) over the course of a year: the solid blue line indicates the historic generating potential at the Dalles Dam on the Columbia River; purple hashed line shows projections for early 21th century (2020), while the hashed green line projects into mid-century (2040), and the gray checked line projects into the late 21st century (2080) (Hamlet et al 2010).
- Hydropower production in the Columbia River basin is projected to decline slightly on an annual basis by mid-21st century overall, with seasonal projected increases in winter and declines in summer.
- By the 2020s, regional hydropower production is projected to increase by 0.5-4% in winter, decrease by 9-11% in summer, with annual reductions of 1-4% (Hamlet et al 2010).
- By **the 2040s hydropower production is projected to increase by 4.0-4.2% in winter, decrease by about 13-16% in summer, with annual reductions of about 2.5-4.0%.**
- By the **2080s hydropower production is projected to increase by 7-10% in winter, decrease by about 18-21% in summer, with annual reductions of 3.0-3.5%.**
- The largest and most robust changes in hydropower production are projected to occur from **June-Sept, during the peak air conditioning season**.

Hydroelectric generating potential also experiences indirect effects, including, but not limited to (Hamlet et al 2010):

- Changes in hydropower production related to climate change adaptation for other water

Figure 3E.1a: The Dalles Dam (OR) Future Hydroelectric Generation Potential



management objectives (e.g. changes in flood control, attempts to adapt to losses of instream flow in summer through aquifer storage initiatives etc);

- Climate-related effects to fossil fuel costs or availability that may drive market forces;
- Climate-related effects to renewable energy resources such as wind turbines or photovoltaic cells;
- Shifts in population that may be partly related to changes in climate or water supply; and
- Changes in energy demand from emerging sources like large scale data server sites and cryptocurrency mining operations.

Drought impacts in spring and summer are worsened in these simulations, with lower energy production occurring for these seasons. Changes in energy demand and regional hydropower production indicate adaptation to climate impacts in the cool seasons will be easier than in the warm seasons, due to changing demand and availability. Peak electrical loads for air conditioning is also likely to increase, creating potential capacity, distribution, or voltage stability problems.

Bonneville Dam on the Columbia River is one of several hydroelectric generating facilities located on the river. Construction of these dams had a huge impact on Tribal fishing and cultural sites, including Celilo Falls.

The ability to transfer electrical energy from the PNW to other regions for monetary profit is likely to decrease in May, June, July, and August. This is due to reduced hydropower supplies and increased local demand, as local demand may meet and potentially exceed production capacity. Regions like California and the Southwest, which purchase electrical capacity from Columbia River generating sources historically, are rapidly implementing their own renewable energy generation sources, which could free up capacity available to Pacific Northwest utilities.

Energy generation in the inland PNW also still remains reliant on fossil fuel production facilities. Utilities like Pacific Power and Umatilla Electric Cooperative, which serve the Umatilla Indian Reservation (UIR) and much of eastern Oregon and Washington, draw their electricity predominantly from coal-fired power plants in eastern Oregon and Idaho. These facilities are also likely to see a decrease in energy production capacity during summer months, as climate impacts reduce efficiency of electrical generation.

Energy generation that supports additional demand above base load (known as "peaking") is generated by gas turbines, solar cells, and wind turbines, which are vulnerable to extreme changes in atmospheric conditions (Bartos and Chester 2015).

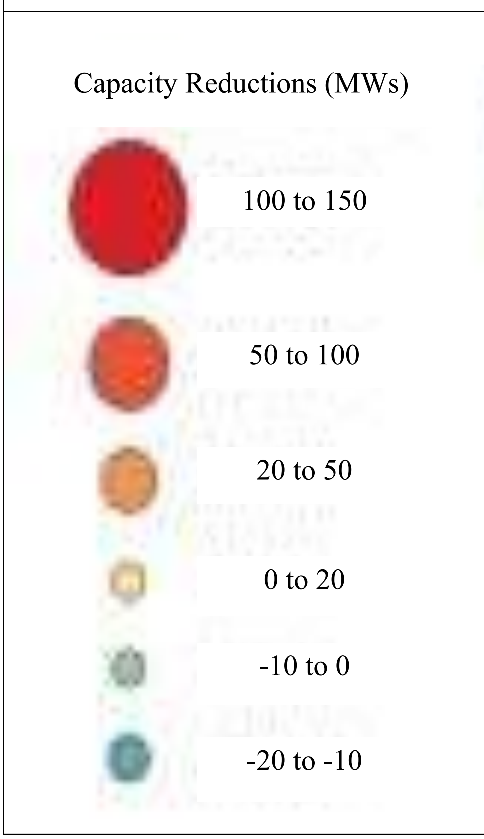
In the Western U.S., renewables and combustion turbines comprising roughly 56% of these kinds of generating capacity for the grid. Sustained reduced level energy production (known as "base-load") is typically generated by steam turbine facilities, like coal and nuclear power plants. Generating capacity of these technologies is controlled by available streamflow from nearby rivers, as cooling water demands depend on the heat, pressure, and volume of air and water entering the cooling system. Combustion turbines and photovoltaic cells experience capacity reductions as air temperatures increase. Wind turbine performance depends on wind speed and air density (Bartos and Chester 2015). All these factors are affected by climate change as extreme events become more frequent.

Figure 3E.1b maps projections for average reductions in summertime capacity by mid-century (2040-2060) for vulnerable facilities in the U.S West.

- The map shows average reductions across multiple model/scenario runs and emissions scenarios (A1B, A2 and B1): circles on the map represent individual energy generating facilities of all kinds, as measured by the change in generating capacity by mid-century. Larger circles with red and orange hues represent large reductions in generating capacity (reductions of 150 to 20 MegaWatts), while modest or no change is indicated in yellow, and gains in generating capacity indicated in blue colors (increases up to 20 Megawatts).
- Thermoelectric technologies (steam turbines and combustion turbines) suffer the largest climate-attributable capacity reductions—about 1.6-3.0% for vulnerable facilities by mid-century, with **average summertime losses of 1.4-3.5% for combustion turbines, and by 7.4-9.5% for steam turbines** (Bartos and Chester 2015).
- **Utility-scale photovoltaics (solar panels) may experience 0.7-1.7% reductions of summertime capacity** due to higher air temperatures (Bartos and Chester 2015).
- Climate change may slightly increase wind turbine performance due to lower average atmospheric humidity.
- As illustrated in this mapping projection, many facilities in the CTUIR Ceded lands will experience a reduction in generating capacity. **Two facilities are projected to experience a 50-100 MW decrease, with others anticipated to have modest reductions of 10 - 50 MW** (Bartos and Chester 2015).

There are many factors that affect regional energy generation in the future. The Western U.S. energy grid is interconnected with various electrical generating technologies, which is likely to largely insulate the Western grid from the worst of climate impacts

Figure 3E.1b Changes in Generating Potential of Western U.S. Energy Facilities by Mid-Century (2040—2060)



(Bartos and Chester 2015). Encouraging decentralized supplementary energy generation would assist in buffering much of the climate impacts to generating capacity. Renewables like wind turbine and photovoltaics can be implemented in small scale grid formats, with special attention paid to critical infrastructure and service needs. Low energy prices from cheap hydroelectricity have been a consistent barrier to implementing wide-scale renewable energy generation, but with declining energy availability from this source, adaptations that increase local energy generation will provide a buffer for this impact.

(Credit: Hamlet et al 2010)

Gaps in Knowledge/Data/Policy:

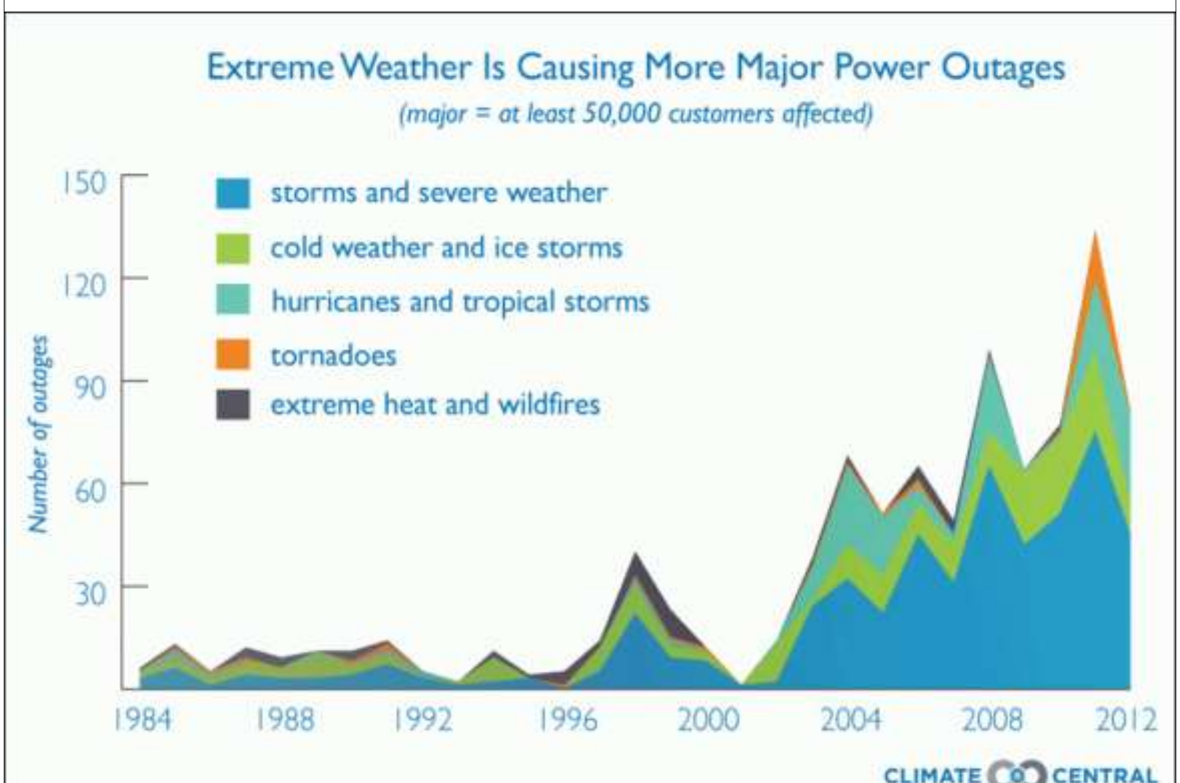
- Changing energy demand due to technological advances, emergency demand for cooling, and other emerging energy intensive industries like data centers and cryptocurrency mining;
- Reduction in demand from regional energy purchasers like southwestern utility companies, and how this may change local energy availability;
- Scale and timing of reduction in capacity from fossil fuel generating sources due to heat;
- Scale and timing of reduction in capacity from photovoltaic (PV, solar) generating sources due to heat and wildfire smoke effects;
- Transmission interruptions that could coincide with summer extreme weather events like heat waves and wildfire.

2. Transmission Interruptions Become More Frequent

The U.S. electricity grid is comprised of three basic sections: the Eastern Interconnection grid, which serves utilities from the Great Plains to the East Coast; the Western grid, which services utilities from the Rocky Mountains to the West Coast, and the Texas Interconnection, which serves much of the state of Texas. These grid systems are connected together by transmission lines that run from generating stations to sites of electrical delivery, such as homes, businesses, facilities, and industries. These lines can be buried underground or located overhead with other essential transmission infrastructure. This interconnected network will be threatened by climate change impacts, causing interruptions in service to people who depend on it.

Figure 3E.2 shows the number of major power outages (defined as affecting at least 50,000 utility customers) nationally caused by extreme weather events from 1984 to 2012.

