



The Future of Renewable Energy & Sustainable Infrastructure in Texas

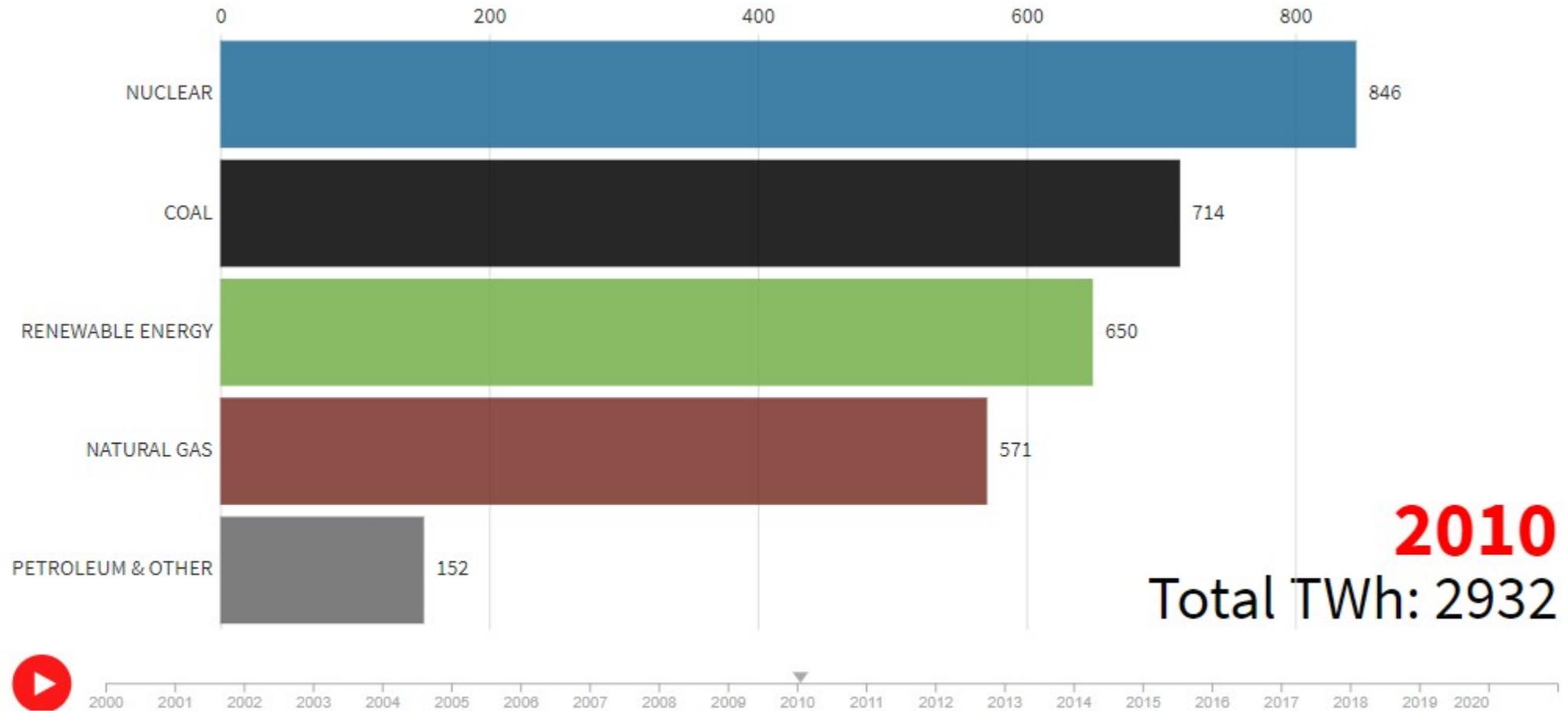


Carlos St. James
Advisor
Texas Sustainability, LLC
Board member, CleanTX

Agenda

- a) Comparative energy matrices over time
 - European Union
 - United States
 - Texas
- b) Texas' projected energy matrix to 2030
- c) The state of coal generation in Texas
- d) Hybrid renewable energy in Texas
- e) Lithium-ion Battery Energy Storage Systems (BESS)
- f) The effect of climate change on energy matrices
- g) Ensuring sustainable infrastructure practices in your county
- h) Where Texas stands on sustainable infrastructure versus the United States

