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CALIFORNIA ENERGY COMMISSION

Climate Parameters for the Energy System

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What Are Climate Relevant Parameters?

We define here “Climate Relevant Parameters” as weather/climate related metrics/variables that are used for the design, management, operation, or planning of the energy system.



Why Do We Need Climate Relevant Parameters?

- Climate scenarios are only helpful to the extent that they address issues that are salient to end-users, and are at scales that fit end-user needs.
- Identifying climate relevant parameters is step one in tailoring climate scenarios to California's energy sector.



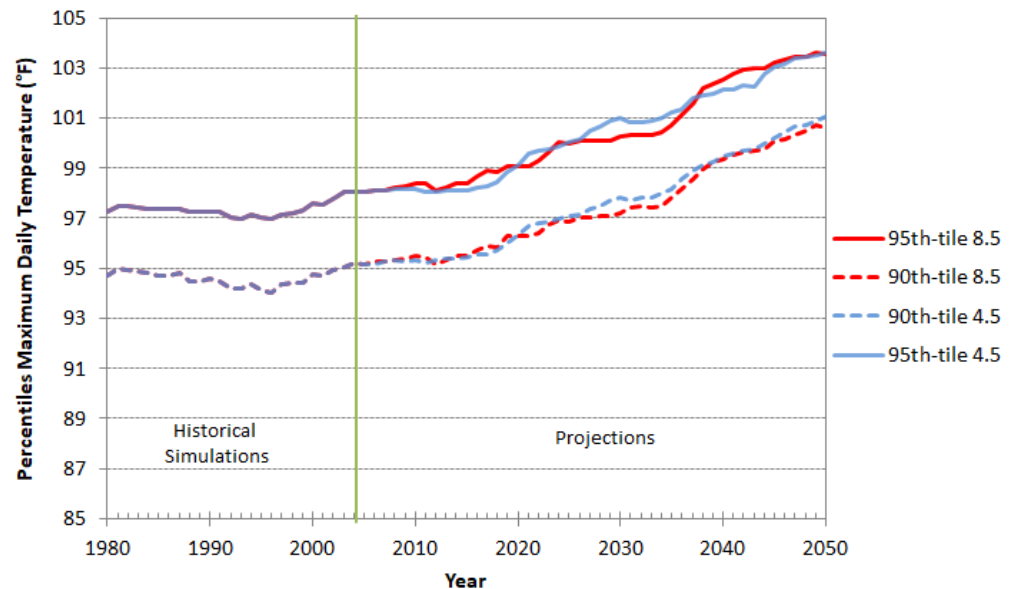
Some Examples



Climate Relevant Parameter: 1 in 10 and 1 in 20 events

- To estimate the peak electricity generating capacity (MW) that should be available for the hot months of the year, forecasters use the **95th percentile of the maximum temperatures (1 in 20 events)** measured in a given meteorological station (or weighted average of multiple stations) in the last 30 years.