Figure 3E.2: Electrical Transmission Interruptions Increased in Recent Years



- Outages caused by different extreme weather events are categorized by color on the graph: blue indicates storms and severe weather such as wind and thunderstorms; cold weather and ice storms are indicated in green; hurricanes and tropical storms in

teal; tornados indicated in orange; and extreme heat and wildfire in black. Nationally, **59% of weather-related outages were caused by storms and severe weather; nearly 19% by cold weather and ice storms**; 18% by hurricanes and tropical storms; 3 % by tornadoes, and **2% by a combination of extreme heat events and wildfires**. Most of these outages come from damage to large transmission lines or substations, as opposed to the smaller residential distribution networks (Kenward and Raja, 2014).
- From 1984 to 2012, the number of transmission interruptions caused by extreme events of all kinds **increased roughly 800% over the past 26 years**, from approximately 10-15 events in 1984, 30+ in the 1990's, 60+ in the early 2000's, and reaching 120 in the early 2010's (Climate Central, 2012).
- Annual costs of U.S. power outages ranged from $100 billion to $164 billion (2001 USD), with the majority of the cost associated with indirect consequences of the power loss, rather than the repair of damaged power lines (Kenward and Raja, 2014).
- Adverse weather is the most common cause of power interruptions, with weather causing 80% of all outages between 2003 and 2012 (Kenward and Raja, 2014).

Some of this increase was the result of improved reporting, however even after stricter reporting requirements were widely implemented in 2003, the average annual number of weather-related power outages doubled. Electrical grid vulnerability includes power loss at individuals' houses (which cause lighting, heating, and air-conditioning losses), and large-scale power outages which pose larger threats to entire communities and business sectors. Examples include, but are not limited to (Kenward and Raja, 2014):

- Water treatment facilities that depend on electricity, with extended power outages interrupting flow of clean water and solid waste removal;
- Hospitals and medical facilities can lose power or clean water, as well as some critical equipment necessary for patient treatment, raising health concerns;
- Power losses often force businesses to close, affecting sales and overall profitability, and potentially disrupting extended business-to-business supply chains;
- Traffic signals and other transportation communication relies on electricity to power poles and lights;
- Combined disasters of extreme heat, wildfire, or flooding with power loss can exacerbate an existing health and public safety crisis.

Climate change impacts conflate with aging grid infrastructure serving greater electricity demand, to create recent increases in major power outages. These unreliable grids can cause health complications and safety risks as well (Markolf, 2019). California State's deadly Camp Fire in 2018 was the direct result of aging energy transmission infrastructure sparking catastrophic wildfire, and resulted in 85 fatalities, as well as the financial bankruptcy of the utility company responsible, Pacific Gas and Electric (PG&E). In years since, California electrical utilities have tried to address hazardous conditions caused by cutting power to vulnerable transmission lines during storm events, leaving entire communities without electricity for hours and even days. A warming planet provides more fuel for increasingly intense and violent storms, heat waves, and wildfires, which will continue to strain, stress, and overload highly vulnerable electrical infrastructure. The replacement of aging power system infrastructure can improve reliability in uncertain future years.

(Credit: Climate Central, 2012)

<u>Gaps in Knowledge/Data/Policy:</u>

- Pace of electrical grid infrastructure replacement;
- Speed of renewable and decentralized energy generation infrastructure;
- How other non-infrastructure adaptations might impact transmission, like vegetation management and customer behavior changes.

3. Energy Facility Operating Costs Increase

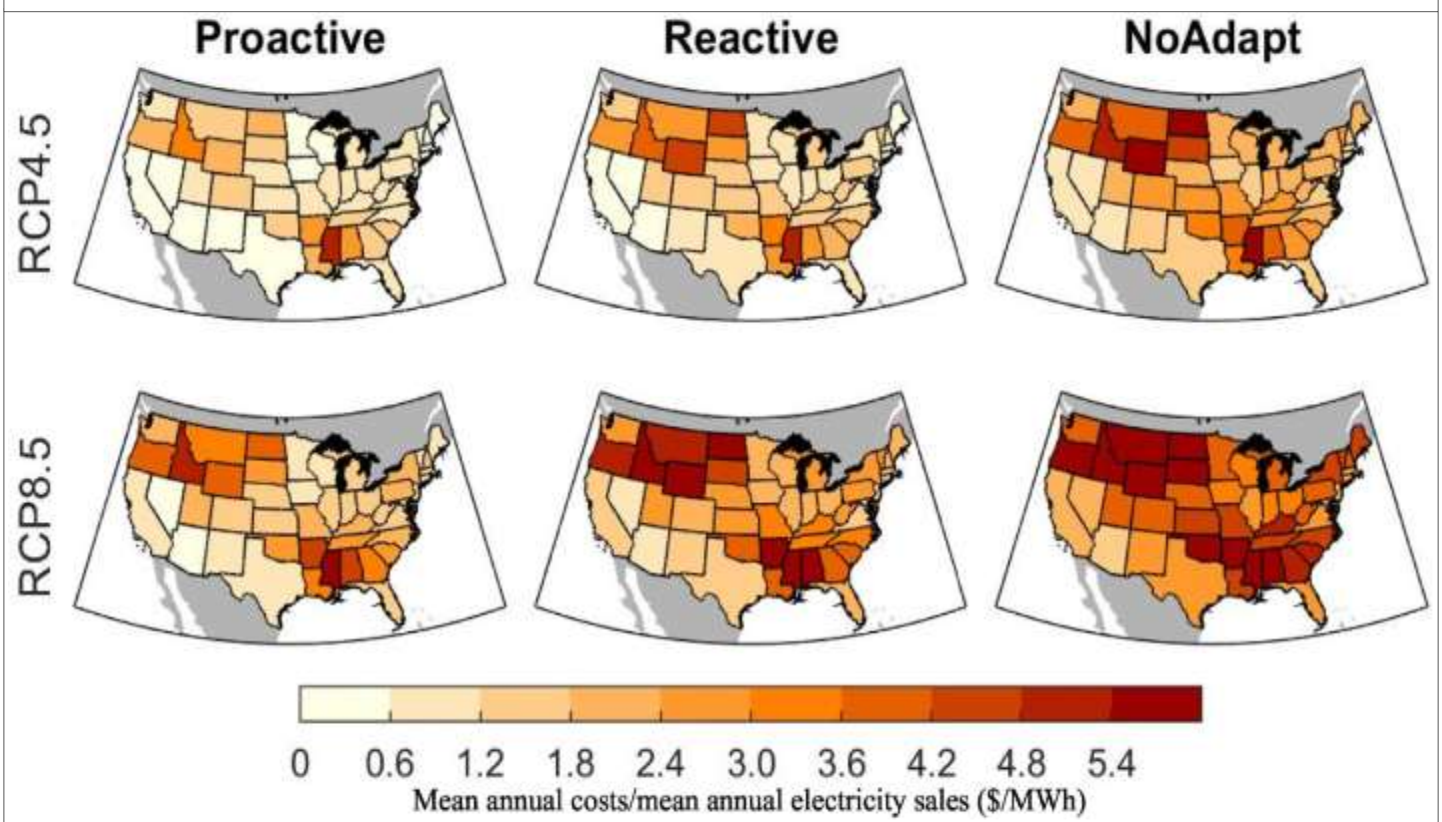
Energy generating facilities cost billions of dollars to construct, and maintaining these buildings and their associated transmission infrastructure is required to prevent interruptions in service, or decreases in generating capacity. These facilities are also negatively impacted by climate changes and future uncertainty, which creates risk for national energy supply and transportation.

Figure 3E.3 illustrates cost increases that can be anticipated by energy producers as a result of climate change under two carbon emissions scenarios, and which geographical regions can expect more severe impacts to their electrical grid.

- Three categories of utility response to climate change adaptation were studied: the chart shows these as "No Adapt," where no action to adapt to change was taken; "Reactive," which demonstrates utilities replacing infrastructure "as needed" using historical weather information; and "Proactive" costs estimates if utilities are using climate projections in their construction and maintenance planning.
- Increasing temperature is the primary driver of compounding costs to the energy grid. Hotter summers increase resistance to the channeling of electricity along transmission lines. Heat also increases the demand for vegetation management around storage and distribution infrastructure, and creates ideal conditions for fungal and mold decay of wooden grid poles (Fant et al 2018).
- Nationally climate impacts create a 25% increase in cost for operation. **Oregon is projected to experience 2-4$/MWh for a Proactive response; 3-4 $/MWh increase for a Reactive response; and 4-6 $/MWh for No Adaptation by the end of the century.**
- Overall, the study found that incorporating climate change projections in current energy planning and construction projects would reduce potential cost increases by at least 50% (Fant et al 2018).

Because of the long lifespan of energy projects, accounting for climate change projections in planning and construction can encourage projects being built now to anticipate a future climate that looks nothing like the current one. This can reduce the burden on operators and utilities customers.

Figure 3E.3: Increased Cost of Facility Operations Based on Adaptation Strategy



(Credit: Fant et al 2018)

Gaps in Knowledge/Data/Policy:

- How many Pacific Northwest energy generating facilities (existing and planned) are adapting to climate change;
- How rapidly communities will implement microgrid and local generation capabilities.

Adaptation Goals for **Energy Generation & Transmission**

A. Support and Expand CTUIR Renewable Energy Generation Potential

"Both on and off-Reservation, renewable energy development poses challenges for the CTUIR in protecting its natural and cultural resources from such developments while still encouraging renewable energy to combat climate change. For example, the CTUIR does not support categorizing hydropower as a renewable energy when it impacts fish. Large scale wind farms are not appropriate in all locations where they can impact important natural resources or destroy the view shed and quiet of residential areas.

Further, some renewables such a thermal solar require large amounts of water for cooling which in some cases might not be appropriate for our region. In evaluating both on and off reservation renewable energy projects, we shall examine each projects on a case-by-case basis, looking at both on and off-Reservation impacts and benefits, with an emphasis on protecting its cultural and natural resources, including the cumulative impacts of multiple energy projects, as well as creating economic opportunity for the CTUIR (CTUIR Energy Policy, 2009)."

Energy sources that reduce greenhouse gas burdens are key to adaptation, and methods that reduce dependence on grid connectivity will also improve resilience to risk of transmission failure.

i. Photovoltaic (PV) Solar Potential

Solar electrical potential for the Umatilla Indian Reservation (UIR) is viable for energy generation at moderate levels, and there is potential across the reservation to generate this form of energy. Existing CTUIR solar energy projects demonstrate the feasibility of this kind of energy source, and could provide a roadmap to future solar energy development projects.

Short Term:

- **Celebrate and expand site-specific PV generation like the Antuksh Tinqapapt Solar Array with the Energy and Environmental Sciences Program (EESP)** completed in 2018. Real time updates for Antuksh Tinquapapt PV array are available at the online dashboard, which displays an instantaneous feed from the array, found at the below website: https://ctuir.org/departments/natural-resources/energy-and-environmental-sciences/energy-projects/field-station-solar-project/
This site provides a lifetime energy count for the project, recorded at 474 MWh (as of March 3 2022). With this information, impacts from wildfire smoke and extreme heat on solar energy generation could be quantified and used in future generating estimates.

Long Term:

- **Expand and pursue solar generation potential preliminary studies for the UIR;** current estimates of solar energy generating potential approximate 4.2 kWh/m²/day (annual average) are

possible. Generating potential is higher in the summer, and lower in the winter. Further feasibility and resource assessments would need to be conducted to better understand this potential.

- **Celebrate and expand other solar arrays include generating panels located at Tamástslikt Cultural Institute (TCI), and at Yellowhawk Tribal Health Center.** There are also tentative plans to develop solar generating potential with Nixyaawii Education Center, and further generation planned at Yellowhawk, but not yet installed.

Fisheries support infrastructure like hatcheries, rearing ponds, and fish ladders could be excellent locations to co-locate microhydro generating opportunities due to their essential proximity to stream flows.

ii. Geothermal Systems Potential

Heat from the earth's core is another source of renewable energy: energy generated can be turned into electricity and other forms of transportable energy, and is a viable source of energy for the UIR. Geothermal energy is typically harnessed using deep bore holes that reach down to areas of tectonic hotspots which provide enough of a temperature gradient to heat specialized conducting fluid used to power turbines to create electricity. As a closed loop system, these operations allow for the conservation of resources during electrical or heat production.

Short Term:

- **Continue to pursue Geothermal Phase 2 planning,** which is scheduled to begin in the near future; this includes the drilling of boreholes in identified locations, with an ideal drilling depth of 5,000 feet to examine temperature gradients at that depth. Phase 1 included this initial generating potential study that identified potential feasibility locations, and was completed in 2018. Drilling of boreholes could also be paired with further studies on groundwater resources in these locations.