European Union's Power Generation by Source in 2010

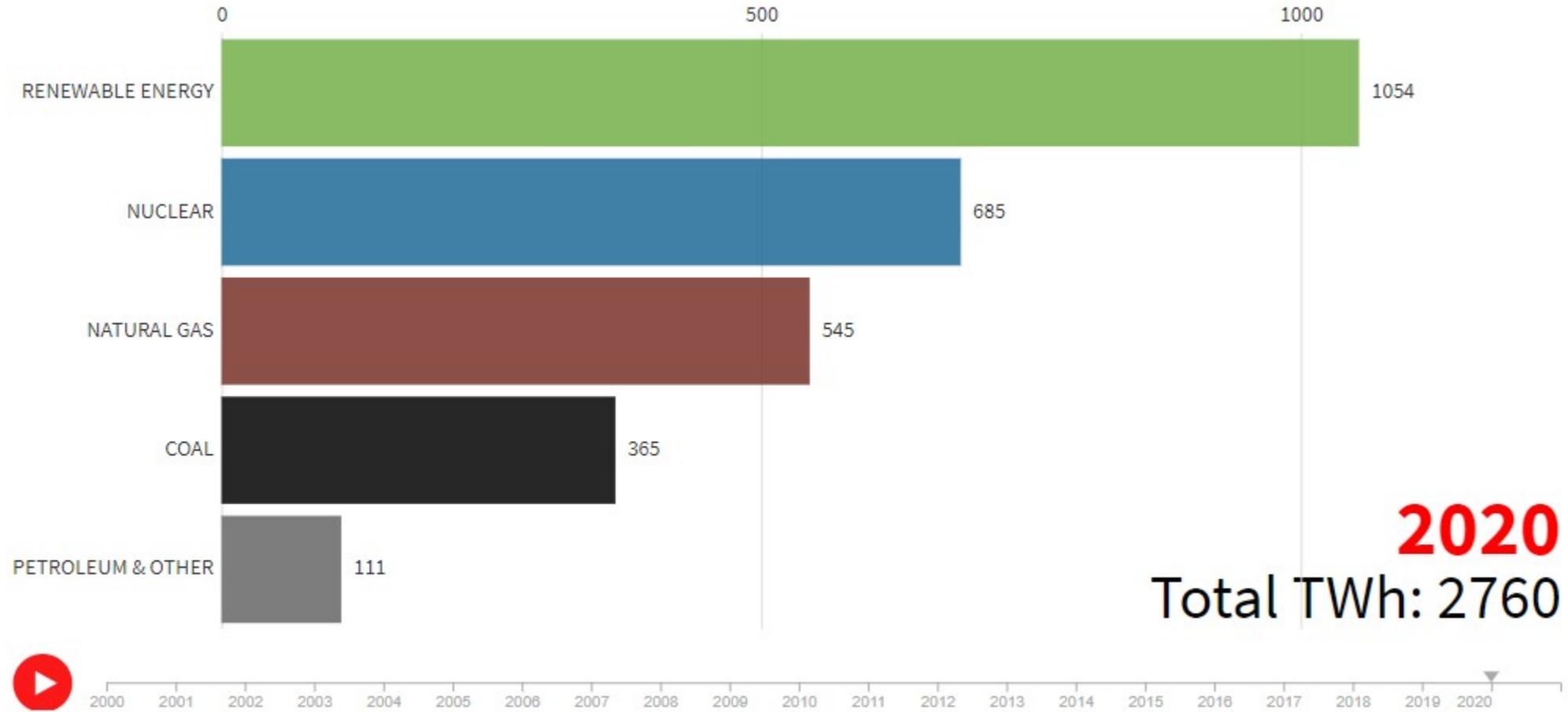


Source: [Texas Sustainability, LLC](#) • using Agora Energiewende/Ember data from European Power Sector in 2020 report