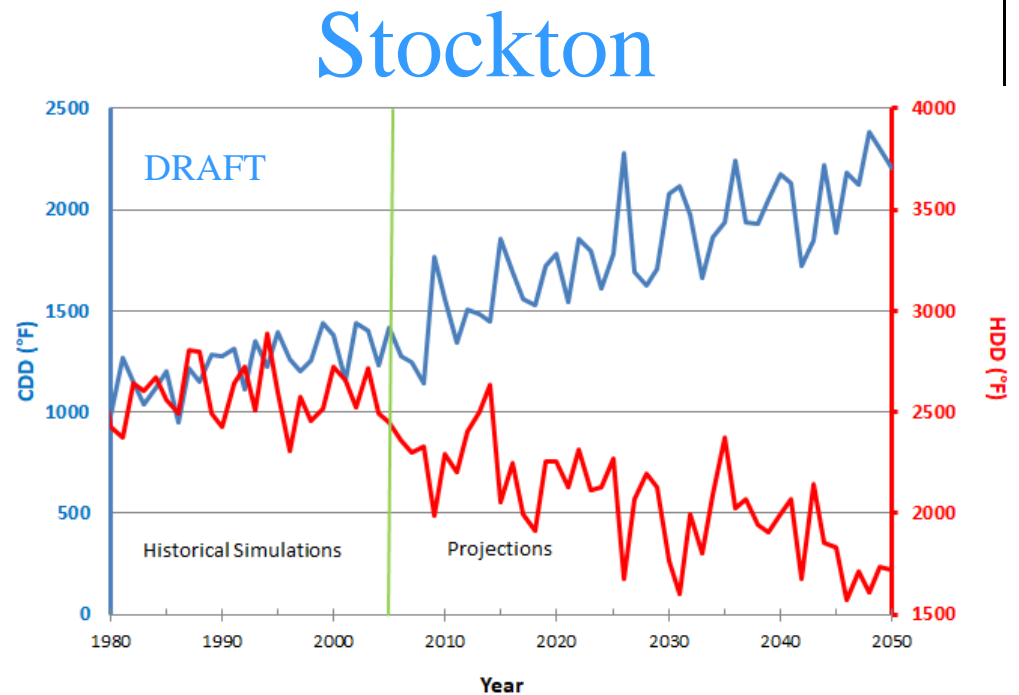
Thirty year 90th and 95th
Percentiles of Maximum Daily
Temperatures: Stockton





Climate Relevant Parameter: Cooling and Heating Degree Days

- CDD* and HDD are used to forecast energy demand.
- CDDs would go up at a faster rate than HDDs decline, as already observed in the historical record.



CDDs are a proxy for how much energy is needed to cool buildings and thus increases with hotter temperatures. HDDs, conversely, proxy energy needed to heat buildings and decline as climate warms.