Long Term:

- **Continue and support identification of geothermal locations on the UIR that are optimal for electrical generation with EESP**. Currently an existing resource assessment that is underway, which should provide additional data for determining feasibility of a geothermal plant in identified locations.

- **Explore potential for hydrogen fuel generation, which could be paired with geothermal energy,** as an option for transportable renewable fuel. Hydrogen energy requires power to create, but could be a replacement fuel for liquid fossil fuels. This could be considered "renewable" if the originating energy comes from a non-carbonized energy source. Hydrogen has potential for transportation and grid balancing in energy systems.

iii. Micro-Hydrogeneration Opportunities

Power from hydroelectrical generating stations is debatably referred to as "renewable" in many conversations about energy, however Tribes are not united in viewing this energy source as favorable. Many of these operations block river flow either partially or entirely, and create daunting passage barriers for migratory fish like salmon and lamprey. Decision-making around large-scale hydroelectric facilities must be considered in an evolving and ongoing way by tribal leadership. There are also opportunities for hydroelectric energy generation that does not include river-blocking infrastructure to accomplish generation, though no resource assessments have been conducted for these energy sources on the UIR.

Short Term:

- **Explore potential for irrigation modernization to create opportunities for hydropower**

generation. By placing generating turbines within irrigation piping, particularly as old irrigation ditches are converted into closed piping circuits to reduce water loss through infiltration into soil and evaporation to the air. Irrigation modernization planning and project assistance funding are available to irrigation districts, and CTUIR should consider partnering with irrigation districts in the Ceded lands on irrigation modernization and hydropower project planning and implementation. These include Stanfield, Hermiston, Westland, Owyhee, Powder River Water Control, and other Oregon and Washington Irrigation Districts.

- **Explore potential for run-of-the-river small scale hydrogenation as an alternative hydropower option** that diverts surface water to power turbines, but does not pool or heat diverted water in the process. These small generating turbines can be located at residences near streams and rivers, and at other locations on the UIR where floodplain restoration is impeded by prioritized infrastructure, such as at salmon rearing and release ponds operated by CTUIR.

Long Term:

- **Explore potential co-generation opportunities with a future CTUIR water treatment plant.** Co-generation with water infrastructure provides additional options for energy generation in conjunction with planned infrastructure improvements and developments. Water treatment facilities pump water around their systems for treatment and release, and thus could be potential partners for co-locating in-pipe turbines for small scale hydroelectrical production. This kind of operation could also function as an energy storage opportunity for grid balancing.

iv. Wind Turbine Potential

Wind energy in the inland Pacific Northwest is relatively controversial, and this regional division of opinions also exists within the CTUIR Tribal community. Generating potential for wind energy on the UIR is highly dependent on topography, and other factors, though generally there is higher generating potential at higher elevations on the foothills of the Blue Mountains. Resource assessments and feasibility studies have not been conducted for this energy potential.

Short Term:

- **Celebrate community implementation of alternative energy, such as the wind turbine at TCI, as they provide an example of the opportunities that exist** for wind energy generation for Tribal facilities.

Long Term:

- **Engage Tribal community and leaders around wind energy development, especially to identify barriers to implementation.** Impacts to wildlife migration and cultural "viewsheds" are consistently factors mentioned in opposition to wind energy projects, though it is important to note that not all Tribal Members and departments share these concerns.

v. Biomass Energy Potential

Rethinking a traditional source of fuel, biomass energy is a carbon-balanced power source that relies on the combustion of plant-based carbon sources to produce heat and electricity. Biomass energy typically comes from the combustion of excess or waste plant materials, such as the

kind that comes from forestry thinning projects and commodities processing, and from biological waste from large animal feeding operations. While this energy source does involve burning carbon, these carbon fuels have been sourced from non-fossil fuel sources, and represent a balancing of the carbon extraction that was required for their production. Resource assessments and feasibility studies have not been conducted for these energy sources.

Short Term:

- **Explore potential for forestry thinning projects as a local source of energy generation using biomass fuel**. Slash from these projects is currently burned in place, but potentially could be utilized in biomass energy generating equipment. The US Forest Service (USFS) offices that serve the Umatilla, Wallowa-Whitman, and Malheur National Forests, which border the UIR and for which the CTUIR has co-management agreements, have expressed interest in partnering with CTUIR on investigating this energy potential.

Long Term:

- **Explore potential for energy generation potential using biomass fuel from Confined/ Concentrated Animal Feeding Operations (CAFOs)** within the Columbia River region. While not an industry that CTUIR traditionally supports, there are currently a number of these CAFOs permitted and operational within CTUIR Ceded lands. There is potential to partner with or support these operations in pursuing biomass energy generation. A local example exists with Three Mile Canyon Farm and Dairy's methane digester near Boardman OR.

- **Explore potential for energy generation using biomass fuel from food processing facilities.** There are a number of these industrial facilities within CTUIR's Ceded lands, such as Smith Foods in Weston, and Newlywed Foods in Pendleton. If CTUIR decides to support pursing biomass recapture efforts, these companies are potential partners in this effort.

vi. Energy Decentralization

Electrical grid reliability has been identified as an existing challenge for energy sources which supply the UIR with electricity. With electrical sources from Pacific Power and Umatilla Electric Cooperative, residents on the UIR experience chronic power outages, connected to both extreme weather events, as well as smaller routine failures. Implementing renewable energy generating sources that provide grid redundancy can help buffer for these connection interruptions.

Short Term:

- **Identify facilities and other locations that are considered "critical" for prioritizing in energy project development**, such as healthcare facilities, community emergency gathering locations, and wastewater treatment operations, among others. Some of this identification occurred as part of the development of the Energy Strategies Plan, and could be expanded for more robust input.

Long Term:

- **Organize and facilitate opportunities for CTUIR's Tribal community to identify energy needs, priorities, and preferred strategies** for ongoing energy independence. The Strategic Energy Plan is a first step in this process, and sustained community engagement is an identified component to updating this document.

Forest thinning projects that promote appropriate stocking density and improve conditions for prescribed burn implementation create "slash" waste that could be used as biofuels.

B. Implement Tribal Sovereignty in Regional Energy Planning

"For the Tribes, major ecological change is not new. Our oral history and current science demonstrate that, for more than 10,000 years, we have adapted to climatic shifts that produced changes in the region's vegetation and wildlife. In the past 200 years, our environment changed dramatically as non-Indian settlers invaded our homeland. Overgrazing by livestock decimated our traditional root crops. Irrigation, hydropower and soil erosion from farming and forestry destroyed our salmon runs. Over-hunting, homesteading, new towns, and road building drove off our wildlife. But now, a new kind of environmental threat, rapid climate change, threatens us all (CTUIR Energy Policy, 2009)."

i. Extend Energy Generating Potential Studies to CTUIR Ceded Lands

Energy generating potential on the Umatilla Indian Reservation (UIR) has undergone a preliminary estimate of resources, but areas around the reservation and in Ceded lands and traditional use area have not been examined in much detail. Energy projects are often large in their scale and funding needs, thus partnering with regional organizations and agencies on efforts throughout the Ceded lands could yield additional opportunities for renewable energy development.

Short Term:

- **Explore opportunities to partner with regional Irrigation Districts for modernization planning** that includes implementing in-pipe hydro-electric generating turbines as part of these updates. Irrigation districts with an Improved Watershed Plan can apply for critical federal funding through PL-566 with Natural Resources Conservation Service (NRCS). Examples include Three Sisters Irrigation District, and the Central Oregon Irrigation District that can be used as guides in this process. CTUIR should consider partnering with irrigation districts in the Ceded lands on irrigation modernization and hydropower project planning and implementation, such as Stanfield, Hermiston, Westland, Owyhee, Powder River Water Control, and other Oregon and Washington Irrigation Districts.

Long Term:

- **Explore opportunities to collaborate with other potential bio-energy sources within CTUIR's Ceded lands**. These could include industrial partners with local feedlots, dairies, breweries, commercial food waste and water resource recovery facilities, and pulp mills, among others. Opportunities exist to partner with or support these operations in pursuing biomass energy generation, and local examples include Three Mile Canyon Farm and Dairy's methane digester. Biomass energy associated with forestry thinning projects through USFS have also been offered to CTUIR as a potential biomass energy project.

ii. Consider Micro-grids

"Micro-grids" are a renewable energy generating operation that is paired with some capacity of battery storage and control. This allows for energy generated to be stored for future use or fed back into the connected electrical grid. A micro-grid system can be for a single residence, several facilities linked together, or for a connected community powered by the same source. Micro-grids increases energy

resilience by allowing for power to critical loads to continue during outages, and enables those critical lifelines to continue functioning.

Short Term:

- **Organize and facilitate a community visioning session around the creation of micro-grids**, including identifying facilities and functions that would be a high priority for energy resilience. Some of this has already been conducted with the Energy Strategies Plan; planning future opportunities for community engagement will improve implementation.

Long Term:

- **Pursue funding for planning and implementation of energy resilience projects** like micro-grid formation through governmental and private funding sources. Funding sources from federal, state, and private sources should be considered.

Wind turbine blades are transported via rail through the Umatilla Indian Reservation, to be installed in renewable energy projects around the region and boost energy availability.

iii. Support and Expand CTUIR Monitoring of Air, Water, and Soils to Maintain "Treatment as State (TAS)" Status

Tribal sovereignty is loosely measured by a Tribe's ability to regulate itself, which relies on scientific information, routine data collection, evidence-based policy planning, and regulation enforcement. All of this combines together to provide eligible Tribes with functional "Treatment as State (TAS)." TAS frameworks create conditions for Tribes to continue to exercise sovereignty in matters of natural, built and social resources in various capacities. Much of the work that CTUIR does within its Tribal government supports its Tribal sovereignty as a result, and CTUIR is strong in its ability for self-determination, particularly when it comes to regional energy generation.

Short Term:

- **Support Federal Air Rules for Indian Reservations (FARR) programing and Clean Air Act regulation administration and enforcement** within the UIR. FARR includes monitoring air shed and establishing burn permits, and providing education and outreach. Financial assistance agreements with Environmental Protection Agency (EPA) strengthen CTUIR regulatory and TAS abilities.

Long Term:

- **Expand capacity for *de facto* Tribal sovereignty through monitoring of air, water, soils, First Foods, and other relevant avenues for providing necessary information**. Once these practices are routine and established, they increase regulatory justification for Tribal self-determination.
- **Consider regulatory priorities as a Tribal community, should legal challenges to Tribal sovereignty arise**. Governance activity may eventually be questioned legally, and proactively identifying "must act" priorities for the Tribal government and community could assist with timely court and legal defense of challenged sovereignty.

iv. Fund Capacity to Address Energy and Climate Issues

Funding to build capacity and implement projects is a large component to the success of Tribal self-determination. It is a point of pride in CTUIR's Tribal sovereignty development that its government has been able to hire and administer internal staff and programs. Federal government funding in recent decades has expanded Tribes' ability to conduct their own affairs internally. Continued funding from these state and federal sources, along with private funding as necessary, will continue to expand CTUIR's ability to perpetuate self-governance.

Short Term:

- **Continue to develop and pursue CTUIR's Strategic Energy Plan**. This plan establishes CTUIR community's energy vision and guides the organization's energy conservation and generation efforts for years to come.

- **Organize and implement resource assessments and feasibility studies for community-identified preferred energy options**, as outlined in the Strategic Energy Plan and the associated strategic energy visioning exercises.

Long Term:

- **Continue to expand and implement climate adaptation planning as prescribed in this and other Tribal policy document.** Planning documents are ultimately useful for directing project development in a long-term coordinated strategy, so as to facilitate continuous funding from various sources.

- **Continue to pursue and advocate for inclusion of Tribal-specific funding pools in governmental legislation**. Funding is critical to supporting and expanding Tribal sovereignty for climate change and energy projects.

v. Youth Engagement with Tribal Sovereignty

Tribal youth are future government leaders and community decision-makers, and education around energy and Tribal sovereignty should be prioritized from a young age. Organizing opportunities for youth to learn about and engage with Tribal sovereignty will prepare them to have a role in Tribal governance at many different levels.

