U.S. Energy Consumption

Sustainability Analysis

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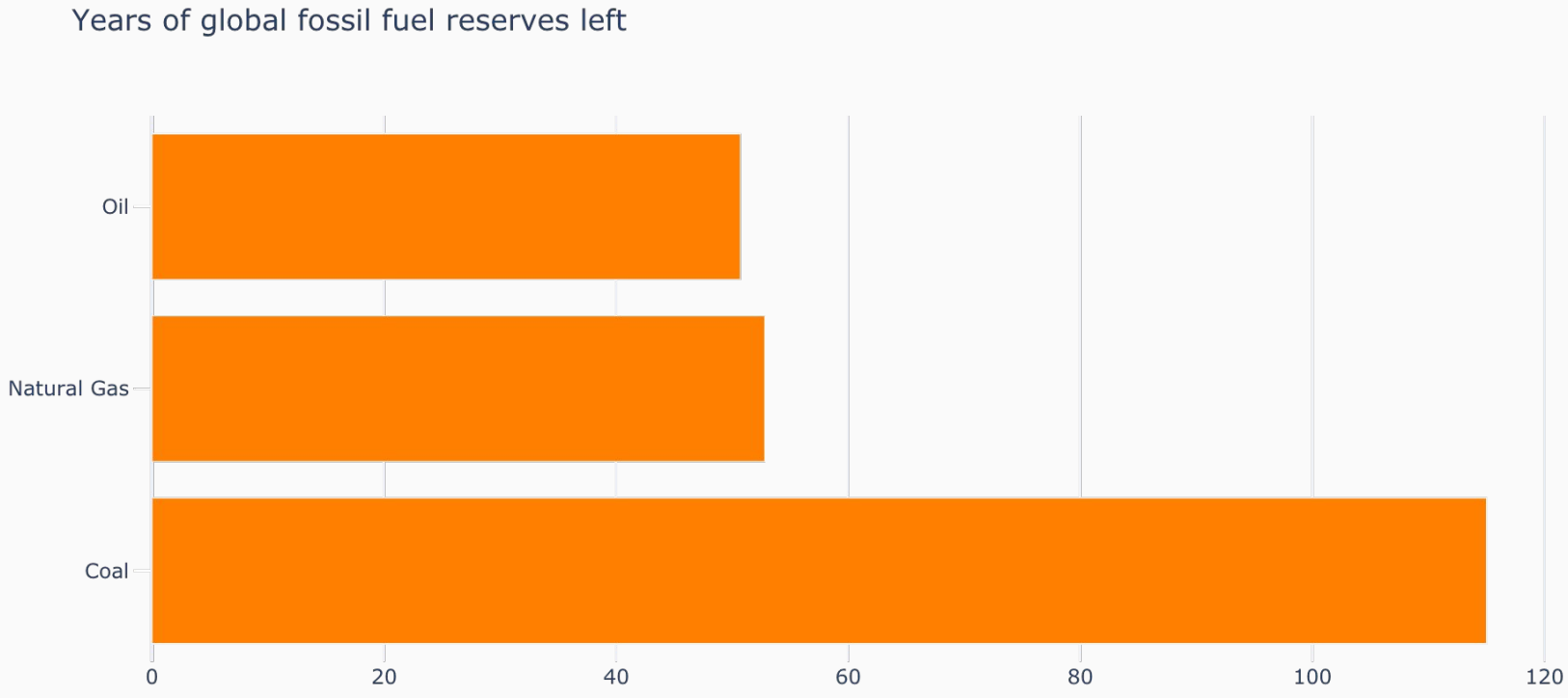
Sustainability

Avoidance of the depletion of natural resources in order to maintain an ecological balance.

