Climate Resilience, Energy Dynamics, and Environmental Impact Analysis: Inland Southern California

Summary Data Book

Equity Council Presentation
12/1/2023

Prepared by Center for Sustainable Energy

Center for Sustainable Energy®

About CSE

Mission-driven national nonprofit

Center for Sustainable Energy® (CSE) is a national nonprofit that accelerates adoption of clean transportation and distributed energy through effective and equitable program design and administration.

- Administer cutting-edge programs valued at over $4 billion for governments, utilities and the private sector across the U.S.
- Leader in data-driven incentive program design and administration for:
- Electric vehicle and EV charging incentive programs
- Renewable energy incentive programs (solar and storage)
- Headquartered in San Diego with more than 250 employees across the nation

Objective and trusted

- Governments, utilities and the private sector trust CSE for its data-driven and software-enabled approach, deep domain expertise and customer-focused team.
- CSE's fee-for-service business model frees it from the influence of shareholders, members and donors, and ensures its independence.
- CSE's data and insights have informed policy at the local, state and federal level.

Center for Sustainable Energy®

State Requirements

“ii. Climate and Environmental Impact: Identify anticipated climate impacts and the factors that increase the region’s vulnerability to those impacts.

- Identify short term and long-term impacts of climate change on the people and economy of the region. These include disproportionate impacts on disinvested communities and expected increases in occupational hazards for workers.

- Identify major sources of air pollution, water pollution, toxic and hazardous waste and their impacts on diverse communities, especially disinvested communities.

- Identify major sources of Greenhouse Gas (GHG) emissions and their impacts on diverse communities, especially disinvested communities.

- Assess impacts of climate change on targeted emerging industries, sectors, or clusters and how these impacts might hinder success of the proposed plans and transition strategies (e.g., damage to critical infrastructure, loss of productivity, loss of population).”

Considering Equity

California Climate Investments' Priority Populations

- Disadvantaged Communities (CalEnviroScreen 4.0)
  - Environmental, health, and socioeconomic information to produce scores for every census tract in the state.
  - The scores are mapped so that different communities can be compared. An area with a high score is one that experiences a much higher pollution burden than areas with low scores.

- Low Income Communities (AB 1550)
  - AB 1550 identifies "Low-income communities" as census tracts with median household incomes at or below 80 percent of the statewide median income, or census tracts with median household incomes at or below the threshold designated as low-income by HCD's State Income Limits adopted pursuant to Section 50093.

Considering Equity

Identified Equity Groups

- Ethnic Minorities
- Labor Organizations
- California Native American Tribes
- Workforce Entities

These groups were often identified in climate mitigation programs, white papers, and reports, but their definitions aren’t standardized. Many climate mitigation programs confirm the completion of the project and scope, but do not provide access to any retrospective work or evaluation data, making the impact they have on these equity groups difficult to assess.

General Methodologies

- **Pre-research Phase**
  - Expert Review
  - Researcher Roundtable
  - Expert review and brainstorming

- **Research Phase (Climate, Energy, Environment)**
  - Primary Research Interviews [10+ interviews]
  - Secondary Research Literature Reviews
  - Gap analyses

CLIMATE

Climate

Questions / Topics

- Baseline climate condition
- Climate change mitigation strategies
- Future climatic conditions
- Region-specific considerations
- Flooding potential
- Snowpack
- Extreme event frequency, intensity

Please note that slides providing detailed information are in work and are subject to change. Selected topics and associated slides are still being finalized and will be added at a later date.

Climate

Methods

- CalAdapt Climate Data Models
  - temperature
  - precipitation
  - relative humidity

- LANDSAT 8 TIRS data
  - surface temperature

- Secondary Literature Review
  - GHG methodologies
  - Regional Climate Action Plans
  - Climate mitigation programs
  - Heatwave events

Climate

Key Takeaways

- Surface temperatures are higher in low-income communities
- Temperatures are projected to rise through the end of the century
- There will likely be a significant increase in the frequency and intensity of extreme heat events
- The top GHG-emitting sectors are on-road vehicles and electricity/building energy
- Current climate mitigation strategies primarily target energy and transportation sectors

Climate

Temperature

- Surface temperatures are 3.2% to 4.7% higher in equity communities

- While both disadvantaged (DAC) and low-income (LIC) communities have higher average surface temperatures, LICs have a greater magnitude of difference than DACs, 3.4% - 4.7% versus 3.2 to 4.4%, respectively.