<https://public.flourish.studio/visualisation/5072436/>

European Union's Power Generation by Source in 2020

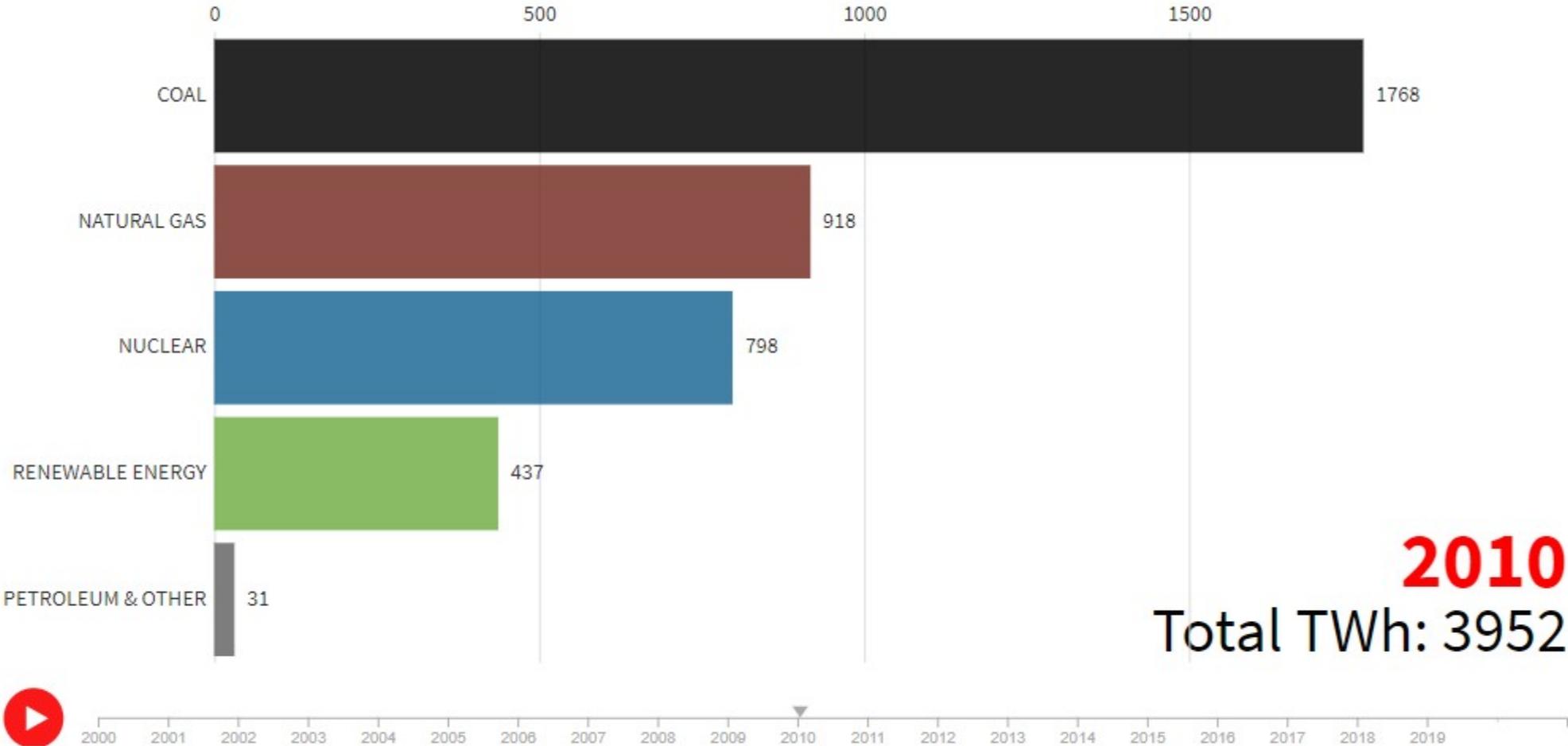


Source: [Texas Sustainability, LLC](#) - using Agora Energiewende/Ember data from European Power Sector in 2020 report