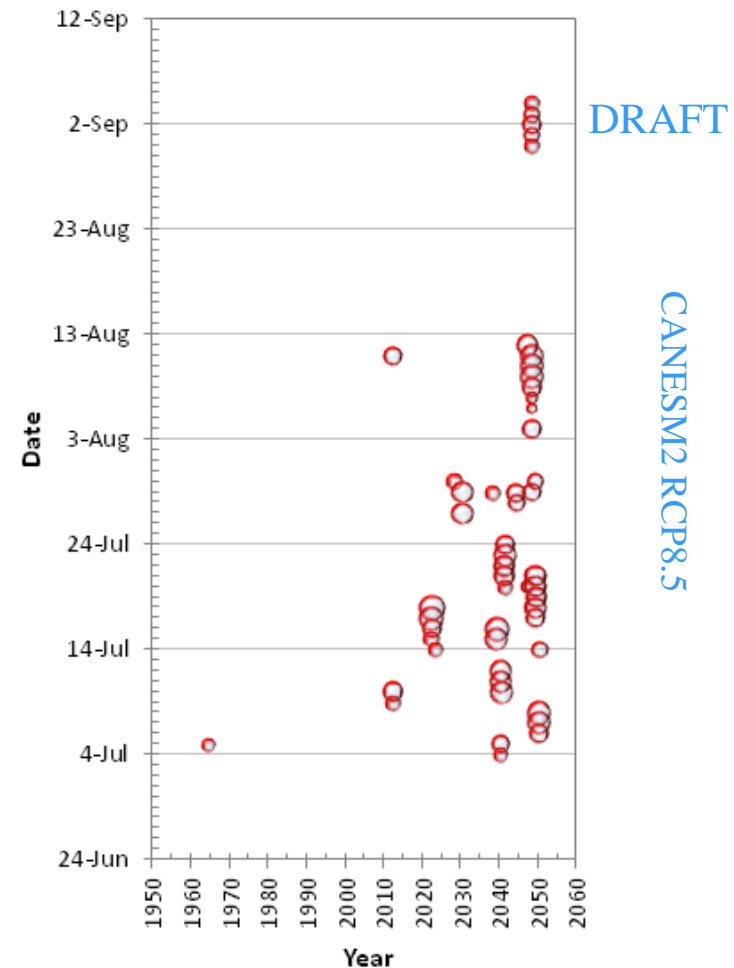
Additional Parameters

- Selection of materials for transmission lines are based, among other factors, on the maximum temperature that is expected to be experienced in the geographical area where the transmission line is going to be installed during its service life.
- The design of supply capacity of natural gas infrastructure to serve **core** customers considers the coldest average daily temperature that may be exceeded once every 90 years, on average.

Potential Parameter: Region-wide Heat Waves

- The electricity system experiences stresses during heat waves covering states in the Southwestern United States.
- Here we define region-wide heat waves when major cities in California, Arizona, Utah, and Nevada experience their historical 1 in 50 year events **simultaneously**.
- Using simulations for one of the global models downscaled with LOCA from 1950 to 2050, we found: 1) these heat waves are rare in the historical period, as expected; 2) they will become more common in the future, and 3) their duration and temperatures will increase.

Heat Waves covering CA, AZ, UT, and NV:
1950-2050



The size (area) of the bubbles are proportional to temperature.



COMMENT

ASTROBIOLOGY A profile of the indomitable woman at the helm of SETI p.596



HEALTH Documentary traces the roots and legacy of a pioneering aid agency p.598

ENERGY Call for caution following China's gas-hydrate extraction p.599

TAXONOMY Rebuttals on bureaucracy, hypotheses, conservation and more p.600



Decarbonizing the world economy will require renewable energy generation from vast solar farms, such as this one in Nevada.

Three years to safeguard our climate

Christiana Figueres and colleagues set out a six-point plan for turning the tide of the world's carbon dioxide by 2020.

In the past three years, global emissions of carbon dioxide from the burning of fossil fuels have levelled after rising for decades. This is a sign that policies and investments in climate mitigation are starting to pay off. The United States, China and other nations are replacing coal with natural gas and boosting renewable energy sources. There is almost a unanimous international agreement that the risks of abandoning the planet to climate change are too great to ignore.

The technology-driven transition to low-carbon energy is well under way, a trend that made the 2015 Paris climate agreement possible. But there is still a long way to go to decarbonize the world economy. The political winds are blustery. President Donald Trump

has announced that the United States will withdraw from the Paris agreement when it is legally able to do so, in November 2020.

The year 2020 is crucially important for another reason, one that has more to do with physics than politics. When it comes to climate, timing is everything. According to an April report¹ (prepared by Carbon Tracker in London, the Climate Action Tracker consortium, the Potsdam Institute for Climate Impact Research in Germany and Yale University in New Haven, Connecticut), should emissions continue to rise beyond 2020, or even remain level, the temperature goals set in Paris become almost unattainable. The UN Sustainable Development Goals that were agreed in 2015 would also be at greater risk.

That's why we launched Mission 2020 — a collaborative campaign to raise ambition and action across key sectors to bend the greenhouse-gas emissions curve downwards by 2020 (www.mission2020.global).

As 20 leaders of the world's largest economies gather on 7–8 July at the G20 summit in Hamburg, Germany, we call on them to highlight the importance of the 2020 climate turning point for greenhouse-gas emissions, and to demonstrate what they and others are doing to meet this challenge. Lowering emissions globally is a monumental task, but research tells us that it is necessary, desirable and achievable.