- Literature review supports the finding that places with higher temperatures (surface and air) are places with lower vegetation and both are correlated with lower household income and greater proportion of non-white residents

How to read the chart:

The bars here indicate, on average, how much warmer equity communities are than non-equity communities. For example, the first bar indicates that low-income communities in Riverside are - on average - 2.82 degrees Fahrenheit hotter than more well-off communities

Climate

Temperature

- Surface temperatures are higher in low-income communities (LICs)
- While both disadvantaged (DAC) and low-income (LIC) communities have higher average surface temperatures than non-DACs/LICs, LICs have a greater magnitude than DACs
- This trend remains at all resolutions, including county, sub-region, and PUMA
- Literature review supports the finding that places with higher temperatures (surface and air) are places with lower vegetation and both are correlated with lower household income and greater proportion of non-white residents

Climate

Temperature

- Surface temperatures are higher in disadvantaged communities (DACs)
- While both disadvantaged (DAC) and low-income (LIC) communities have higher average surface temperatures, LICs have a greater magnitude than DACs
- This trend is clear at the county and sub-regional levels, but the trend is less clear as you increase the resolution to PUMAs
- Literature review supports the finding that places with higher temperatures (surface and air) are places with lower vegetation and both are correlated with lower household income and greater proportion of non-white residents

Climate

Temperature, Precipitation, Relative Humidity

- Temperatures are projected to increase
- Precipitation is projected to become more extreme over time, with wet months experiencing more precipitation and dry months experiencing less precipitation
- Relative humidity is projected to decrease over time
- For each climate variable, RCP* 8.5 has a greater magnitude than RCP 4.5

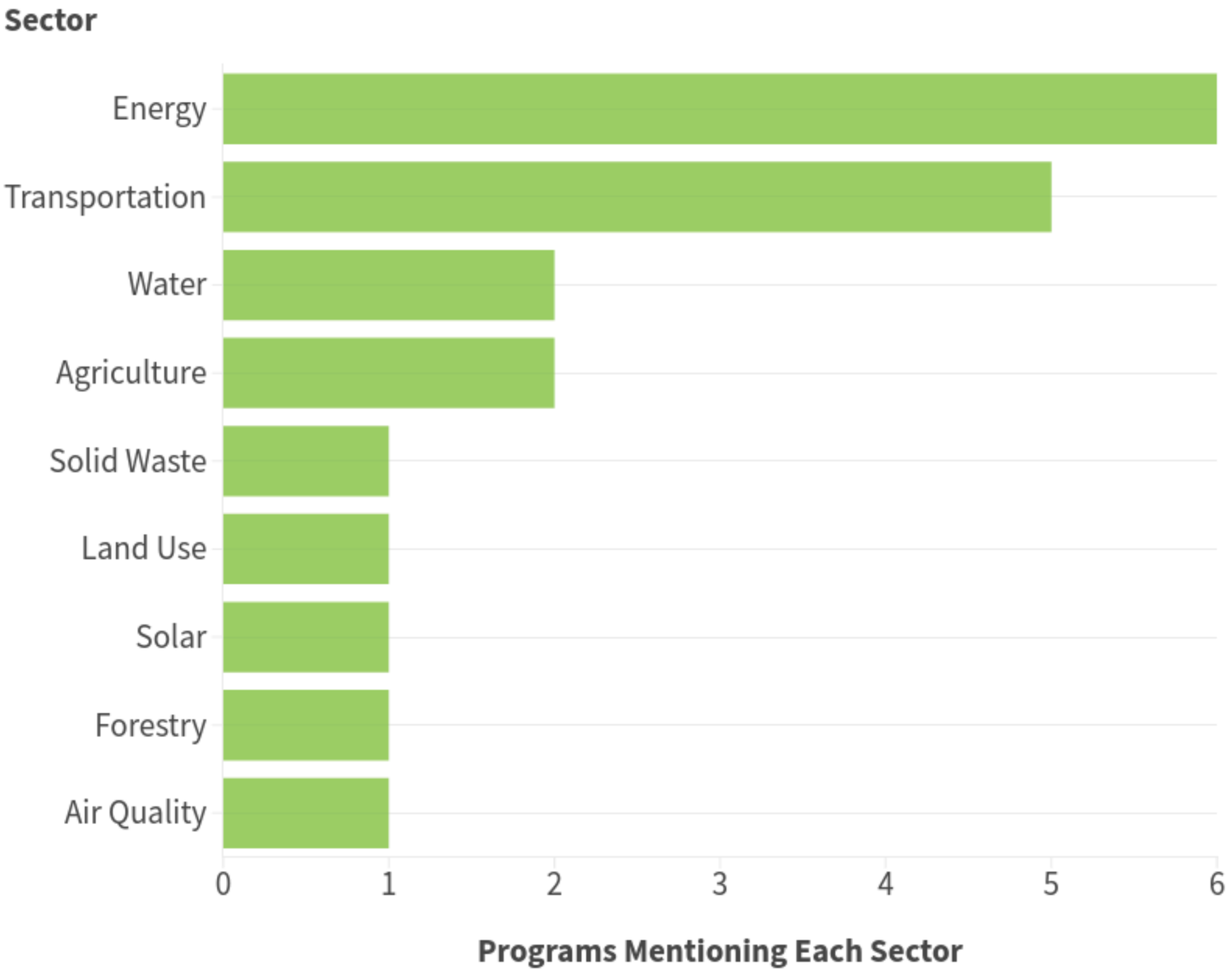
- RCP 4.5 & 8.5 - Representative Concentration Pathway (RCP) greenhouse gas concentration trajectories. Each pathway describes different climate change scenarios and are labeled after a possible range of radiative forcing values in the year 2100 (4.5, 8.5 W/m^2).
- RCP 4.5 is the IPCC's intermediate scenario, RCP 8.5 assumes that emissions continue to rise throughout the 21st century. Originally published in IPCC's Fifth Assessment