Short Term:

- **Explore and expand opportunities to engage CTUIR Tribal Youth Leadership Council in climate resilience planning.** Tribal Youth Council is an excellent example of building youth capacity for self-determination, and collaboration with this Council to increase youth-specific renewable energy education opportunities.

- **Expand participation with Energy Trust of Oregon's Strategic Energy Management (SEM) program**. SEM is a holistic approach to improving energy performance of communities through cohort-driven engagement. The program helps participants understand how building design, occupancy, and staff are affecting energy efficiency, by examining building systems, equipment, operating procedures, and occupant behaviors. Current CTUIR engagement with SEM includes projects associated with Wildhorse Resort and Casino (WRC) and Cayuse Technologies facilities.

- **Encourage Tribal student engagement with EESP Antuksh Tinquapapt Solar array and online dashboard**. Analyzing and quantifying solar generating capacity under different conditions, such as extreme heat and wildfire smoke, would make for an engaging high student, undergraduate, or graduate research project/internship/ thesis. https://ctuir.org/departments/natural-resources/energy-and-environmental-sciences/energy-projects/field-station-solar-project/

Energy sources for processing of First Foods, like smoking huckleberries (pictured), were historically "renewable." Teaching about these methods expands cultural energy knowledge.

Long Term:

- **Develop a K-12 educational approach to engaging youth in understand what sovereignty means in practice**. Tribal youth will need to be prepared to manage complex Tribal sovereignty issues like climate change, energy generation, and Hanford restoration. Approaches like the CAP Webinar Series that utilize Tribal Members who are professionals working in these fields, can help youth envision themselves future similar roles. Frameworks that engage families in these learning exercises will experience greater success.

vi. Build Renewable Energy Solidarity with Impacted Communities

No form of energy is without environmental impacts. Many renewable energy opportunities available have potential to outsource materials extraction impacts to other vulnerable communities. Technologies used in solar and wind energy development are often built from materials extracted from Indigenous communities globally. "Global South," is a term referring broadly to the regions of Latin America, Asia, Africa, and Oceania. Use of the term marks a shifted recognition of focus on development or cultural difference, toward an emphasis on geopolitical relations of power (Dados and Connell, 2012). Many global Indigenous communities are part of this "Global South" designation, and are negatively impacted by renewable energy materials extraction. Among minerals used in renewable energies technologies, 7% of nickel, 89% of copper, 79% of lithium and 68% of cobalt reserves and resources in the U.S. are located within 35 miles of Native American reservations (ESG Research, 2021). In building renewable energy generating capacity, CTUIR must do so in solidarity with — not at the expense of — other Tribes and Indigenous Nations.

Short Term:

- **Organize and facilitate opportunities to provide Tribal community engagement and education of communities impacted by energy development**. One regional example within CTUIR's traditional use area is Tribal communities impacted by lithium mining on the Oregon-Nevada border at Thacker Pass, or Peehee mm'huh, sacred land for the Northern Paiute, Fort McDermitt Tribe, Western Shoshone, and Reno-Sparks Indian Community Tribal people, and with other Indigenous people globally.

C. Continue to Monitor and Engage with Hanford Nuclear Reservation

"With the Tribes successes there has also been many issues to attend to. The Columbia River fisheries are dwindling, the forests are sick, the water is polluted. Through our Country passes thousands of miles of roads, power lines, pipelines, extensive irrigated land, water issues, forest and mineral speculators, private industry, developers, county, state, and Federal agencies and governments. Within the CTUIR aboriginal territories is the Hanford Nuclear Site the most polluted place in the Western Hemisphere (CTUIR Comprehensive Plan 2010)."

i. Support NRDA's Tribal Loss Service Scenario and Injury Determination Process

Previous sections have identified the need to determine Tribal Member-specific exposure pathways for climate change impacts. The CTUIR Hanford Natural Resource Damage Assessment (NRDA) has already begun to conduct these kinds of exercises. Steps within this process are reaching a completed stage, and CTUIR is in a unique position to include human health exposure within this legal damage assessment process.

Short Term:

- **Engage with Tribal-specific estimates of impacts from energy development and climate change**. NRDA team members have developed formulas to incorporate radiation exposure injuries incurred through practicing Treaty Rights at the HNR site that put CTUIR members at risk, and need to be understood. This risk calculator could be used as a template for similar considerations of climate change impacts to Tribally-specific cultural activities and practices.

Long Term:

- **Develop a CTUIR "threshold opinion" about the risk of exposure at Hanford to inform health policy**. Using the NRDA risk calculator tool, Tribal policy makers are able to consider and model complexities that exist around radioactivity exposure and impacts to human health, with the benefits and opportunities to culturally connect with Hanford's unique ecosystems and artifacts.

ii. Develop Education around Hanford Concerns

Millennia-long half-lives of many of the radioactive contaminants from operations at Hanford will persist far longer than can be reasonably controlled by current government access restrictions. CTUIR retains Treaty Rights into perpetuity on this same site. Cultural sites like pit houses on the UIR and Ceded lands date back 4,500 years at least, and provide undeniable evidence that CTUIR has managed and utilized the Columbia River Central Plateau for First Foods harvest and cultural practices far longer than any other stewards of these lands, and that Tribal people will always be present on the site.

Short Term:

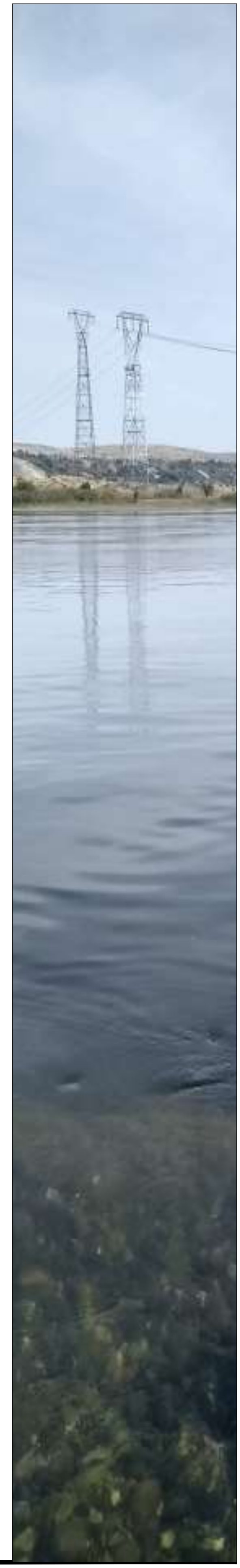
- **Develop opportunities for education about processes and issues with Hanford restoration efforts**, long term planning, injury assessments and Tribally specific exposures, as well as opportunities to create new "Coyote Stories" that could be used to extend these lessons and warnings to generations in the far future.
- **Organize and implement opportunities to educate CTUIR staff and leadership on Hanford issues**, and build communication capacity on negotiation process input between departments and programs.

Long Term:

- **Organize and facilitate regularly-occurring educational outings to learn about the effects and governance of the Hanford 100-F site, especially for Tribal youth and students** who will be the next generation of stewards. These could include field trips to the site as appropriate, student research projects about remediation and long term stewardship, and a dedicated on-site learning exchange/"day camp" format, to increase understanding of these issues, among other opportunities.

iii. Build CTUIR Capacity to Biomonitor Hanford Ecosystems

In connection with "Treatment as State (TAS)" Tribal sovereignty goals, continuing to monitor and collect information about conditions at Hanford will be essential to long term stewardship of this unique site. CTUIR has a number of developing



opportunities to conduct biological monitoring of ecosystems and First Foods in these affected areas.

Short Term:

- **Secure and implement funding for internal program or contracting capability to implement biologist full time equivalent (FTE)** (1.0 or more) position, dedicated to building monitoring capacity for the Hanford site specifically. Dedicating staff energy to a coordinated monitoring approach for the unique conditions of Hanford would improve engagement with the site.
- **Develop additional contaminant monitoring protocol and activities using the Hanford NRDA risk calculator as a foundation.** Other environmental contaminants of concern could include microplastics and polyfluoroalkyl substances (PFOS/PFAS), among others.

Long Term:

- **Conduct and support artificial environmental monitoring projects,** which involve the use of sampling tools or artificial mimics of First Foods like freshwater mussels, to uptake targeted contaminants at a documented rate. These monitors and can be used to approximate the potential contamination of First Foods in these locations to estimate risk and safety to engage with and consume those plant and animal species.

- **Conduct and support comparative environmental research approaches.** This is likely to involve performing or inventorying scientific studies with a goal to improve CTUIR understanding of how environmental threats affect First Foods (as well as access and availability). These research approaches can be extended to other questions of contamination such as per-and PFAS and fate & transport of mobile contaminants.

- **Invest in and expand use of long term stewardship control technologies** like the Ishtish Project, which involves developing natural institutional traffic control 'technologies' for CTUIR on sites like Hanford. Improving conditions to restore culturally-significant species on the site for multiple purposes can reduce non-cultural access to lands and reduce risk of unintended radioactivity exposure. These projects and are aimed at providing traffic-reducing services for access into an uncertain future.

Hanford Nuclear Reservation (HNR) is culturally part of CTUIR history. Cultural knowledge keeper Althea Huesties-Wolf examines historical artifacts while on a tour of the site.

iv. Engage with Cultural Site Protection

Tribal burial grounds are located in the northwest section of the 300-Area on the Hanford site near the Columbia Generating Station, and are of great cultural significance to CTUIR. In 2011, a process was started to identify specific contaminants on the site, but there still hasn't been any conclusions released on exactly what contaminants are present to date. Though it is an ongoing process with which CTUIR Energy and Environmental Science Program (EESP) is monitoring and engaged. Artifact pit houses on Columbia River islands near the Central Plateau HNR site are also present as evidence of CTUIR's historic and ongoing claim to lands and resources used by Hanford.

Short Term:

- **Coordinate discussions with CTUIR Board of Trustees (BOT), General Council (GC), and committees and commissions to determine issues of access to the Hanford site**, including legal and technical definitions of "human exposure." Such definitions could be part of an access agreement as part of a future Hanford NRDA settlement.

Long Term:

- **Advocate for the recognition of cultural and First Foods concerns at the Hanford site, and for the inclusion of Tribal leadership and engagement in demonstrating the complexity of Hanford issues**. NRDA and EESP staff need to coordinate on certain activities, and provided capacity and guidance to participate in intergovernmental discussions for long term planning. There are still large gaps in knowledge of highly toxic contaminants for the site that impact Tribal resource decision-making.

v. Define "Renewable" and "Alternative" Energy Positions at a BOT Level, Especially with Potential Use of Small Modular Nuclear Reactors (SMNRs)

Nuclear energy is another source of power often classified as "renewable" or "alternative" to carbon-intensive energy sources, though it poses significant challenges in the resource impact it creates. CTUIR has a unique relationship with nuclear energy, as the legacy of nuclear development looms with the Hanford Nuclear Reservation is located within the Tribe's Ceded lands, with Treaty Rights retained on some of the most contaminated soils in existence. Clean-up efforts at Hanford have identified the need for ongoing power generation at the site, and have proposed the use of Small Modular Nuclear Reactors (SMNRs) to meet this energy demand.

Short Term:

- **Advocate for community and leadership understanding of nuclear energy concerns at Hanford.** Nuclear energy issues are extremely complex, and thus must be considered by Tribal leadership in an evolving and ongoing process. CTUIR Board of Trustees (BOT) and General Council are the formal decision-makers within Tribal governance, and frameworks that allow for constructive and progressive conversations about the role of nuclear power within Hanford, and around the region must be implemented for ongoing decisions.

- **Update CTUIR Hanford Policy to provide guidance around SMNRs**. Currently guidance on additional nuclear capacity provided in this document states: "It is the policy of the CTUIR that. . . Hanford and Hanford-affected lands and resources should not be further developed and no new nuclear missions or expansion of nuclear energy. . . undertaken unless explicitly permitted by the CTUIR Board of Trustees through government-to-government consultation (CTUIR Hanford Policy, 2007)."