Energy resources are limited

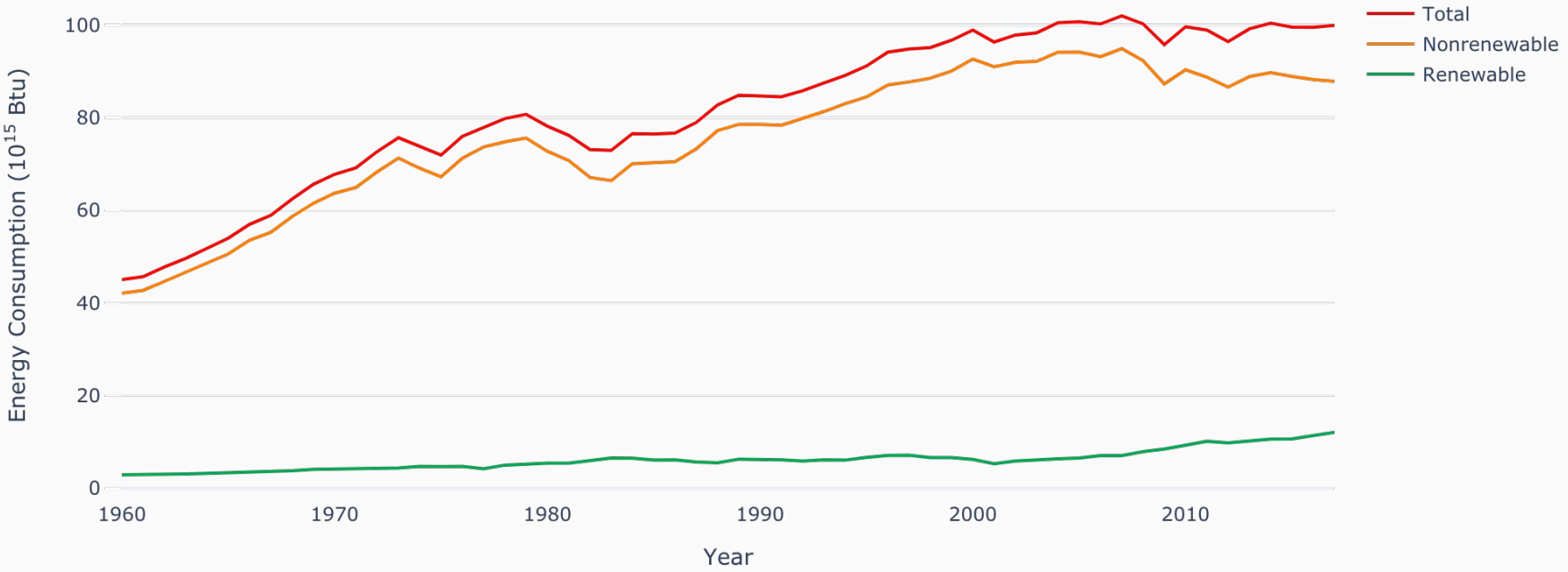


BP statistical Review of World Energy 2016

US energy consumption has increased

United States Energy Consumption

Total consumption has more than **doubled** since 1960, mainly due to nonrenewables

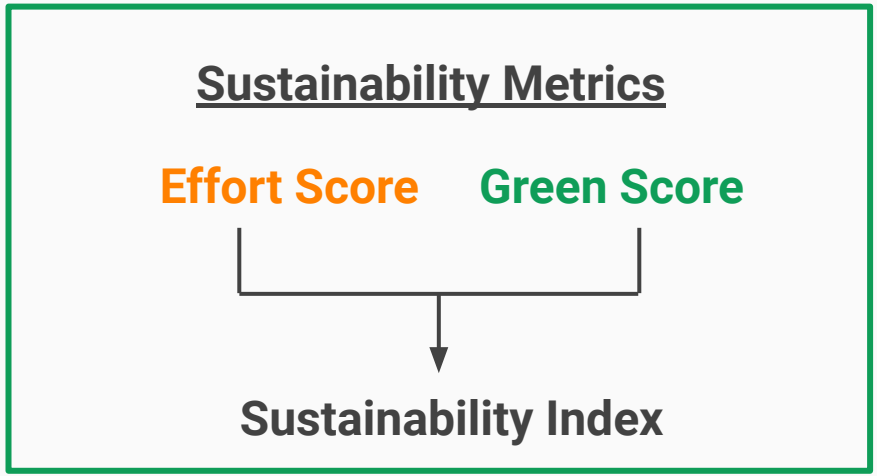


U.S. Energy Information Administration

How do we take action?

Define metrics for sustainability to explore questions like:

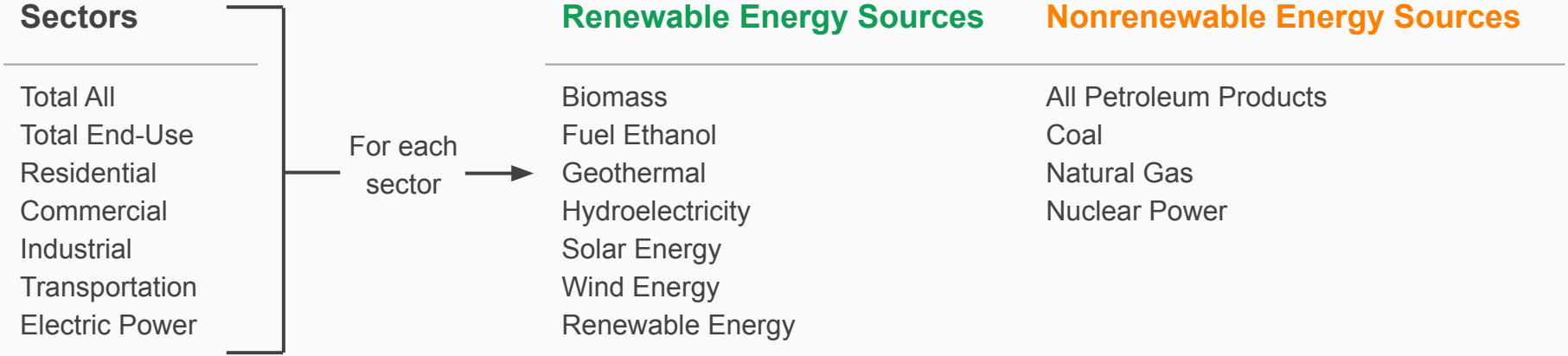
- Which states are most sustainable?
- How do they consume energy by sector and fuel type?
- What can we learn and apply from these sustainable states?