Climate

Mitigation Policies

- Climate mitigation strategies primarily target the energy and transportation sectors
- These programs are usually not standardized nor continued long-term, and results are often unqualified

What Sectors do Climate Mitigation Programs Address?



Climate

- **Gaps we will address soon**
  - Historical climate change at a microclimate scale
  - Disparities in impact of other climate variables (besides surface temperatures) on equity communities
  - Ongoing review of climate mitigation programs inside and outside the Thrive Inland SoCal region
  - Effect of flooding potential and snowpack in the region, along with the projected impact of climate change

- **Gaps in data (haven’t found it, doesn’t exist, or isn’t publicly available)**
  - Neighborhood-level projections of temperature, precipitation, and humidity data
  - Results of historical climate mitigation programs
  - Recent regional greenhouse gas data

ENERGY

Energy

Questions / Topics

- Energy conditions
- Energy infrastructure assets
- New access to energy for industry, sectors
- Greenhouse gas emissions by sector
- Energy resiliency
- Future energy and infrastructure requirements and energy demand
- Jobs, production that involve working on climate or environmental issues

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Energy

Methods

- Geospatial analysis of existing infrastructure
  - powerplants
  - distributed energy resources
- Advanced modeling of projected electric vehicle adoption
- Primary research interviews with energy experts
- Secondary research of regional reports and white papers