Long Term:

- **Update CTUIR Energy Policy to expand on issues like Hanford and climate impacts to energy generating potential.** Currently the document provides guidance, stating

“CTUIR may face some difficult choices in whether to accept such risks in order to see power generation sources built that are large enough to offer real alternatives to power generation sources that impact salmon, whether through climate change (coal and natural gas fired power plants), or through more direct impacts (hydropower) (CTUIR Energy Policy, 2009).”

vi. Engage with Ongoing Hanford Restoration and Decision Making

CTUIR will always retain Treaty Rights on Hanford site lands, and are actively engaged with decision making and long term planning for restoration and remediation of contaminants, with a focus on Tribal Member health and safety. CTUIR will continue to participate as a sovereign entity with these processes in many different ways. U.S. Department of Energy (DOE) has produced a “Vision of the Future for Hanford” document, which largely revolves around energy, with which CTUIR needs to be involved to maintain Tribally-desired outcomes.

Short Term:

- **Participate as appropriate with current Hanford activities** (2021-2026), including Tank Waste Clean Up, Central Plateau Clean Up, and River Corridor Clean Up efforts. CTUIR has managed the lands Hanford is located on since time immemorial, and has a long-term investment in remediating these lands and waters.

- **Maintain and expand Hanford Air Quality Monitoring Plan** to assert CTUIR’s involvement as a sovereign entity to be recognize by other state and federal sovereign participants. Tribes have unique mechanisms to improve monitoring and reporting of conditions for Hanford, thus maintaining and expanding sovereignty in the form of regulation and data collection is essential.

- **Organize CTUIR staff involvement in Hanford reporting**, and estimate staff time needed to provide science-based comments to the Hanford NRDA process.

Long Term:

- **Continue with Tri-Party Agreement (TPA) Milestone Tracking**, which allow CTUIR to leveraging relationship capital to influence TPA regulators towards Tribally-desired outcomes. As a uniquely sovereignty entity that participates with this agreement, continuing to emphasize CTUIR’s presence and interest in the site reminds all involved of the longer legacy of the location and the importance of Tribal sovereignty.

Hanford’s 100-F site in CTUIR’s northern Ceded lands is a paradox of risk and beauty. Because of the nature of work conducted with the Manhattan Project circa 1945, the site is both contaminated by radioactivity and preserved from the type of development that occurred along the rest of the Columbia River ecosystems.

Measuring Success and Gaps in Energy Generation Adaptation

How Do We Measure the Success of These Adaptations?

"The Creator placed us here, at this place, and ever since we have been inextricably connected to the lands, processes, resources, and other people of the Columbia Plateau and beyond. The Creator loaned us the air, the water, the fish, the game, the plants and the medicines, and we honor this by conserving these resources to ensure their availability for current and future generations (CTUIR Energy Policy, 2009)."

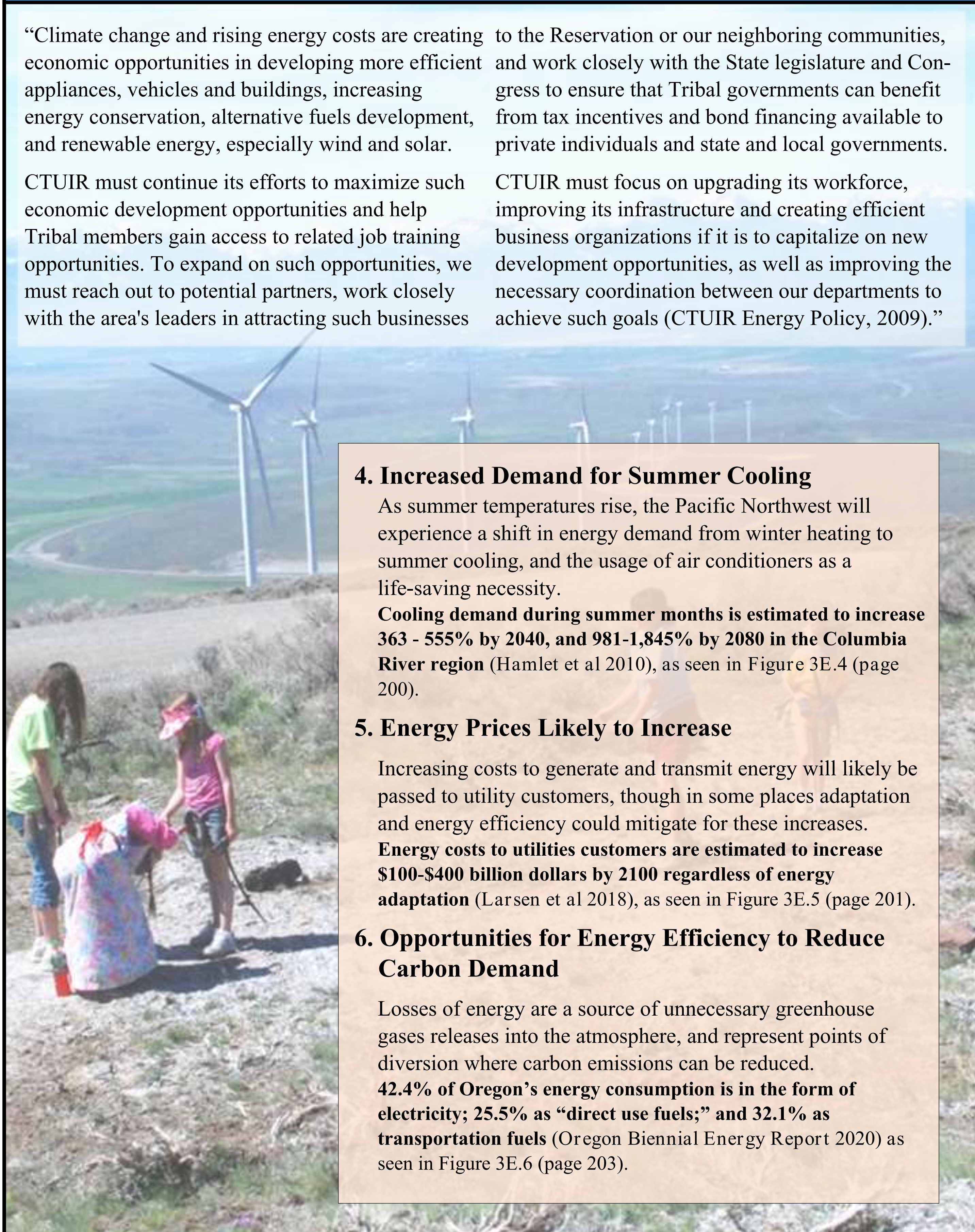
- **CTUIR Energy Policy (2009)** Energy Goals (pages 20-24)
- **CTUIR Strategic Energy Plan (2022)** Part 3: Energy Vision Qualitative Performance Measures (Table 6, page 22) and Targets and Tracking Measures (Table 7, page 23)
- **Comprehensive Plan Objective 5.15.1:** Enhance Tribal sovereignty through energy independence (see Comp Plan page 127 for benchmarks);
- **Comprehensive Plan Objective 5.15.7:** Diversify sources of energy and reduce overall energy use to reduce the CTUIR's consumption of fossil fuel (see Comp Plan page 127 for benchmarks);
- **Comprehensive Plan Objective 5.15.3:** Diversify the CTUIR economy through energy investment in all feasible aspects of energy including power generation and bio fuels (see Comp Plan page 127 for benchmarks).
- **CTUIR Comprehensive Economic Development Strategies (CEDS) Objective 20:** Support CTUIR efforts to acquire lands through federal land transfer, such as at the Hanford Site.
- **CTUIR Hazard Mitigation Plan (2021) Section 3**: Hazard Identification and Risk Assessment Results (page 68-190).
- **CTUIR Hanford Policy (2006)** benchmarks
- Geothermal generation potential feasibility study (2018)

What Gaps in Knowledge, Policy, Capacity, or Education Exist?

- Many gaps exist for renewable energy generating potential; resource assessments and feasibility studies are needed.
- Future energy generating potential for regional small-scale renewable projects.
- How future policy and legislation will impact what is permitted in energy development and transmission.
- Whether market forces will encourage a regional shift to non-hydroelectric renewable energy.
- How other unforeseen circumstances like cyberattack, terrorism, and huge disasters, like a potential Cascadia earthquake, will affect future energy production, among others.

View of Bonneville Dam on the Columbia River in Oregon at night, as seen from a Tribal fishing scaffold, as the facility is lit up. Photo by Bud Herrera.

Climate Impacts for **Energy Use & Cost**



"Climate change and rising energy costs are creating economic opportunities in developing more efficient appliances, vehicles and buildings, increasing energy conservation, alternative fuels development, and renewable energy, especially wind and solar.

CTUIR must continue its efforts to maximize such economic development opportunities and help Tribal members gain access to related job training opportunities. To expand on such opportunities, we must reach out to potential partners, work closely with the area's leaders in attracting such businesses to the Reservation or our neighboring communities, and work closely with the State legislature and Congress to ensure that Tribal governments can benefit from tax incentives and bond financing available to private individuals and state and local governments.

CTUIR must focus on upgrading its workforce, improving its infrastructure and creating efficient business organizations if it is to capitalize on new development opportunities, as well as improving the necessary coordination between our departments to achieve such goals (CTUIR Energy Policy, 2009)."

4. Increased Demand for Summer Cooling

As summer temperatures rise, the Pacific Northwest will experience a shift in energy demand from winter heating to summer cooling, and the usage of air conditioners as a life-saving necessity.

Cooling demand during summer months is estimated to increase 363 - 555% by 2040, and 981-1,845% by 2080 in the Columbia River region (Hamlet et al 2010), as seen in Figure 3E.4 (page 200).

5. Energy Prices Likely to Increase

Increasing costs to generate and transmit energy will likely be passed to utility customers, though in some places adaptation and energy efficiency could mitigate for these increases.

Energy costs to utilities customers are estimated to increase $100-$400 billion dollars by 2100 regardless of energy adaptation (Larsen et al 2018), as seen in Figure 3E.5 (page 201).

6. Opportunities for Energy Efficiency to Reduce Carbon Demand

Losses of energy are a source of unnecessary greenhouse gases releases into the atmosphere, and represent points of diversion where carbon emissions can be reduced.

42.4% of Oregon's energy consumption is in the form of electricity; 25.5% as "direct use fuels;" and 32.1% as transportation fuels (Oregon Biennial Energy Report 2020) as seen in Figure 3E.6 (page 203).

4. Increased Demand for Summer Cooling

Demand for energy intensive cooling in the Pacific Northwest has historically been low compared to other places in the U.S., but climate change is likely to increase the demand for air conditioning through the century, as extreme heat events become more common.