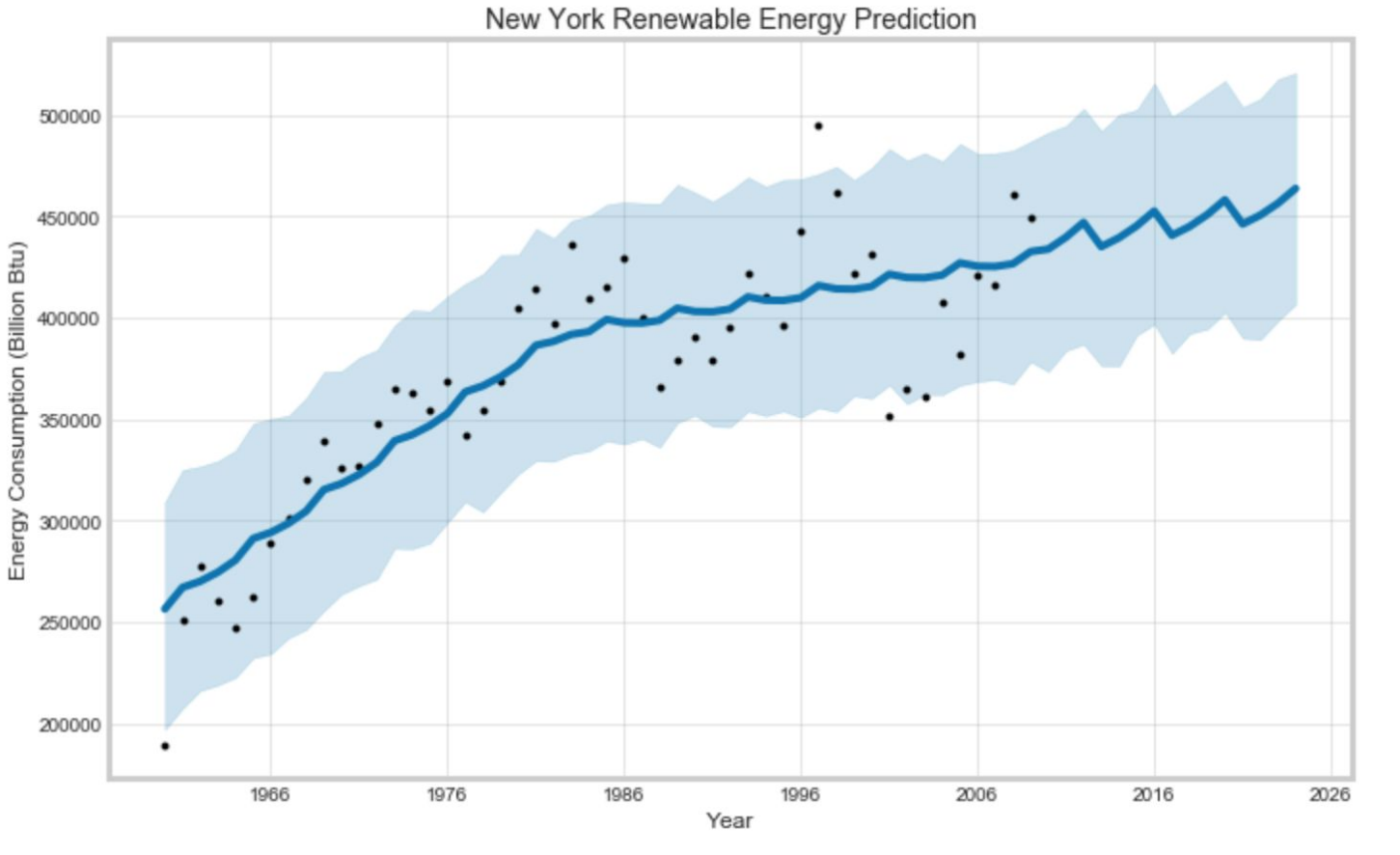
Gathering data

Yearly Energy Data (1960 - 2017)

U.S. Energy Information Administration (EIA)