Energy

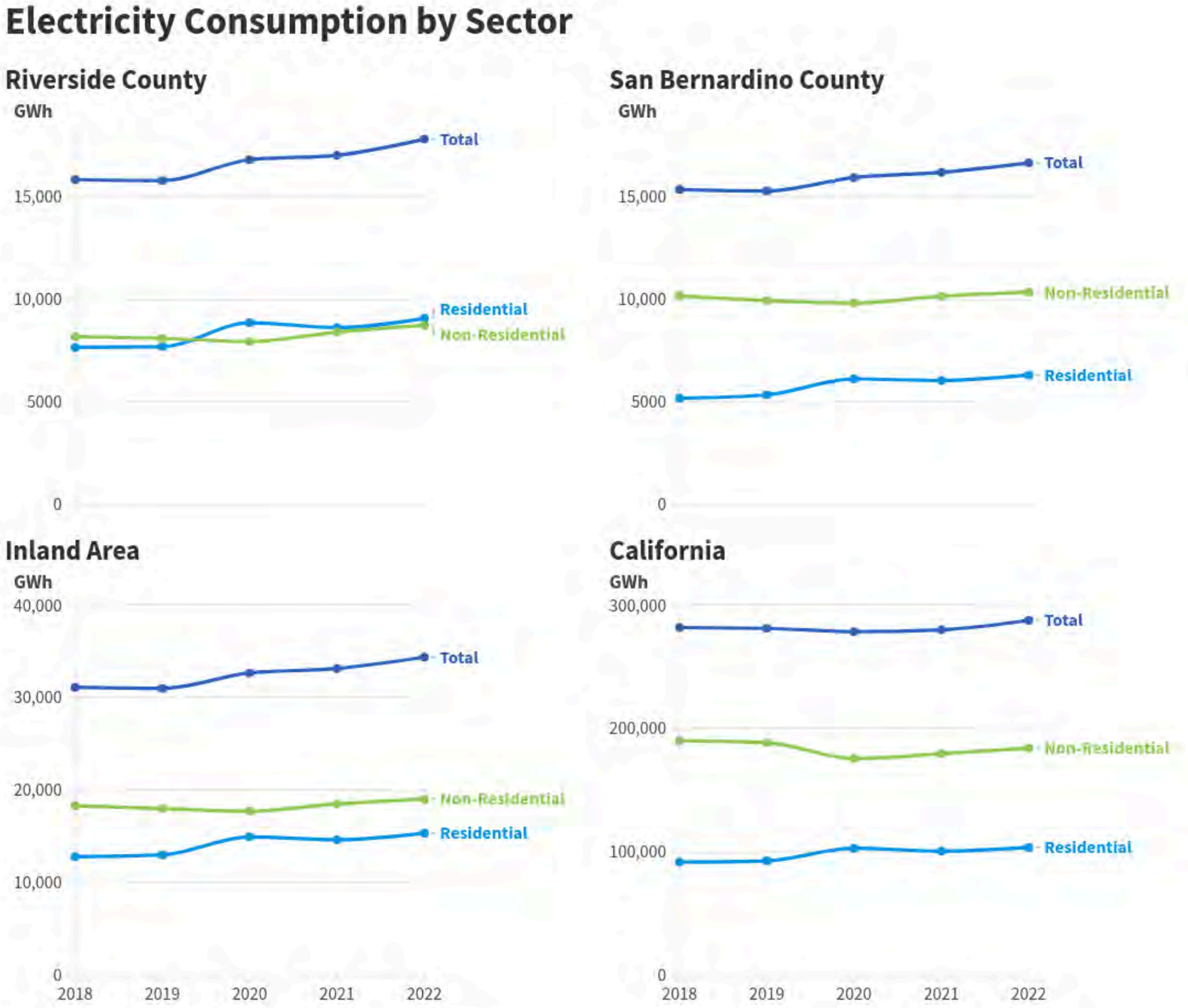
Key Takeaways

- Top energy consumers are transportation and warehousing sectors
- Electricity peak demand and consumption has increased over time.
- Projected increase in residential and non-residential energy consumption
- Inland SoCal is committed to transitioning to renewable energy sources, with solar currently leading in recent installation and production capacity

Energy

Electricity consumption has risen over time

- In 2020, non-residential electricity consumption decreased and residential energy use increased



Source: California Energy Commission Electricity Consumption by County

Energy

Power generation has started to shift more toward renewable energy sources

- Renewable energy adoption is gaining momentum in Inland Southern California, with solar energy leading in recent decades
- Natural gas continues to generate a majority of power in the Inland SoCal region (approximately 60%)