<https://public.flourish.studio/visualisation/5072436/>

United States Power Generation by Source in 2010

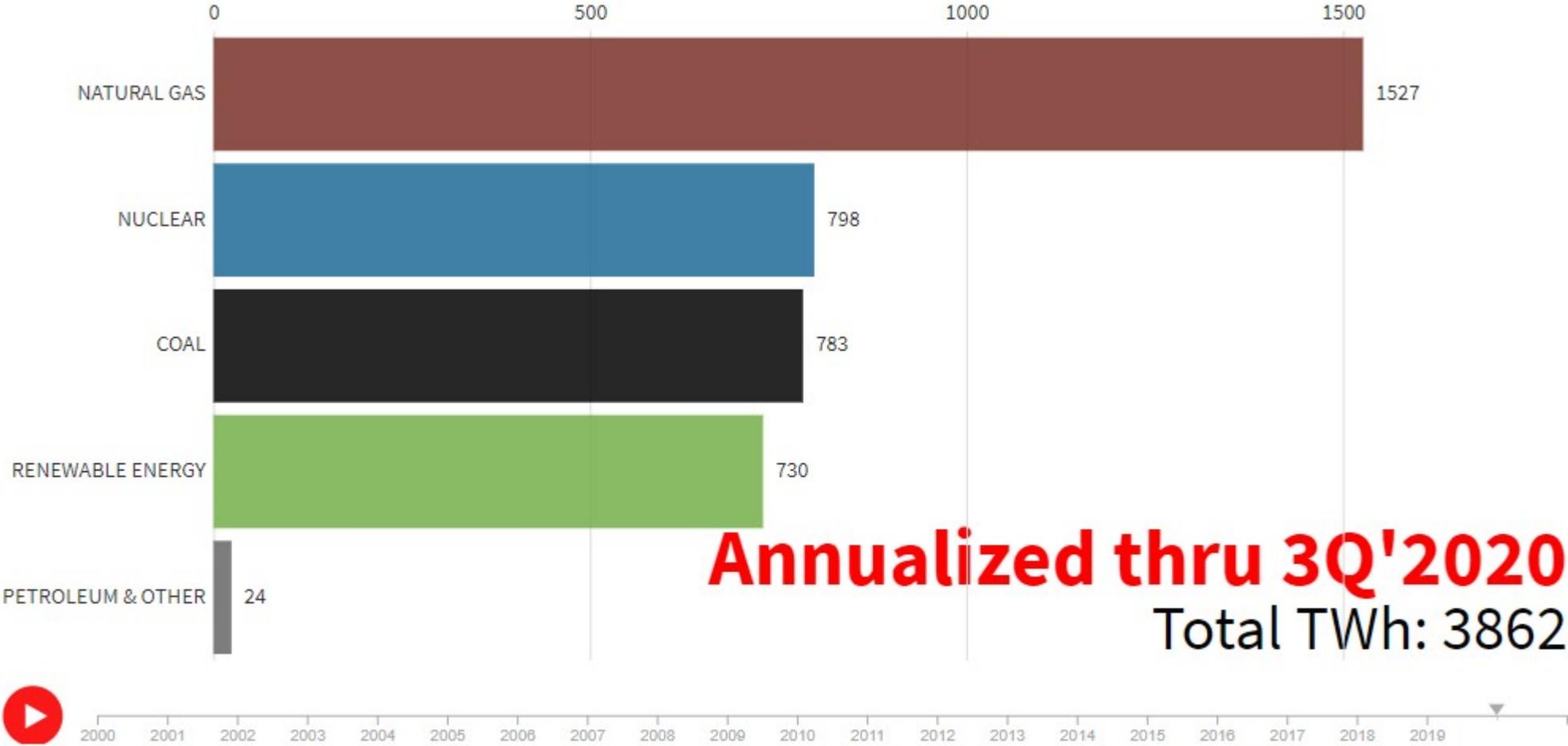


source: [Texas Sustainability, LLC](https://www.texasustainability.com/) - using U.S. Energy Information Administration (EIA) data



<https://public.flourish.studio/visualisation/5071965/>

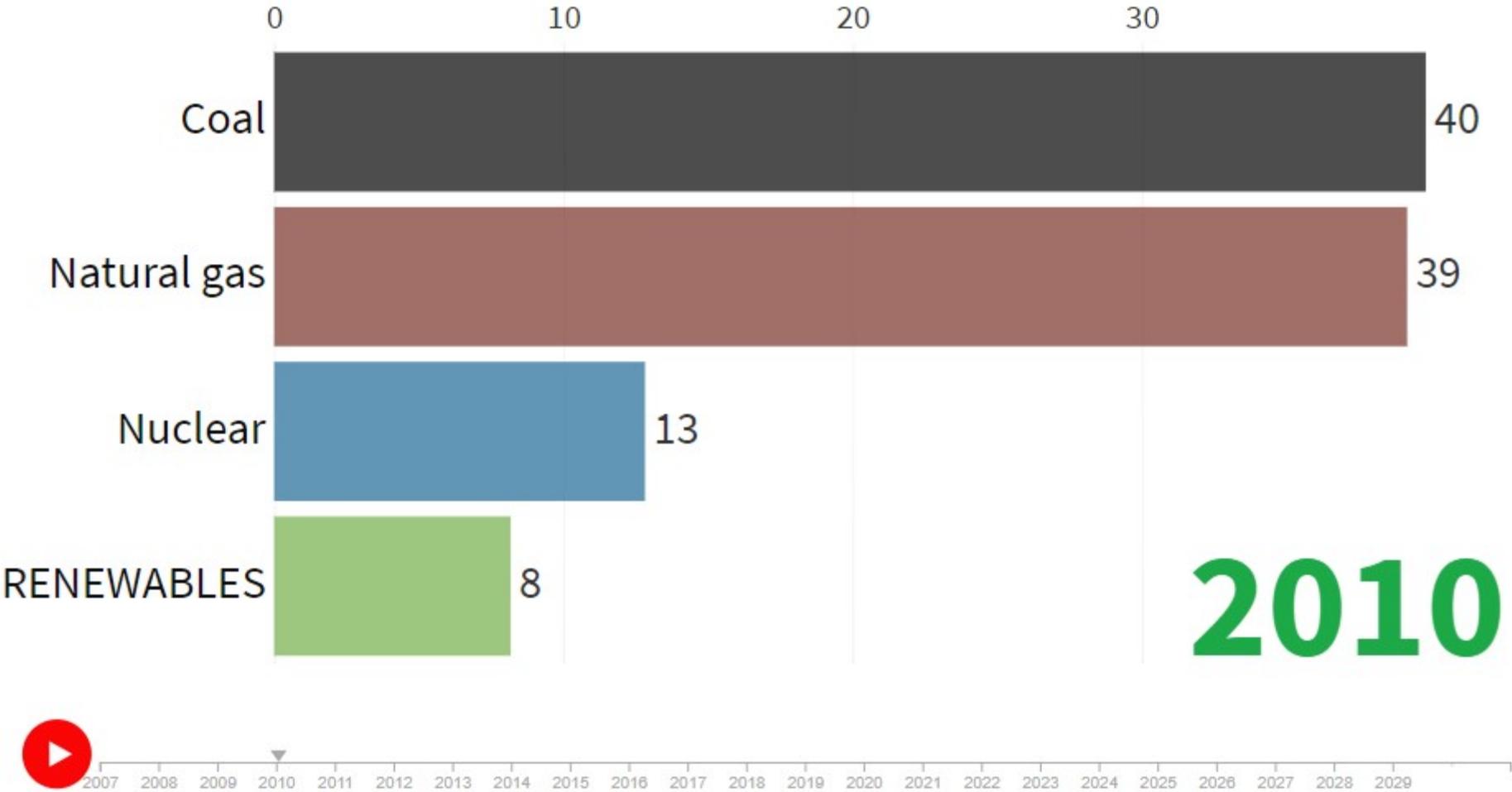
United States Power Generation by Source in 2020