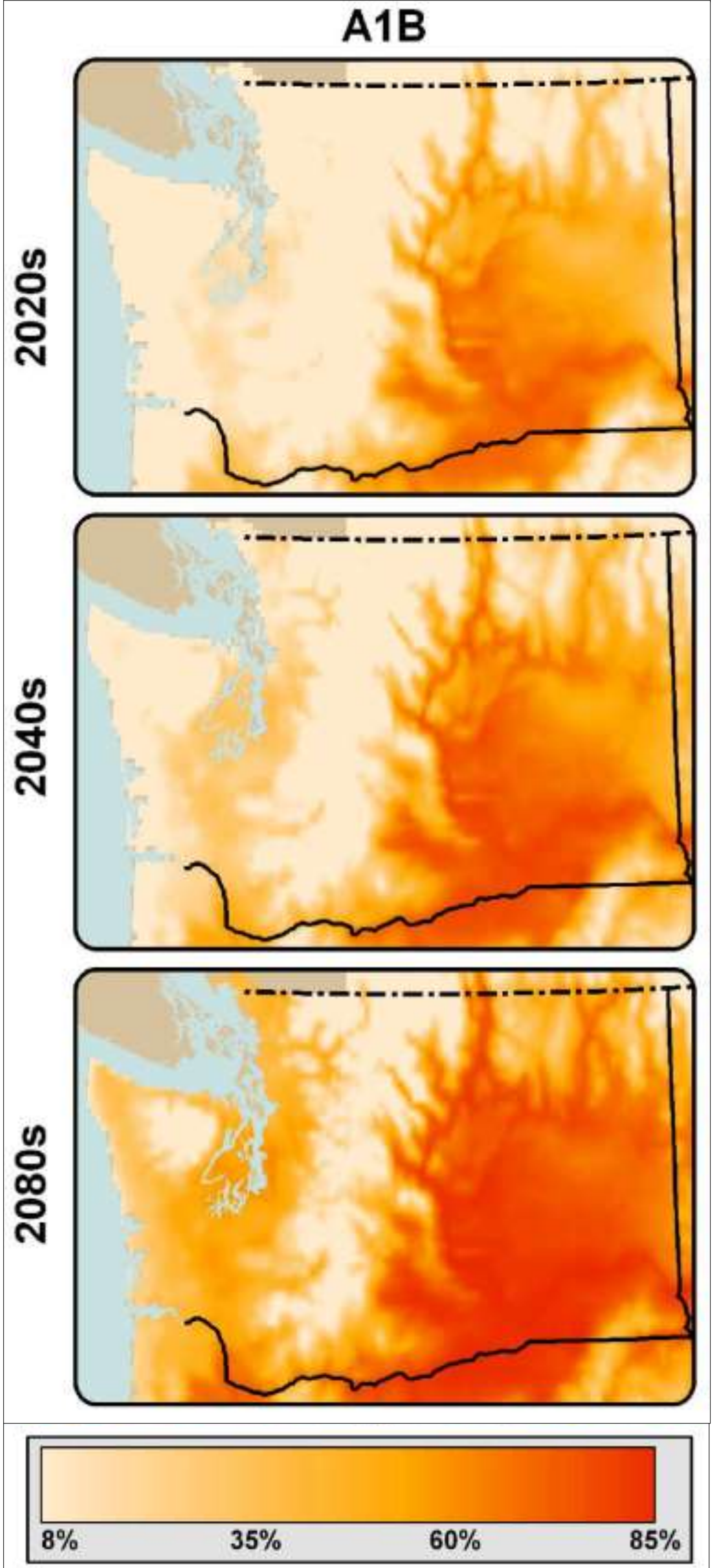
Figure 3E.4 shows how the current density of energetic cooling demand increases over time, as a percentage of historic air conditioning demand, under an A1B scenario at three future points.

- Through the 21st Century (2080), demand for air conditioning dramatically increases, in even the coastal regions of the Pacific Northwest. This summer demand for increasing energy comes during a season when hydroelectric energy generation will be reduced. This disconnect in supply and demand is likely to negatively affect energy users in both energy availability and affordability of services.
- **Cooling demand during summer months is estimated to increase by 165-201% by 2020, 363-555% by 2040, and 981-1,845% by 2080 in the Columbia River region**, due to increasing heat, and to population growth.
- For many places in the Pacific Northwest, the presence of air conditioning will become a life-saving technology and a human right.

For many people, emergency and health needs may face unfortunate choices in managing for indoor air quality, extreme heat, and ventilation needs. Combined with increasing risk of energy transmission interruption, securing cooling needs during extreme heat events is a public health concern. Health policies that assist with equipment and decision-making needs, as well as increased energy resilience, could help mitigate again these effects.

(Credit: Hamlet et al 2010)

Figure 3E.4: Future Summer Cooling Demand Increases



Gaps in Knowledge/Data/Policy:

- Initiatives to improve passive cooling and how these could reduce energy burdens;
- Population changes that incorporate potential domestic and international climate migration;
- Additional heat burdens from "heat dome" events like June 2021.

5. Energy Prices Likely to Increase

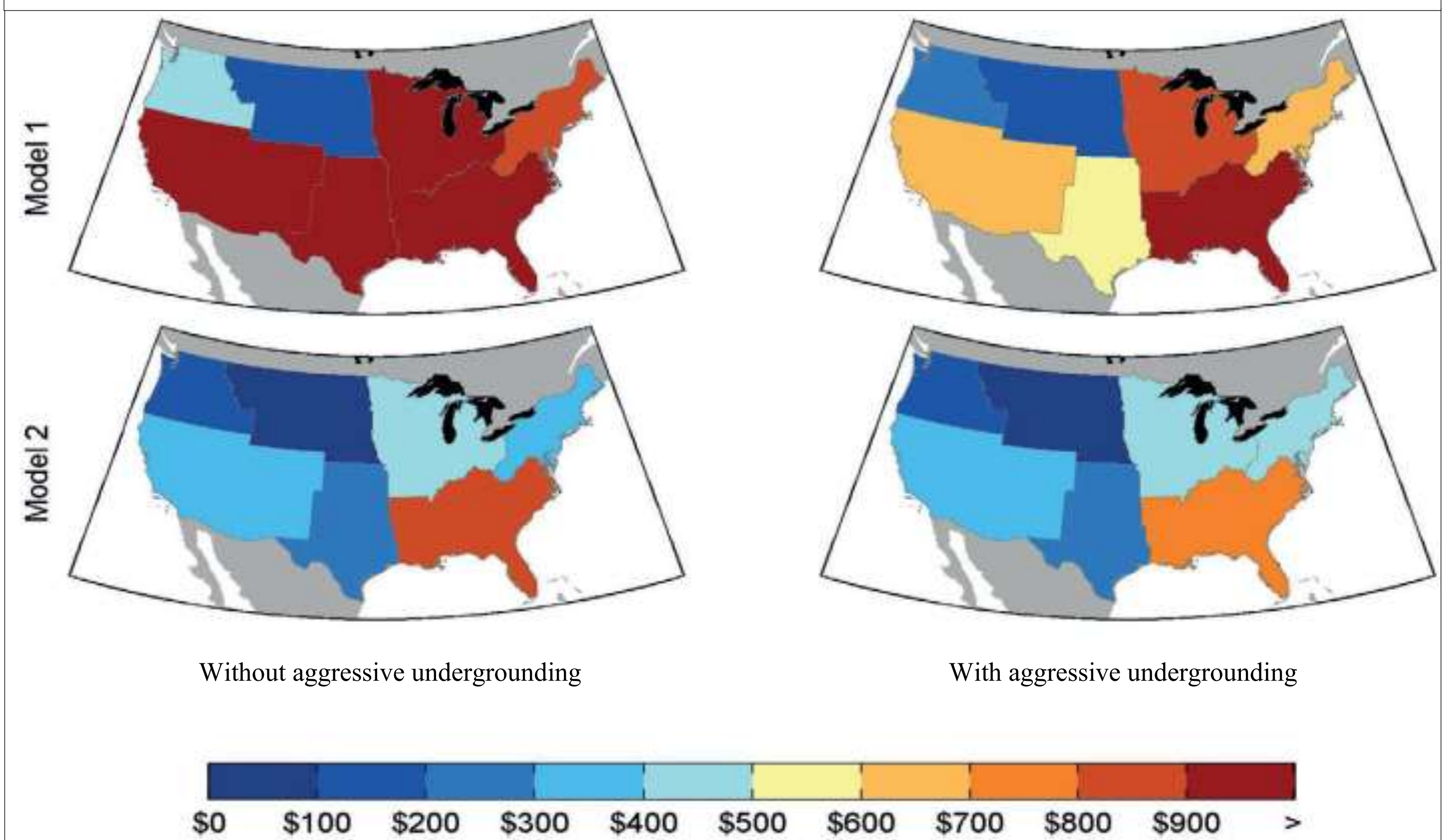
Climate impacts to energy generation will likely cause increasing maintenance costs, decreased reliability of delivery, and risk of hazard due to transmission. The cost burden of this increase is likely to fall largely on utilities users and taxpayers. Regions of the Southwestern United States could provide some information about future conditions the Pacific Northwest may experience. Rolling blackouts are now a seasonal norm in California State, while extreme heat events cause surges in demand for cooling as a life-saving measure.

In addition to the potential for increased risk from extreme weather events, aging power systems infrastructure, and decrease in power system reliability add to the risk of rising electricity costs and shortages.

Figure 3E.5 illustrates the importance of planning ahead for these electrical grids.

- Two different predictive models were run to estimate power system reliability: these maps show cumulative costs through the end of the century for RCP 8.5 scenario.
- Cumulative energy costs at the end of century (2100) in billions of dollars (2015 USD) are shown in the color coded gradient: colors in blue represent $0-400 billion dollars for electricity; yellows and oranges represent $500-800 billion dollars, and red colors indicate 900+ billion dollars in energy costs directly tied to increasing demand of production and transmission.
- Models 1 (top row) and 2 (bottom row) represent the highest and lowest cost estimates across the four models considered, respectively. Within the models, energy reliability was measured by how often customers experience sustained electrical interruptions, as well as how long an average electrical interruption lasts. These two measures were

Figure 3E.5: Cost of Electric Utility Service With (Right) and Without (Left) Climate Adaptation under RCP 8.5



incorporated in the two models in ways that were based on realistic customer and energy utility behavior (Larsen et al 2018).

- For the study, “undergrounding” indicates an assumption that power system planners and policymakers at all levels have perfect foresight for risks, and immediately implement proactive strategies to reduce the frequency, typical duration, and the cost of power interruptions to customers. The effect of this planning is represented in the maps on the right in the figure (Larsen et al 2018). Factors include: abnormal weather, utility sales, Operations and Maintenance (O&M) spending, share of underground line miles, and other variables relevant to energy transmission resilience.
- Mid-Century estimates (2050) for cumulative customer costs nationally are projected to be $1.52 -$3.43 trillion per year without aggressive undergrounding; and $1.50-$2.51 trillion per year with aggressive undergrounding (Larsen et al 2018).
- End of the century costs (2100) nationally are projected to be $1.92-$5.62 trillion without undergrounding; and $1.95- $3.63 trillion with aggressive undergrounding.
- For the Pacific Northwest region, **energy costs are estimated to increase $100-$400 billion dollars by 2100 regardless of energy adaptation**. This non-response to adaptive measures in PNW region was the only part of the U.S. where this prediction was observed (Larsen et al 2018).

Full-scale implementation of potential technologies to reduce energy demand and improve transmission reliability would likely reduce future costs, though installation and maintenance of these technologies will require large investments by utilities. For the risk reduction scenario in Fig 3E.5 “with aggressive undergrounding,” it is known that future power system reliability will continue to worsen, and there are only a limited number of options available to planners to reduce the impacts to customers. Advocacy of regional energy suppliers to proactively plan for increasing costs could buffer some of these effects for utility customers.

(Credit: Larsen et al 2018)

Gaps in Knowledge/Data/Policy:

- Rate of implementation of energy decentralization by communities;
- Advancements in energy efficiency, generation, and resilience that could improve outlook;
- How co-occurring impacts to energy systems could compound issues.

6. Opportunities for Energy Efficiency to Reduce Carbon Demand

“One of the most effective methods of fighting climate change is to reduce the use of energy that releases carbon dioxide into the atmosphere, i.e. conservation of energy. Conservation is also important in reducing Tribal Member's power bills, reducing Tribal government costs, and reducing the pressure to trade salmon for hydropower. Our challenge will be in promoting the development of and making use of new technologies, tax incentives and grants, and other tools to conserve energy. We need to more aggressively address weatherization of and energy efficiency in Reservation homes, businesses and government buildings through investing in improvements, providing incentives and updating Tribal laws. More energy efficient transportation and reduction in our use of fossil fuels also will be key (CTUIR Energy Policy, 2009).”