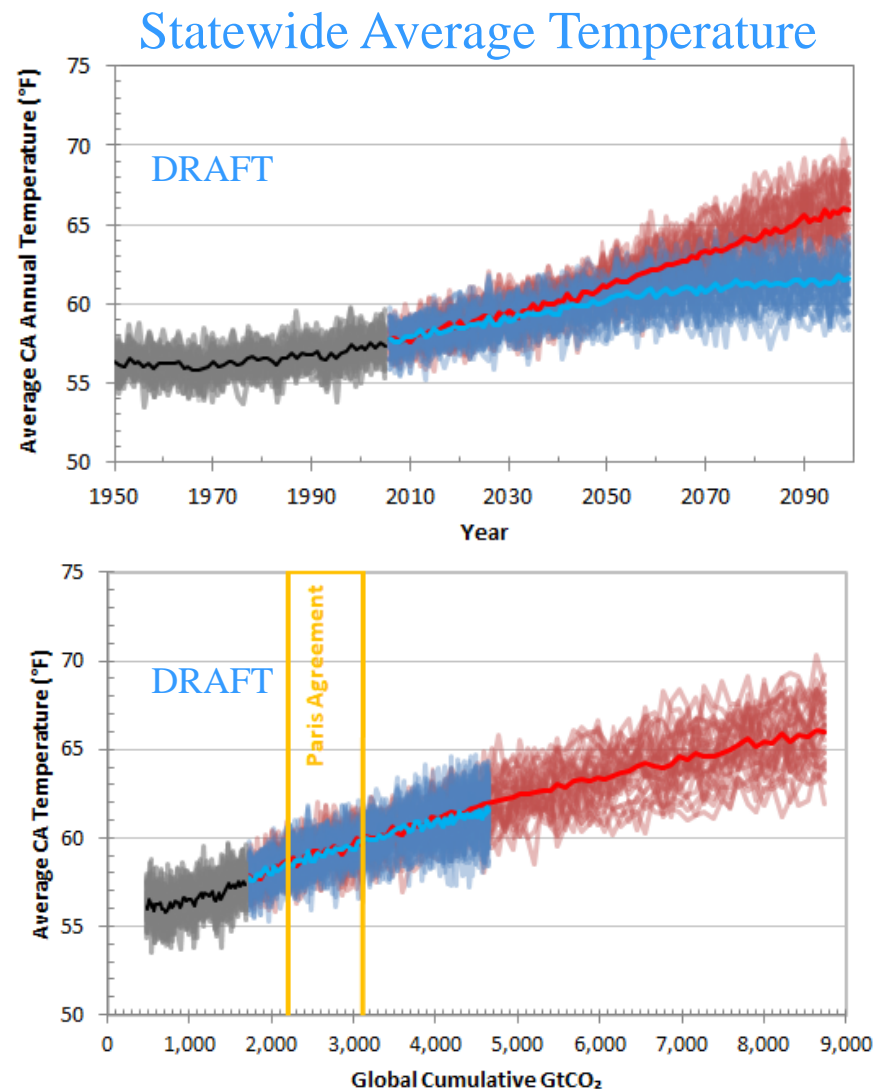
After roughly 1°C of global warming driven by human activity, ice sheets in Greenland ▶

“After subtracting past emissions, humanity is left with a ‘carbon credit’ of between 150 and 1,050 gigatonnes of CO₂ to meet the Paris target of 1.5 °C or well below 2 °C.”

Note in Nature
co-signed by
Governor Brown

Potential Climate Parameter: Minimum Expected Warming

- To achieve the Paris goal of limiting global average temperature to between 1.5 °C and 2 °C (2.7 °F to 3.6 °F) from pre-industrial levels, total global CO₂ emissions could only increase by certain amounts from the cumulative emissions emitted since 1850.
- The “Paris” range of cumulative CO₂ is shown in the yellow rectangle.
- Temperatures in California would go up from 1.6°F to 2.8 °F from the 1976-2005 average temperature.
- California has already experienced an increase of average temperature of about 2°F since 1895.





Concluding Remarks

- The identification of climate relevant parameters may facilitate the consideration of climate change in the design, management, and planning of the energy system.
- A suite of these climate parameters will be available via Cal-Adapt.



Thank you !

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