Source: [Texas Sustainability, LLC](#) - using U.S. Energy Information Administration (EIA) data



Texas' Projected Power Generation by Source in 2010

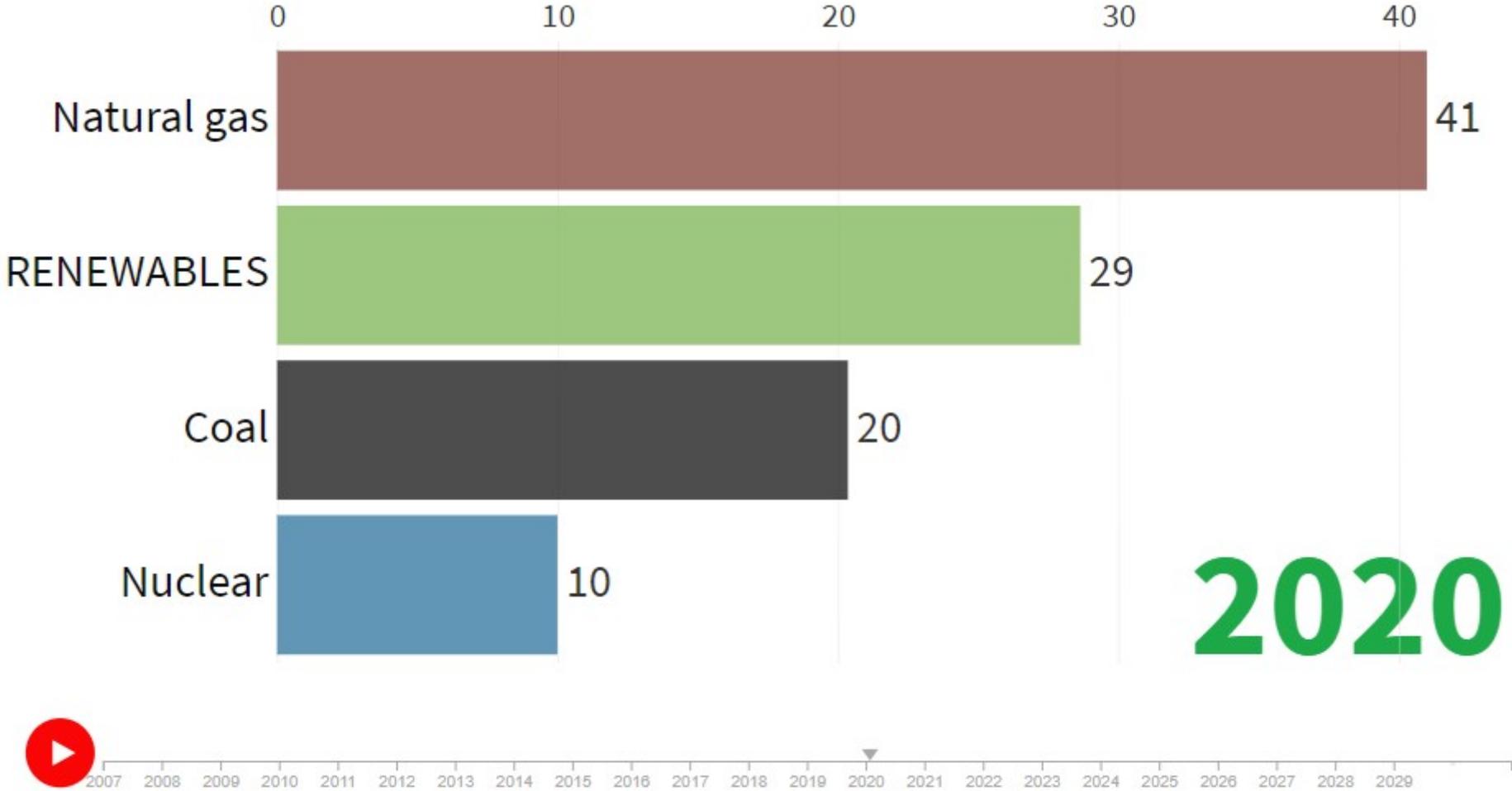


Source: [Texas Sustainability, LLC](#) • using ERCOT and CleanTX data