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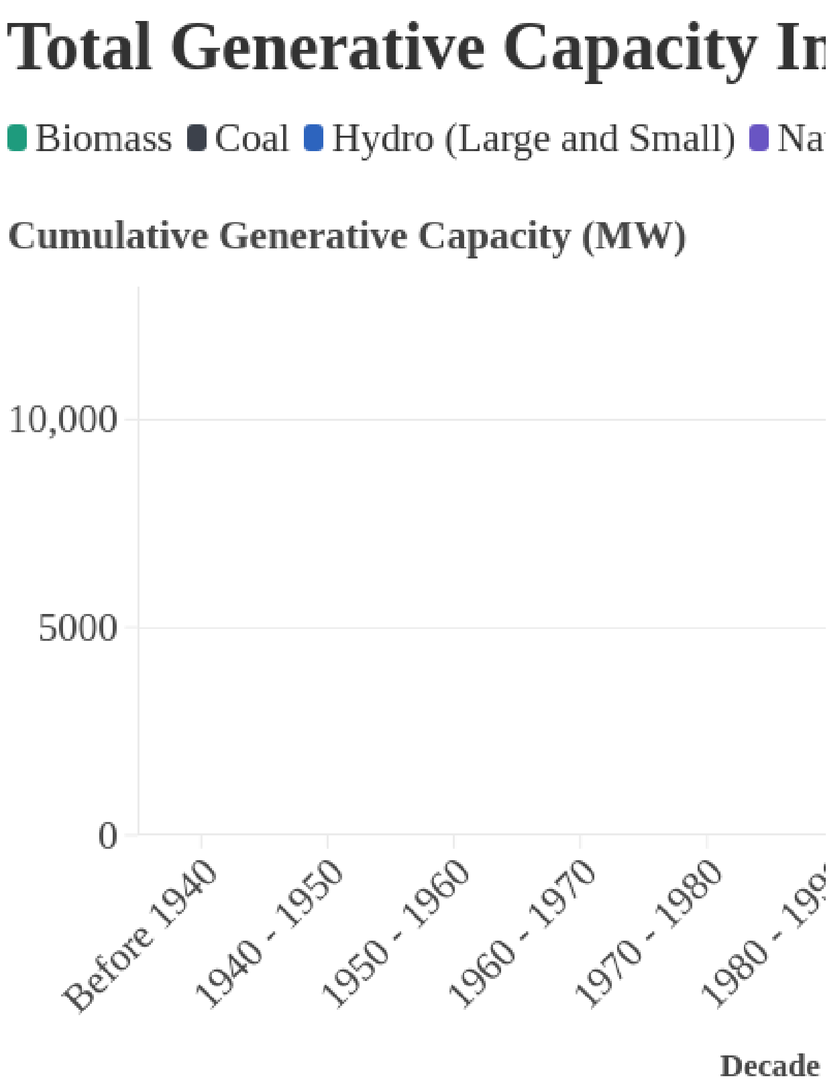

Source: California Energy Commission •
Power plant locations and characteristics as recorded in the Qua
California Energy Commission (CEC). Last updated in May 20

Energy

More wind and solar energy power plants are being installed

- In recent years, a greater percentage of power plants using renewable resources have been installed
- Riverside has installed more wind power plants and San Bernardino has installed more solar power plants
- The number of natural gas and hydro (large and small) power plants has remained relatively consistent since 2000

Energy

Future Energy Generation

- Future energy demands in the region are expected to rise due to population growth and increasing temperatures
- Increased demand will likely intensify the focus on renewable energy, electric vehicle infrastructure, and energy storage solutions.
- Between 2015 and 2022 there has been a continuous increase in recent energy consumption in the region for both the residential and nonresidential sectors

Energy

Energy Resiliency

- Distributed energy resources (DERs), such as small-scale generation and storage facilities play a pivotal role in bolstering energy resilience

- DERs reduce reliance on centralized grids, are crucial in managing peak load demands, and enhance overall grid efficiency

- Significant utility-scale energy projects in the pipeline include the transformation of the Thrive Inland SoCal Energy Center into a large-scale energy storage facility and the Crimson Energy Project, a 350-megawatt battery storage system set to enhance regional energy reliability.

Energy

Accelerating Adoption of Renewable Energy

- Renewable energy adoption is gaining momentum in Inland Southern California, with solar energy leading the charge
- The regional energy mix is evolving, with a notable decrease in natural gas usage and a significant increase in solar and wind energy generation
- This shift is influenced by state mandates, economic incentives, and growing environmental consciousness.
- However, the transition is challenged by regulatory hurdles, the need for substantial investment in infrastructure, and the intricacies of integrating renewable sources into the existing grid

Energy

- **Gaps we will address soon**
  - Recent estimated regional energy use by sector

- **Gaps we cannot address within scope**
  - Long term renewable energy integration strategies
  - Cost-benefit assessments of renewable energy projects
  - Detailed economic impact analysis of the energy transition

- **Gaps in data (haven’t found it, doesn’t exist, or isn’t publicly available)**
  - Data from energy reduction programs (climate mitigation)
  - Detailed proposals of utility-funded infrastructure installations
  - Energy reliability and grid stability