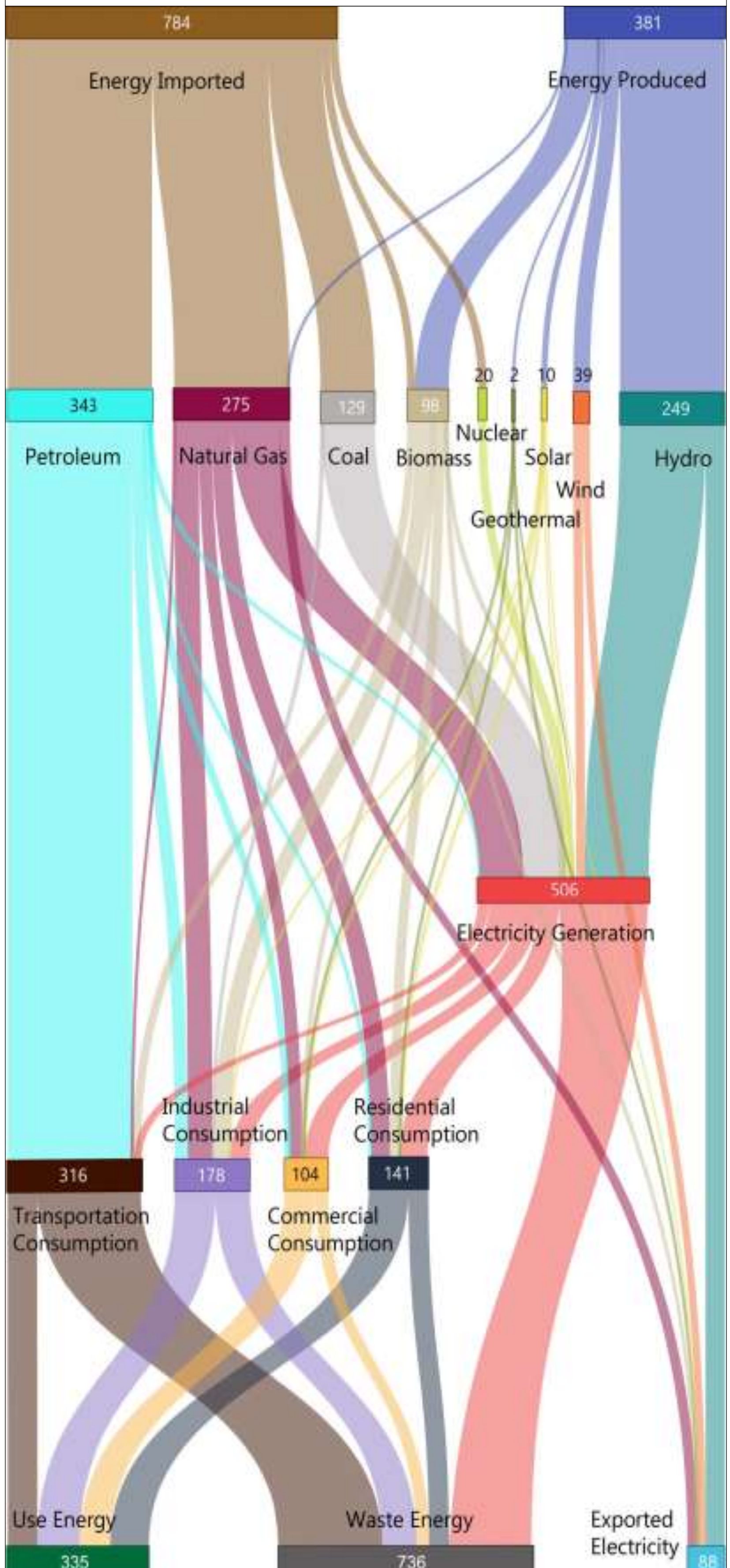
Energy used by Oregon utilities comes from a variety of sources, and goes to many different end uses. Loss of energy due to poor efficiency is possible at every step of this process, and represents a waste of carbon used in the generating process. Because many energy sources still come from burning fossil fuels, reducing the inefficiency of energy transmission and use creates opportunities to reduce losses and require less energy as a result.

Figure 3E.6 traces the flow of energy in the state of Oregon from its source to its end use in recent years, and illustrates opportunities to improve energy transfer and reduce waste.

- At the top of the figure, types of energy are both imported to and produced in Oregon, measured in trillions of British Thermal Units (BTUs) (measurement of the heat content of fuels or energy sources). This data is representative of current conditions measured during 2020.

- The energy lines flow down to show the different types of resources that produce them (hydroelectricity, natural gas, solar/ photovoltaic, and others), and where they end up in Oregon's energy story— from transportation fuels to the natural gas and electricity that supplies homes and businesses. Some energy ultimately goes unused as "waste" (bottom center) and some is exported to other states (bottom right).
- "Energy imported" includes all imported energy to the state, both in raw form or after transformation into other usable forms. For example, some resources are used to create electricity, which is then distributed to different sectors. Other resources are transported to sectors to be consumed as 'direct use fuels,' like those used in supplementary power generators.
- The flow to "waste energy" includes all of the energy that is not harnessed, from the point of extraction, to the point of use. This includes energy lost as heat during combustion or transformation into electricity, losses during transmission, and many other factors. This flow represents opportunities to improve transmission systems to reduce demand for the production of new energy sources (Oregon Biennial Energy Report, 2020), measured at 736 BTUs in 2018.
- **42.4% of Oregon's energy consumption is in the form of electricity** that powers our daily life. Much of this is generated in the Western U.S. and within Oregon.
- **25.5% of Oregon's energy consumption is as "direct use fuels,"** which include fuel oil and natural gas used to heat homes and commercial spaces, fuels used for other residential purposes, like gas stoves, solar thermal heating, and fuels used directly in industrial processes. In 2018, Oregon used 251.5 trillion BTUs of direct use fuels.
- **32.1% of Oregon's energy consumption as transportation fuels** like personal, passenger, and commercial vehicles, both on and off the roads; plus airplanes, boats,

Figure 3E.6: Energy Products and Destinations in Oregon State



barges, ships, and trains. Nearly all transportation-related sources of energy are imported from out of state for in-state use. Oregon's transportation sector consumed 316 trillion BTUs in 2018 — a 185% increase since 1960 (Oregon Biennial Energy Report, 2020).

- In 2018, just 2% of transportation fuel used in Oregon was produced in the state, including 7.3 trillion BTUs of biodiesel and fuel ethanol. Oregon electric utilities provided 0.42 trillion BTUs of electricity to fuel zero-emission vehicles in 2018, about 0.2 trillion BTUs or 48% of which was produced from Oregon resources.

Oregon's emphasis on energy efficiency has helped reduce both total and per capita energy use despite an increasing population, thereby avoiding the need to build new electricity generation plants so far (Oregon Biennial Energy Report, 2020). Petroleum product consumption has steadily increased over time and currently dominates the transportation fuel use in Oregon. Crude oil used at Washington State refineries comes from Alaska, western Canada, and North Dakota.

If energy demand reduction strategies are robust into the future, there is a lot of potential for Oregon to meet its energy demand by investing in renewable and small scale energy, and pairing these efforts with aggressive energy efficiency initiatives. There is also opportunity for greater electrification of heating and transportation sectors that could reduce demand for fossil fuels found in natural gas and gasoline.

(Credit: Oregon Biennial Energy Report, 2020)

<u>Gaps in Knowledge/Data/Policy:</u>

- Speed of electrification of services and how that will change energy demand;
- Scale and speed of other regions in the U.S. to produce energy, and how this generating potential impacts the flow of energy in Oregon;
- How incentives to improve energy efficiency will impact energy demand;
- How policy and market obstacles like net metering will affect energy production.

Tamástslikt Cultural Institute (TCI) implemented renewable energy generation on-site to power climate control services of their museum collection archives. TCI is an excellent example of providing reliable and insulated electricity to important historical artifacts. An electrical grid that is resilient to climate impacts will include diverse energy sources, and is able to interconnect to the larger Western grid, while providing localized generation, especially to priority locations.

D. Pursue Energy Efficiency for Tribal Homes, Businesses, and Facilities

"As a rural Indian Tribe, rising fuel costs are of special concern. High fuel costs will limit Tribal Members' access to health care, educational opportunities, jobs, and cultural practices. High fuel costs will reduce the number of travelers and tourists visiting our Reservation, impacting our Tribal economy. It will impact the ability of the CTUIR to coordinate with state and federal agencies. The CTUIR must support the region's development of alternative fuels and more efficient vehicles to address these concerns, while taking steps to increase public transportation, greater efficiency in its own vehicle fleet, and other methods of reducing fuel consumption (CTUIR Energy Policy, 2009)."

i. Inventory Energy Demand on UIR

Understanding how energy is distributed, demanded, and used on the Umatilla Indian Reservation (UIR) is essential to determining feasibility of energy generation projects. A coordinated energy audit across all CTUIR departments and enterprises, combined with an education and self-reporting outreach effort, could provide necessary information about how energy is used, and how these needs are changing.

Short Term:

- **Organize and implement an education and outreach effort aimed at providing information about energy** use impacts, energy efficiency strategies and assistance programs, renewable energy sources and concerns. This effort should encourage discussion and conservation of energy within Tribal families and communities.

Long Term:

- **Organize and implement a coordinated energy audit of CTUIR facilities, businesses, industry sectors, and other relevant energy uses** on the UIR. This information will be essential in determining feasibility of energy generation projects. Initial data collection about energy use was conducted as part of developing the Energy Strategies Plan, but a dedicated scoping and data collection effort would improve information.

- **Develop and implement a voluntary and confidential self-reporting energy use protocol for families and residents within the UIR.** Initiative participants would consent to identify and share their energy use and reduction strategies, aiming to assist and normalize energy efficiency practices. This information could be used during outreach and incentivizing initiatives, as well as for grant and project funding planning.

iii. "Commission" Existing Tribal Facilities

"Commissioning" is a process of examining the functionality, occupancy, and infrastructure of a facility to determine opportunities for energy use improvement. This process involves balancing the heating/cooling system to run optimally and most efficiently, and can be done for both new buildings, for existing facilities, and can result in significant savings.

Short Term:

- **Partner with Energy Trust of Oregon (ETO) on their commissioning assistance**, which has a robust incentive and cohort program that provides

Passive energy strategies like PV shading for parking facilities. This one at TCI (pictured) provides electricity generation and reduces heat island impacts.

technical assistance with this process, and involves building staff in training and evaluation. Partnering with other reputable and like-minded energy organizations could also bring additional opportunities. and involves building staff in training and evaluation.

Long Term:

- **Continue to support and expand energy commissioning on Tribal facilities** using others that have been thorough the process. Such examples include Yellowhawk Tribal Health Center, which functions at a 60% more efficient energy use rate compared to other buildings, and saves $58,000 annually through passive and active energy reducing building design. Nixyaawii Education Center also received incentives and support for commissioning, early design assistance and "Path to Net Zero" planning (ETO, 2021).

iv. Conduct Passive Features Inventory and Implementation

Building design, orientation, landscaping, and maintenance behaviors can all affect energy efficiency. Utilizing strategies that reduce energy demand without requiring energy input is "passive." There are many strategies that can achieve this reduction that can be implemented.

Short Term:

- **Identify and inventory energy savings come from both passive and active building design**. These include building orientation, daylighting, high performance building envelope, high performance windows, solar heat gain and shading, among others. Strategies which do not actively use energy can reduce energy demand for heating and cooling.

- **Investigate the potential for use of "Variable Refrigerant Flow (VRF)"** in planned and retrofitted CTUIR facilities. Ductless heat pump installation provides heating/ cooling through liquid rather than air, in new and existing tribal facilities, as appropriate.

Long Term:

- **Plan to incorporate available passive energy technology into new construction plans and work to retrofit existing facilities** as is feasible. Many of these are likely to require securing capital expenses to implement, though intermediate steps are available to pursue.

- **Develop landscaping strategies that provide opportunities for increasing passive energy savings**. These include planting shade-generating deciduous trees on south facing windows and along walking routes, implementing solar generating panels over parking lot areas to reduce heat island effects, and geothermal exchange building components, among many others.

v. Support and Expand Ongoing Projects and Address Barriers

CTUIR has been actively developing energy efficiency advances in both existing, new, and planned facilities, and works with many partners to make these energy savings successful. Continuing to support these efforts and identifying barriers where they occur, would improve on these successes and expand energy conservation potential for the CTUIR government and community.