<https://public.flourish.studio/visualisation/2715592/>

Texas' Projected Power Generation by Source in 2020

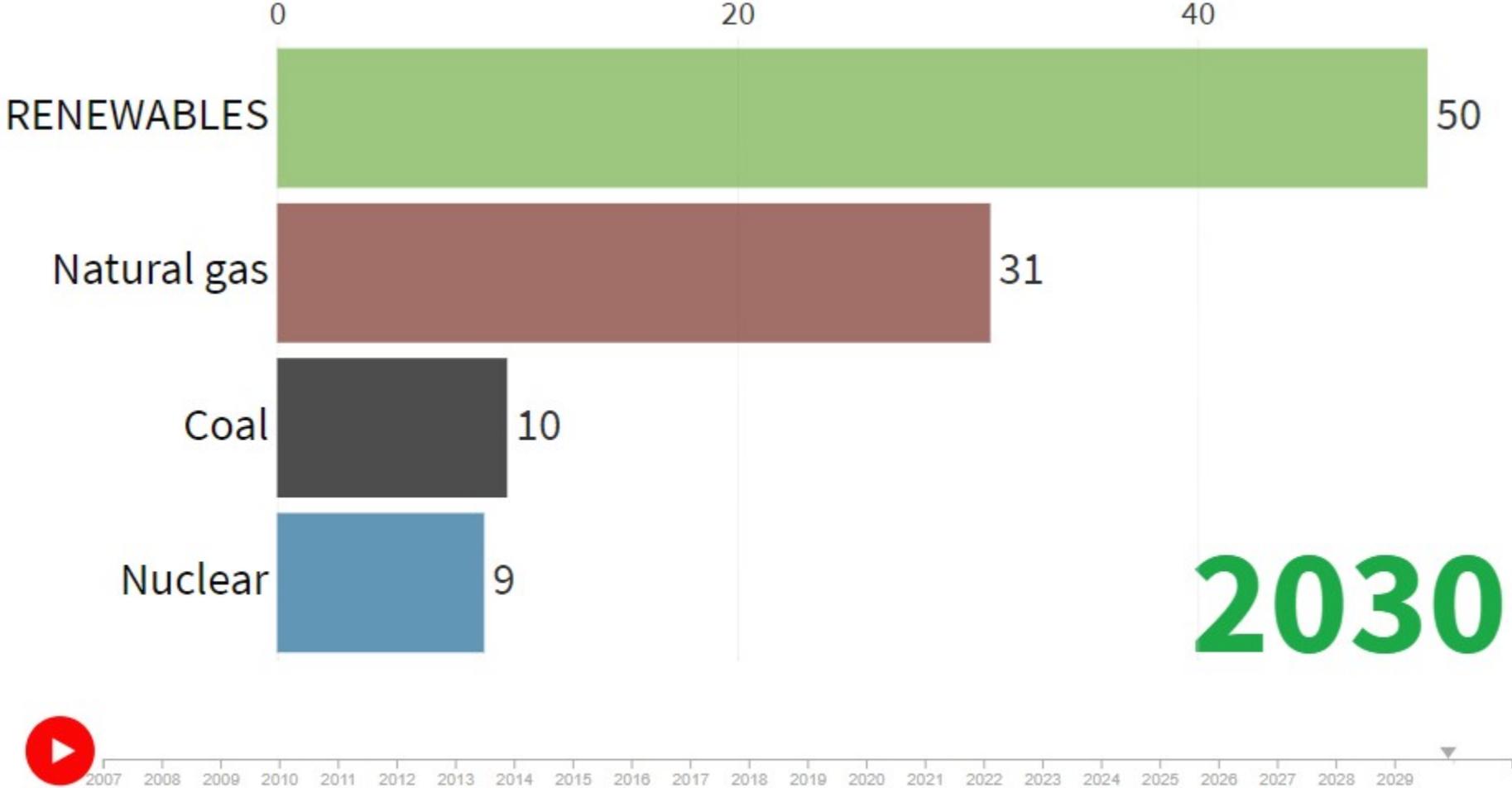


Source: [Texas Sustainability, LLC](#) • using ERCOT and CleanTX data