Original intention: energy consumption forecasting

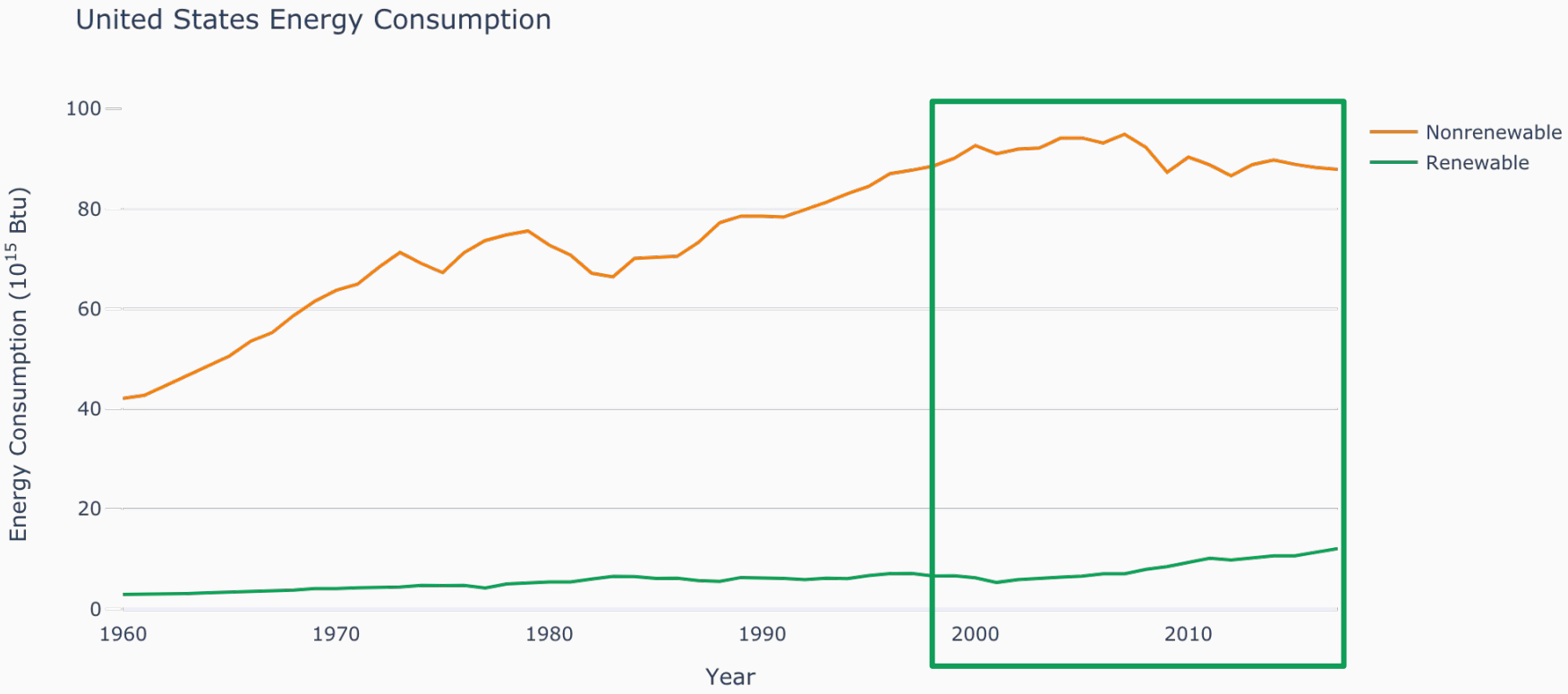


Facebook Prophet model RMSE: 45800

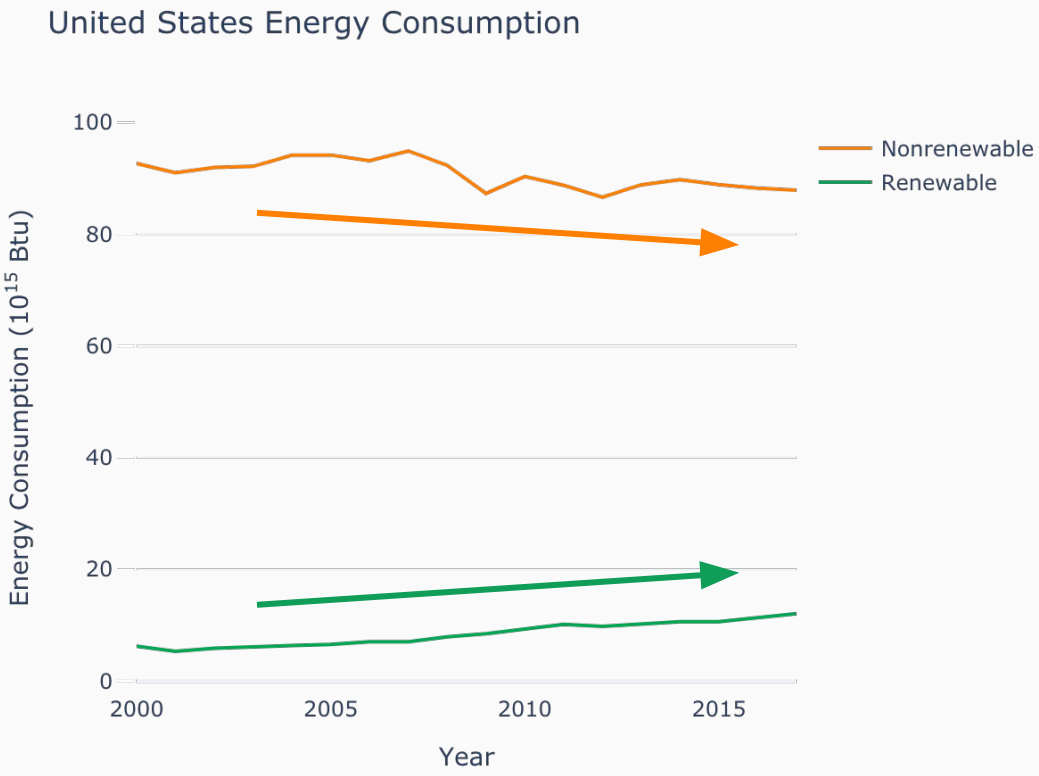
Other models RMSE orders of magnitude higher

Not incredibly useful information

US energy consumption revisited: distinct change in trend post-2000



First measure of sustainability: Effort Score