ENVIRONMENT

Environment

Questions / Topics

- Natural resources assets
- Water quality trends, water demand
- Air quality trends
- Land use trends, conservation, restoration
- Soil quality and impacts on local/small scale and large agriculture
- Impact of extreme events
- Disadvantaged communities disproportionately affected by energy costs and pollution

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Environment

Methods

- Data analysis
  - CARB air quality data
  - USDA soil survey data
  - California Dept of Conservation Farmland Mapping and Monitoring Program data
  - California Heat Assessment Tool data

- Primary research interviews with government officials and environment experts

- Secondary research of academic literature, regional reports, and other white papers

Environment

Key Takeaways

- Ozone levels have in recent years have stopped their trend of improving
- Major pollutants are from transportation, particularly heavy-duty vehicles and port activity. Industrial activities, agricultural, and natural events (e.g., wildfire) are also contributors.
- Dense urban and built-up areas, warehousing districts, and areas near transportation corridors experience lower air quality than rural areas, and are also more likely to be classified as disadvantaged communities
- Significant land use change from agriculture to urban/built-up area and industrial development
- Warehouses are identified as a key area of concern regarding land use change and air quality

Environment

Air Quality

- The region's air quality is primarily affected by pollutants such as ozone, particulate matter (both PM10 and PM2.5), nitrogen dioxide (NO2), sulfur dioxide (SO2), and carbon monoxide (CO).

- In recent years, certain pollutants like ozone have exhibited stalled or worsening trends in specific areas, signaling a need for more robust interventions

- Rise in temperatures and increase in worse air quality (PM2.5, PM10)

Environment

Water Quality

- Groundwater supplies throughout the region suffer from high levels of salts (total dissolved solids or TDS) and nitrate contamination from legacy agriculture.

- In desert regions, groundwater supplies may have high levels of arsenic, fluoride and uranium.

- An increase in the frequency and severity of droughts combined with an increase in storms and large rain events will increase the region's need to manage groundwater supplies, collect and divert storm water, and recharge groundwater basins in wet years.

- The Colorado River flows have declined and are predicted to decline further with climate change

Environment

Soil Quality

- Significant land use from agriculture to urban/built-up area and industrial development

- construction, pollution, and reduced vegetation cover are the major factors that have negatively impacted soil quality
  - chemical fertilizers, pesticides, and monoculture practices

- Soil quality in urban areas is impacted by factors such as construction, pollution, and reduced natural vegetation cover