<https://public.flourish.studio/visualisation/2715592/>

Texas' Projected Power Generation by Source in 2030

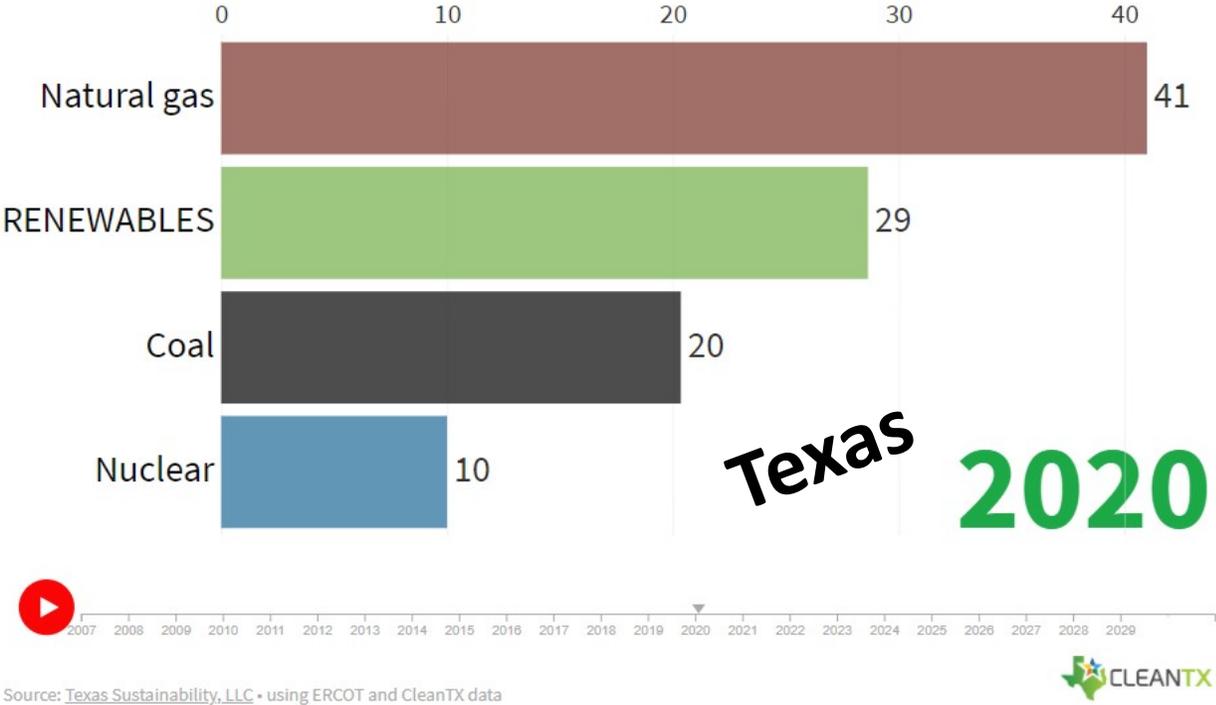
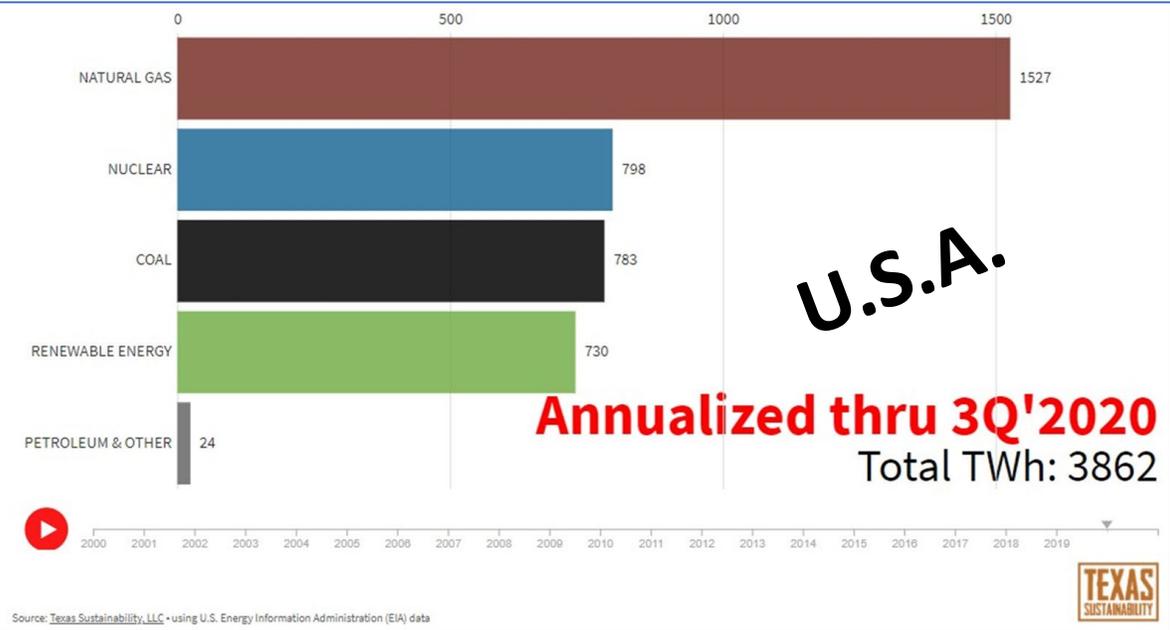
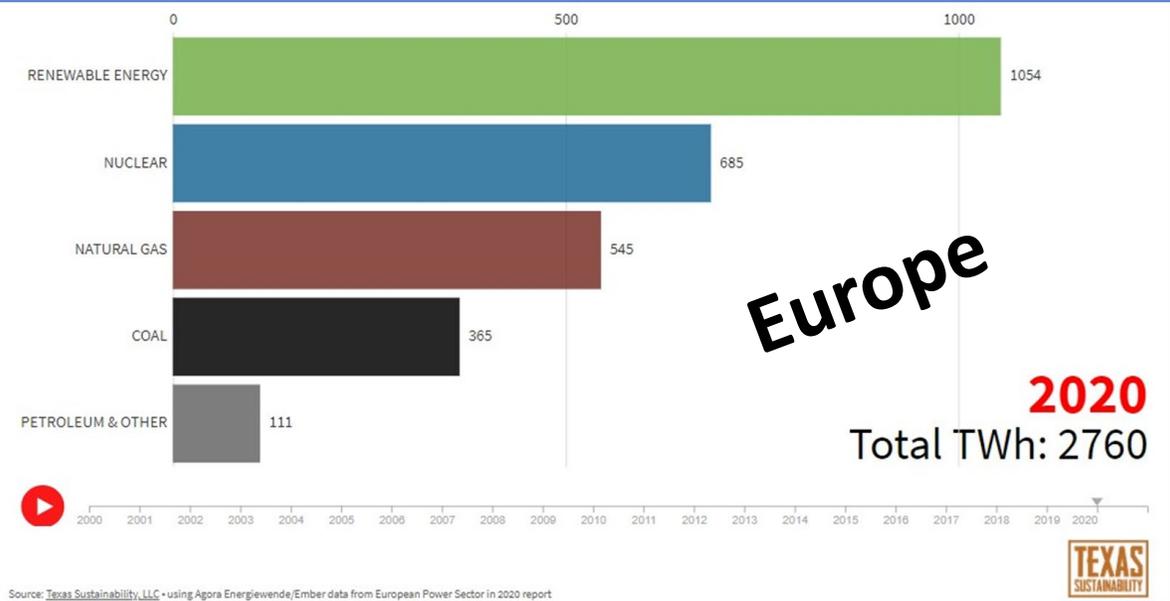