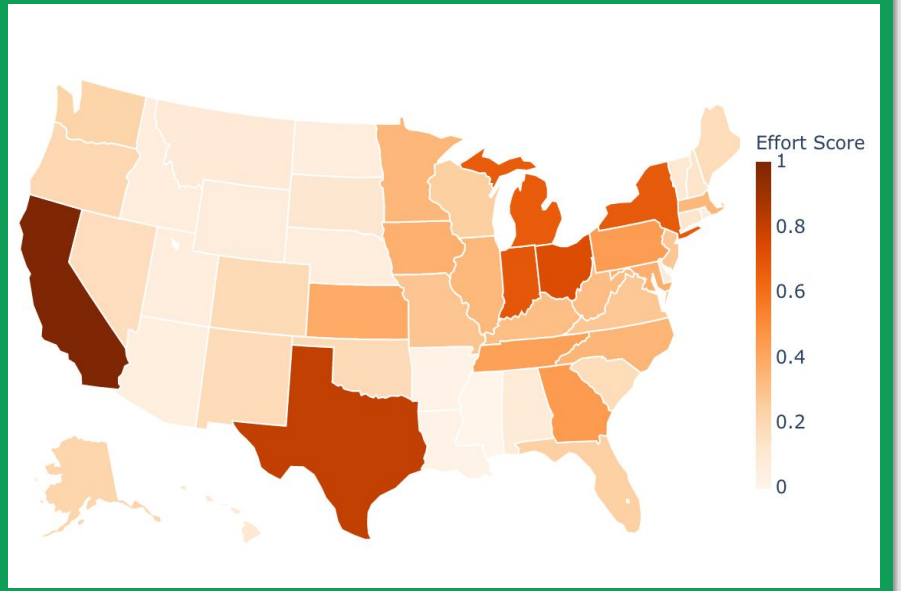


Effort Score

A measure of *change* in a state's nonrenewable energy consumption (NEC) relative to its renewable energy consumption (REC) from 2000-2017. Scores range from 0-1, with 1 being most sustainable.

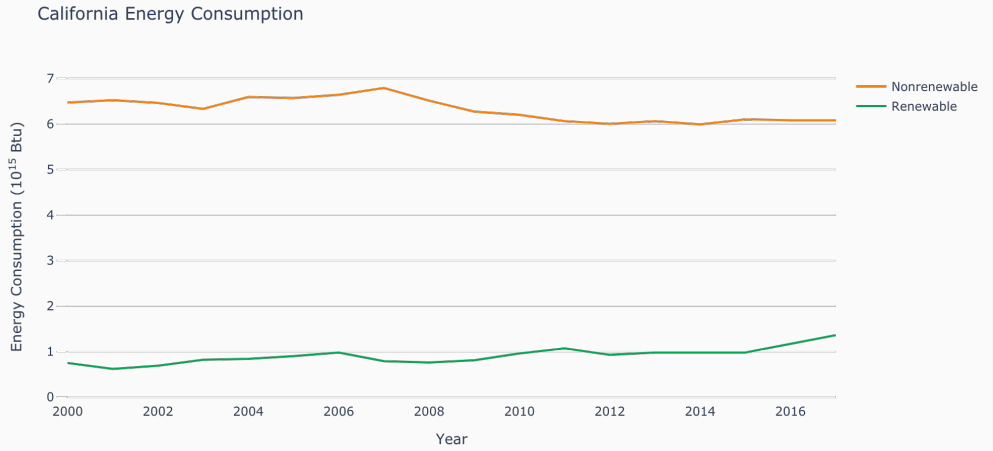
A state is considered to show more "effort" if the gap between the NEC and REC curves decreases over time.