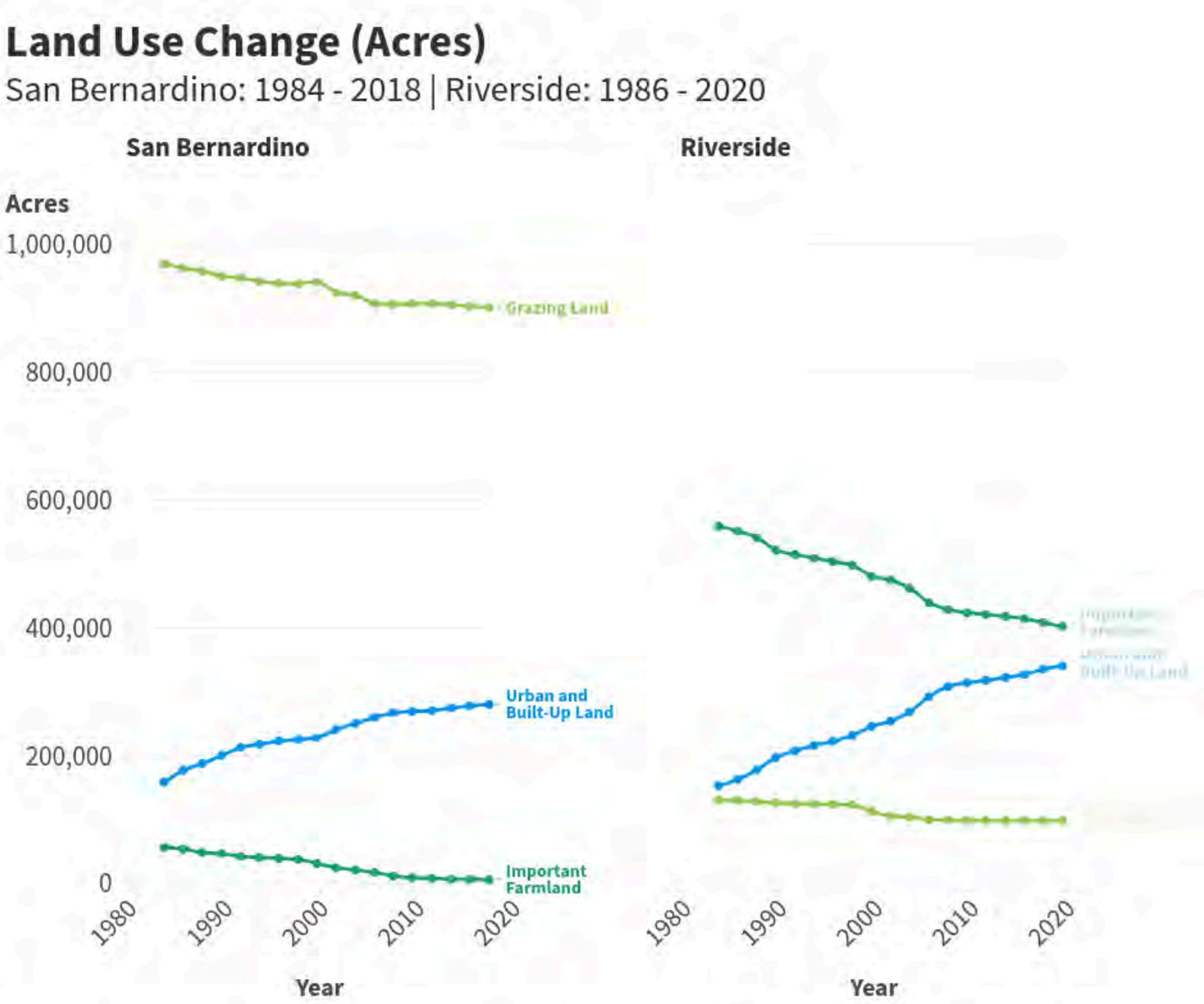
- Industrial activities, especially those involving heavy metals and chemicals, have led to soil contamination, posing risks to human health and the environment.

- Climate change poses a new set of challenges for soil quality — increased temperatures, altered precipitation patterns, and extreme weather events like floods and droughts affect soil moisture, nutrient cycles, and erosion rates.

Environment

Land Use

- Agricultural land has decreased overtime
- Urban / built-up and industrial land has increased overtime
  - implications for economic development and workforce composition
- Implications for air and soil pollutants
  - worse air quality
  - soil not subject to as much agriculture-related pollutants
- Projections describe more urban and industrial development
- Conservation of rural and wildlife areas identified as a priority



California Department of Conservation Farmland Mapping and Monitoring Program: San Bernardino Historic Land Use Conversion, Farmland Mapping and Monitoring Program: Riverside Historic Land Use Conversion

Environment

Extreme Events

- Heat Events: a significant rise in heat exposure risks, with a substantial portion of residents vulnerable to high heat due to climate trends. this risk is expected to increase energy use by about 10%.

- Droughts: Agriculture and ecosystems face the brunt of the drought. Droughts intensify the likelihood and severity of wildfires.

- Wildfires: These pose a notable risk, particularly in forested and rural areas and at the wildland-urban interface. Wildfires also degrade air quality across the board.

Environment

- **Gaps we will address soon**
  - Continued collection and analysis of state and regional data

- **Gaps we cannot address within scope:**
  - Local communities' involvement, especially in disinvested regions, in environmental monitoring and policymaking
  - Policy and regulatory delays regarding resource use and zoning

- **Gaps in data (haven't found it, doesn't exist, or isn't publicly available)**
  - Infrastructure development plans aligned with future economic projections
  - Detailed, recent environmental data on microclimates for neighborhood-level analysis

Summary Takeaways

- **Geographical Diversity**
  - The Thrive Inland SoCal’s varied landscapes, including urban areas and deserts, provide unique opportunities for climate mitigation strategies and renewable energy development, particularly in solar and wind energy.

- **Economic Potential**
  - The region's growing population and industrial activities, particularly in logistics and warehousing, offer significant opportunities for green job creation and sustainable economic practices.

- **Environmental Challenges**
  - The region faces pressing environmental challenges, including air and water pollution and the impacts of climate change, such as increased temperatures and extreme weather events.