Short Term:

Celebrate and expand on existing Wildhorse Resort and Casino (WRC) Expansion Phase B efficiency measures. These improved energy saving through interior & exterior lighting, Energy Star gas fryers, and tankless water heaters. WRC has received $47,657 in incentives from Energy Trust of Oregon (ETO) to date (2021), with an estimated annual energy savings of 198,000 kWh.

- **Celebrate and expand on existing Nixyaawii Community School (NCS)** energy efficiency obtained through passive and active building design and commissioning, which was completed in 2019. This facility boasts annual energy savings estimated at 330,620 kWh per year, and building performance is 44.7% more efficient than similar buildings. Renewable generation is planned, but not yet installed, and would be an excellent goal for expansion and improvement of this facility.

- **Celebrate and expand on existing Yellowhawk Tribal Health Center energy efficiency.** These gains have been obtained through passive and active building design, high performance envelop, efficient heating and cooling energy recovery, solar panels on covered parking areas, LED lighting, low flow water fixtures, and “Path to Net Zero” planning, completed in 2017. Estimated annual energy savings, is 646,000 kWh, with renewable generation planned, but not yet installed.

Long Term:

- **Continue to pursue and fund planned future energy efficiency measures at Mission Market,** which currently has improved high efficiency LED Lighting.

- **Continue to pursue and fund planned energy efficiency measures at Wildhorse Golf Clubhouse**, which currently has planned improved efficiency for LED lighting, Heating Ventilation and Air Cooling (HVAC) systems, and kitchen equipment.

- **Continue to pursue and fund planned energy efficiency measures for UIR residential development**, which has planned improved energy efficiency for Tillicum Grange in 2015, and Lucky 7 Mobile Home Park existing buildings in collaboration with CTUIR Housing and individual homeowners on different programs available.

- **Continue to pursue and fund planned residential energy efficiency incentives for the new manufactured homes** in the Lucky 7 Mobile Home Park, as well as planned efficiency with the new Nixyaawii Community residential development.

vi. Electrification Capacity

Energy efficiency advances have accelerated in recent years, and electricity provides a large number of opportunities to transition away from fossil fuel sources to renewable energies. Much of the fossil fuel sources that are still used in Oregon are within direct use fuels (ex: natural gas heating for residences) or transportation fuels (ex: gasoline in personal vehicles) and represent potential for electrification.

Short Term:

- **Incentivize or reduce barriers to electrification** of home heating, cooking and other direct fuel uses for facilities and residences within the UIR. Examples for opportunities include (but are not limited to) CTUIR's Nixyaawii Governance Center (NGC), which is heated to a temperature baseline with natural gas, and UIR residences using inefficient wood-burning stoves.

Long Term:

- **Support and expand opportunities to reduce dependence on carbonized transportation fuels**. This could include (but is not limited to) encouraging ridesharing and use of public transportation options, particularly with CTUIR's Kayak Public Transit, expanding the availability of electric vehicle charging stations such as those located at Wildhorse Resort and Casino, and exploring alternative fuel options like biodiesel and hydrogen. See Ch 3C pages 119-121 for additional detail.

E. Improve Access to Energy Training, Education, Financial, and Technical Assistance

Microenergy projects can be prohibitively expensive, especially if efforts are made to source ethically and responsibly produced energy technologies. Many Tribal communities exist in "credit deserts" that have been systemically denied resident access to financing and reasonable lending to get these projects up off the ground. Renewable and energy efficiency investments often require access to borrowing power, which can be a barrier to implementation for many Tribal communities and families.

Short Term:

- **Connect Tribal communities with weatherization and energy assistance program regional partner organizations**. Partners in this work include Energy Trust of Oregon, which is mandated to assist in finding energy efficiency opportunities and supporting measures to promote it, among others locally and nationally. Working with these agencies can help Tribal families tap into additional funding and networks, and opportunities to expand renewable energy and weatherization for its community. These organizations may also be able to work with the Tribes in technical skills and community development capacity building. Programs like the AmeriCorps Resource Assistance for Rural Environments (RARE) program can provide capacity building. There are also opportunities to partner with AmeriCorps Climate and Energy Corps, and ETO's Trade Ally Network, among others.

Long Term:

- **Expand and support Tribal community access to credit for residential renewable investments**; working with energy assistance organizations and CTUIR's Nixyaawii Community Financial Services (NCFS) to build and bolster Tribal family access to credit for implementing or expanding micro-energy projects would reduce and eliminate many barriers to energy resilience.

Electrification of tasks and services could facilitate a shift to renewable energy, though investment in infrastructure is necessary to making this successful. Electric vehicle (EV) charging stations like the one at Wildhorse Resort and Casino (pictured) expand the capacity of EV feasibility, as "range anxiety" for these vehicles is cited as a large barrier to their wide-spread implementation.

Measuring Success and Gaps in Energy Use & Cost Adaptation

How Do We Measure the Success of These Adaptations?

"Decisions on how salmon fisherman accessed traditional fishing sites were commonly made based on the availability and distribution of key salmon runs. The same is true for many of our traditional food-gathering sites, where our once naturally abundant wild foods are beginning to show signs of fading away due to human impacts and climate change. Our ecological knowledge makes us especially sensitive to changing conditions in the surrounding global environment; and our ongoing, common historical experience suggests that these changing conditions will continue unabated (Phillip E. Cash Cash, 2015)."

- **CTUIR Energy Policy** (2009) Energy Goals (pages 20-24)
- **CTUIR Strategic Energy Plan** (2022) Part 3: Energy Vision Qualitative Performance Measures (Table 6, page 22) and Targets and Tracking Measures (Table 7, page 23)
- **Comprehensive Plan Objective 5.5.7:** Enable Tribal members to pursue excellence in education, become self-reliant and to contribute to the Tribal Community (see Comp Plan page 76 for benchmarks);
- **Comprehensive Plan Objective 5.12.2**: Assure that community facilities are operated under the most efficient energy conservation measures. (see Comp Plan page 112 for benchmarks);
- **Comprehensive Plan Objective 5.15.2**: Develop strategies to protect the CTUIR and its Tribal Members from rising energy costs through conservation and development of reliable and affordable energy supplies (see Comp Plan page 108 for benchmarks);
- **Comprehensive Plan Objective 5.15.4**: Empower Tribal Members to take advantage of opportunities in energy related job training (see Comp Plan page 127 for benchmarks);
- **Comprehensive Plan Objective 5.15.5**: Promote energy sustainable business practices on the Reservation and assist local businesses with information and access to tax incentives and grant (see Comp Plan page 127 for benchmarks);
- **Comprehensive Plan Objective 5.15.6**: Encourage energy efficient building practices (see Comp Plan page 127 for benchmarks);
- **Comprehensive Plan Objective 5.15.8**: Utilize all available energy programs that provide incentives for energy efficiency and funding for renewable energy development (see Comp Plan page 127 for benchmarks).
- Energy affordability and reliability for UIR residents.

Tribes have been using "biofuel" to process and preserve First Foods since time immemorial. Modern life requires access to electricity, and is closely linked to burning fossil fuels. Energy efficiency improvements can reduce energy cost and demand, and improve quality of life.

What Gaps in Knowledge, Policy, Capacity, or Education Exist?

- UIR-wide energy audit, or voluntary self-reporting on energy use and energy demand of facilities and communities;
- Knowledge of how disruptions in electrical transmission will become more frequent;
- Speed of investment in infrastructure improvements that could reduce energy burdens.

Energy Adaptation Summary

Energy Generation and Transmission Adaptation

A. Support and Expand CTUIR Renewable Energy Generation Potential

B. Implement Tribal Sovereignty in Regional Energy Planning

C. Continue to Monitor and Engage with Hanford Nuclear Reservation

Transitioning away from carbon-intensive fossil fuel based systems requires implementation of renewable energy generation. Various sources of energy are potentially feasible for CTUIR, following community visioning and resource assessments.

Measures of Success:

- CTUIR Energy Policy (2009) Energy Goals (pages 20-24)
- CTUIR Strategic Energy Plan (2022) Part 3: Energy Vision Qualitative Performance Measures (Table 6, page 22) and Targets and Tracking Measures (Table 7, page 23)
- Comprehensive Plan (2010) Objectives 5.15.1, 5.15.3, and 5.15.7
- CTUIR Hazard Mitigation Plan (2021) Section 3
- Geothermal generation potential feasibility study (2018)

Energy Use and Cost Adaptation

D. Pursue Energy Efficiency for Tribal Homes, Businesses, and Facilities

E. Improve Access to Energy Training, Education, Financial, and Technical Assistance

Reducing energy waste has enabled Oregon to meet growing energy demand without the need to create new generation sources. There are still many opportunities to improve energy transfer efficiency, and to reduce demand for energy, especially from carbon-intensive sources.

Measures of Success:

- CTUIR Energy Policy (2009) Energy Goals (pages 20-24)
- CTUIR Strategic Energy Plan (2022) Part 3: Energy Vision Qualitative Performance Measures (Table 6, page 22) and Targets and Tracking Measures (Table 7, page 23)
- CTUIR Comprehensive Plan (2010) Objectives 5.5.7, 5.12.2, 5.15.2, 5.15.4, 5.15.5, 5.15.6, and 5.15.8
- Energy affordability and reliability for UIR residents.

Chapter 3E References and Credits

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- Background Photo, "Holding down the Powwow during Storm," CTUIR CUJ July 2022
- Inset Photo, "Fishing Scafolds in the wake of Bonneville Dam," CTUIR DNR CRPP
- Panel Photo, "Bend in the Umatilla River," CTUIR DNR CRPP
- Inset Photo, "Irrigation diversion and fish ladder on Umatilla River," CTUIR DNR
- Panel Photo, "Sunset over Columbia River Bridge through transmission lines," CTUIR DNR CRPP Wenix Red Elk
- Inset Photo, "Tribal forest managers sort through slash," CTUIR DNR
- Panel Photo, "Sunset hues over Winter Blue Mountains," CTUIR DNR
- Inset Photo, "Wind turbine blades traveling through UIR by rail," CTUIR DNR FFPP 2022
- Panel Photo, "Irrigation wheels and straw bales near WRC," CTUIR DNR FFPP 2022
- Inset Photo, "Huckleberry drying on Tuli mats in cultural revival," CTUIR DNR CRPP
- Panel Photo, "High Voltage Transmission towers over HNR and

Columbia River," CTUIR DNR FFPP 2020
- Inset Photo, "First Foods being prepared for cultural longhouse meal," CTUIR DNR CRPP
- Panel Photo, "Purple Fireweed blooms in Blue Mountain forest understory," CTUIR DNR CRPP Wenix Red Elk
- Inset Photo, "The Dalles Dam lit up at night viewed from fishing scaffold," CTUIR FWC Bud Herrera
- Background Photo, "Tribal youth exercise Treaty Rights near wind turbines," CTUIR DNR CRPP
- Inset Photo, "View of TCI wind turbine and building on approach," CTUIR DNR FFPP 2022
- Panel Photo, "Blue sky and white clouds over CTUIR lands," CTUIR DNR CRPP Wenix Red Elk
- Inset Photo, "Solar panels generate electricity and shade for TCI," CTUIR DNR FFPP 2022
- Panel Photo, "Wind turbine at TCI," CTUIR DNR FFPP 2022
- Inset Photo, "Electric vehicles charge at stations in WRC parking lot," CTUIR DNR FFPP 2020
- Inset Photo, "First Foods cook traditionally over longhouse fire pit," CTUIR DNR CRPP
- Summary Photo, "Antuksh Tinqapapt Solar Panel Array powers EESP Field Station," CTUIR DNR FFPP 2022
- Panel Photo, "Glacier on Wallowa Mountains ridge," CTUIR DNR CRPP Wenix Red Elk
- Inset Photo, "CTUIR Fisheries technicians troll Columbia River waters," CTUIR DNR

CTUIR Dept. of Natural Resources (DNR) Fisheries program staff using a transportation fossil fuel in their motorboat to navigate along the Columbia River. Tribes have been adapting to change for millennia, and will continue to adapt. Transitioning to a renewable energy economy and grid must prioritize Tribal connection to First Foods, access to cultural and subsistence harvest, and minimize harm to all communities affected in development of energy generation.