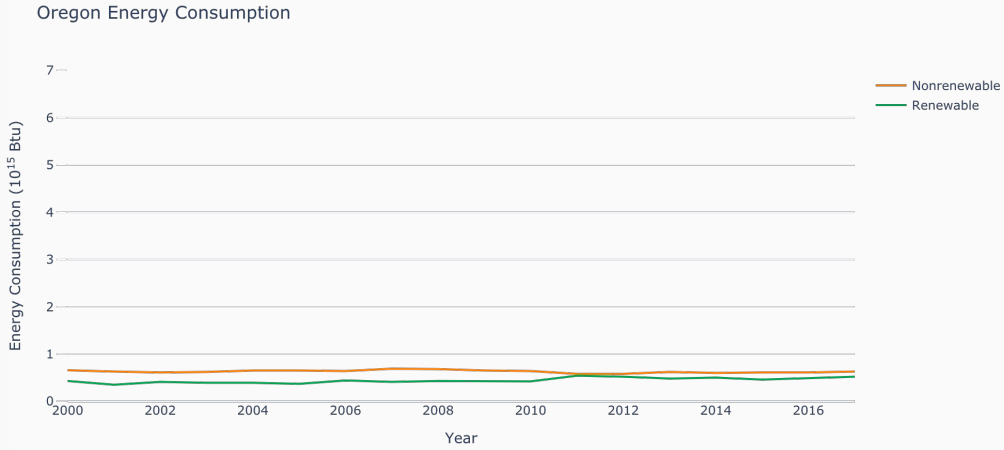
Effort Score



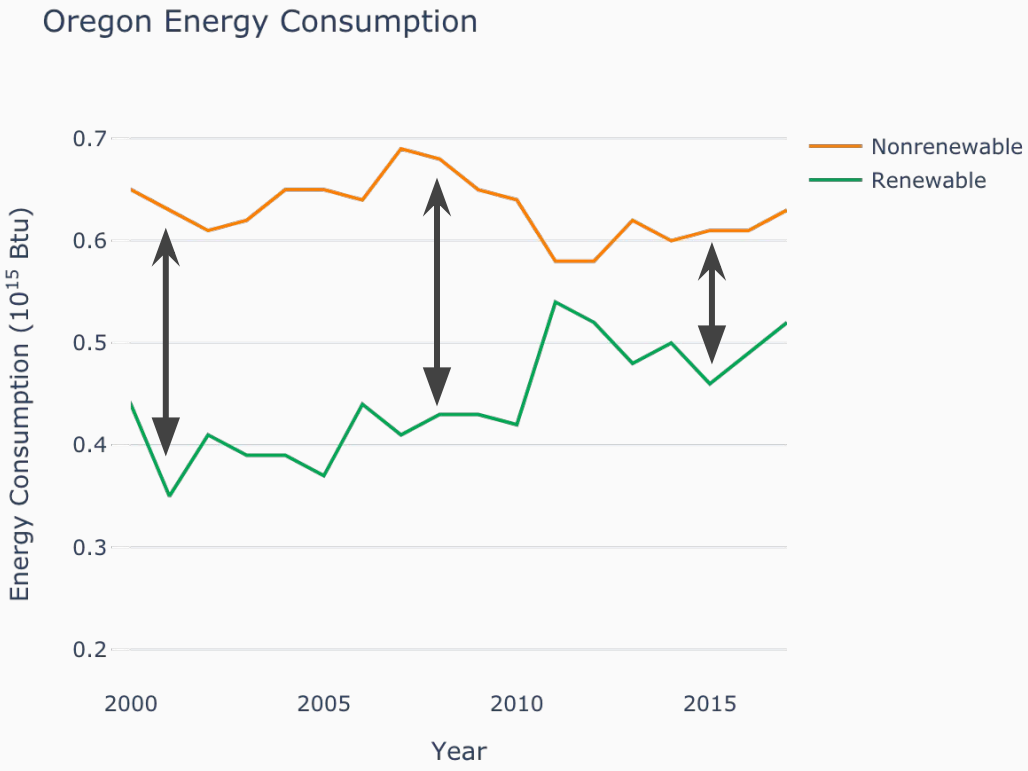
California: 1.000
Oregon: 0.205

Oregon has low ES, but is often considered one of the most sustainable states. This is evident in how close NEC and REC are. **Need another metric** to explain the full picture.





Second measure of sustainability: Green Score

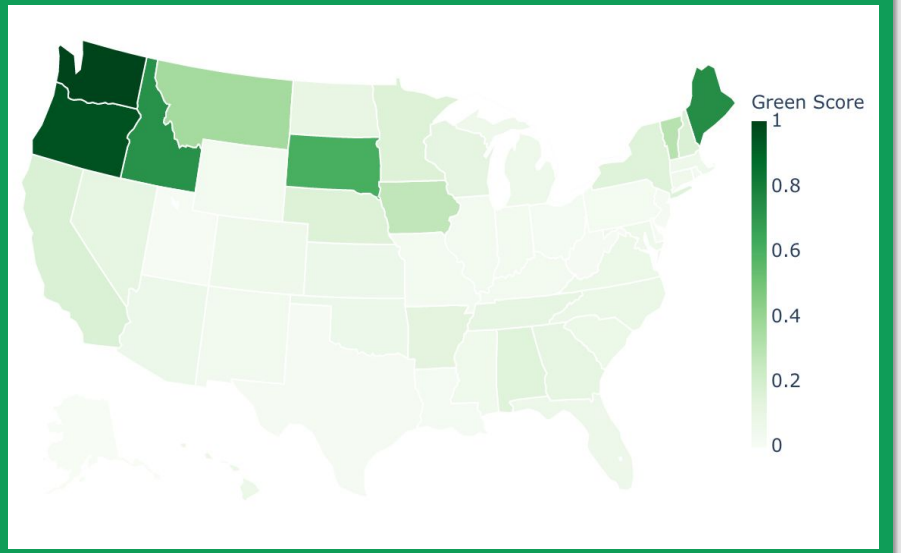


Green Score

A measure of how *close* a state's NEC and REC are from 2000-2017. Scores range from 0-1, with 1 being the most sustainable.

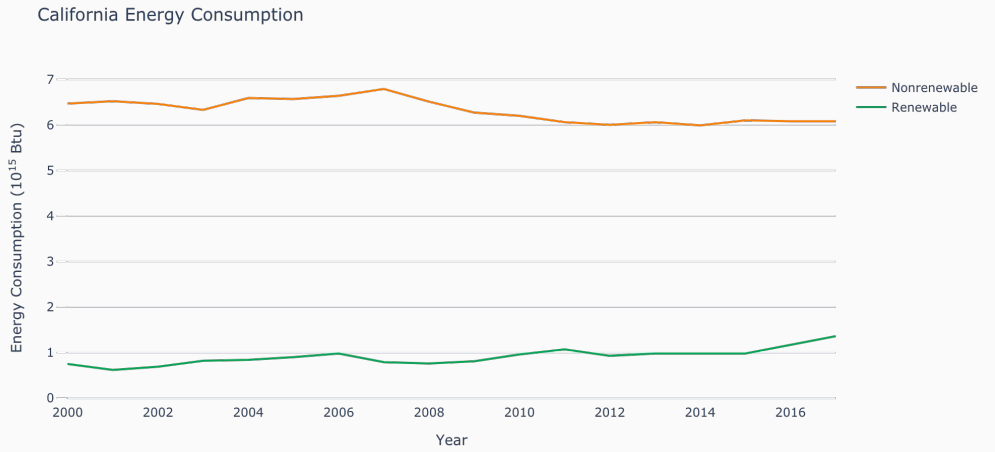
A state is considered “greener” as the ratio of REC/NEC approaches or exceeds 1.

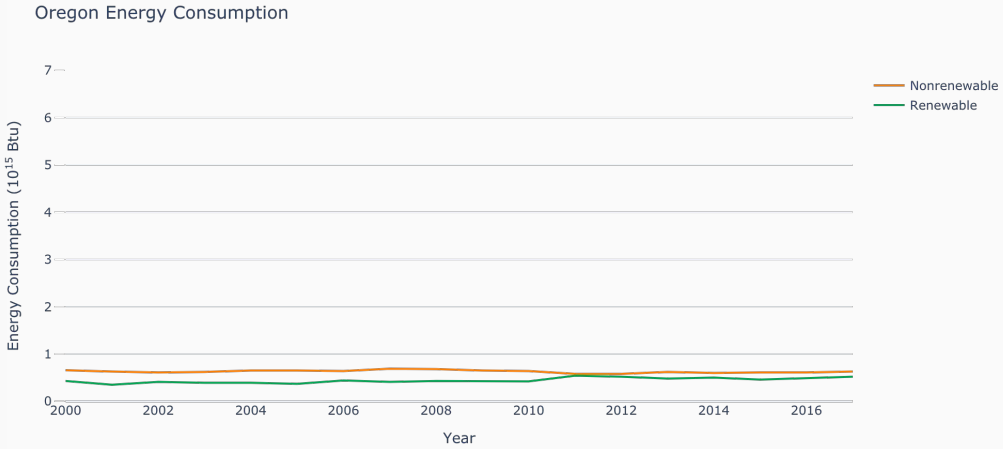
Green Scores



California: 0.166
Oregon: 0.956

Neither Effort Score nor Green Score can always tell the full story. Need one more sustainability metric . . .





Final measure of sustainability: Sustainability Index

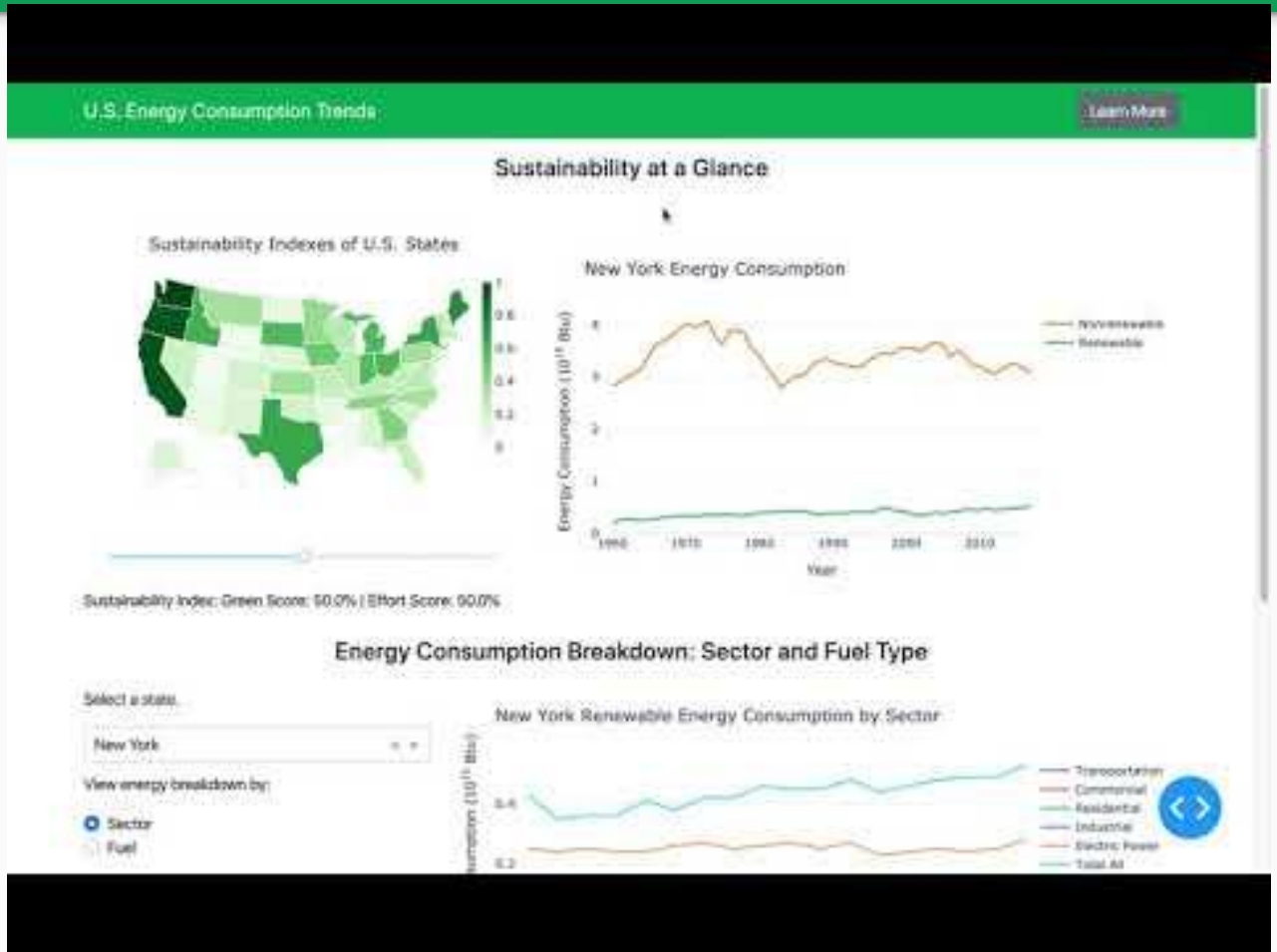
Sometimes we need to consider both Green Score and Effort Score.
Let us combine them into final metric.

Sustainability Index

A weighted average of the Green Score and Effort Score for a state. **You** decide the weights!

% Green Score	% Effort Score
0	100
10	90
20	80
...	...
90	10
100	0

Sustainability metrics in practice: U.S. Energy Consumption Trends Dashboard



Future directions

- Explore how of other variables such as population, GDP, etc. can influence SI.
- Rank and show states based on SI.
- Revisit modeling, predict SI in the future.