Source: [Texas Sustainability, LLC](#) • using ERCOT and CleanTX data

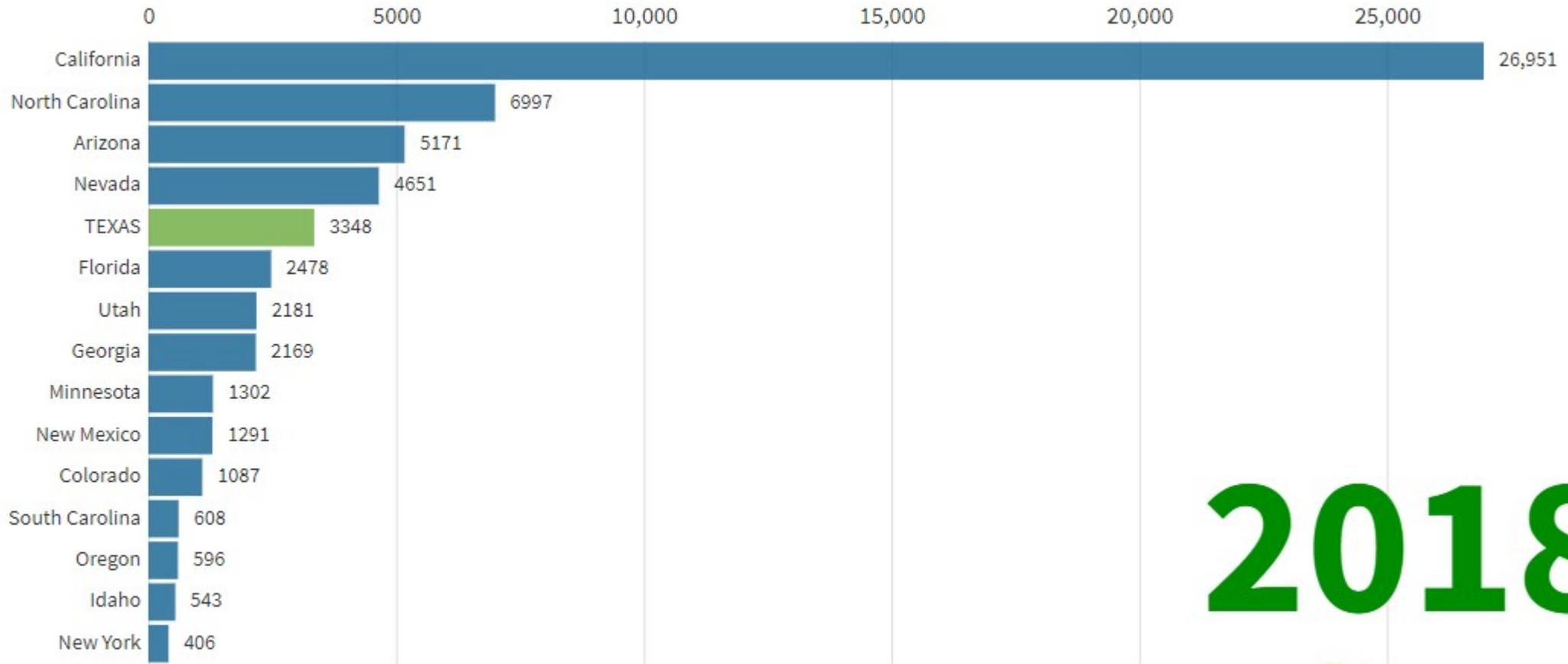


<https://public.flourish.studio/visualisation/2715592/>

European, U.S. & Texas Power Generation by Source in 2020



Solar Power Generation by State, 2018



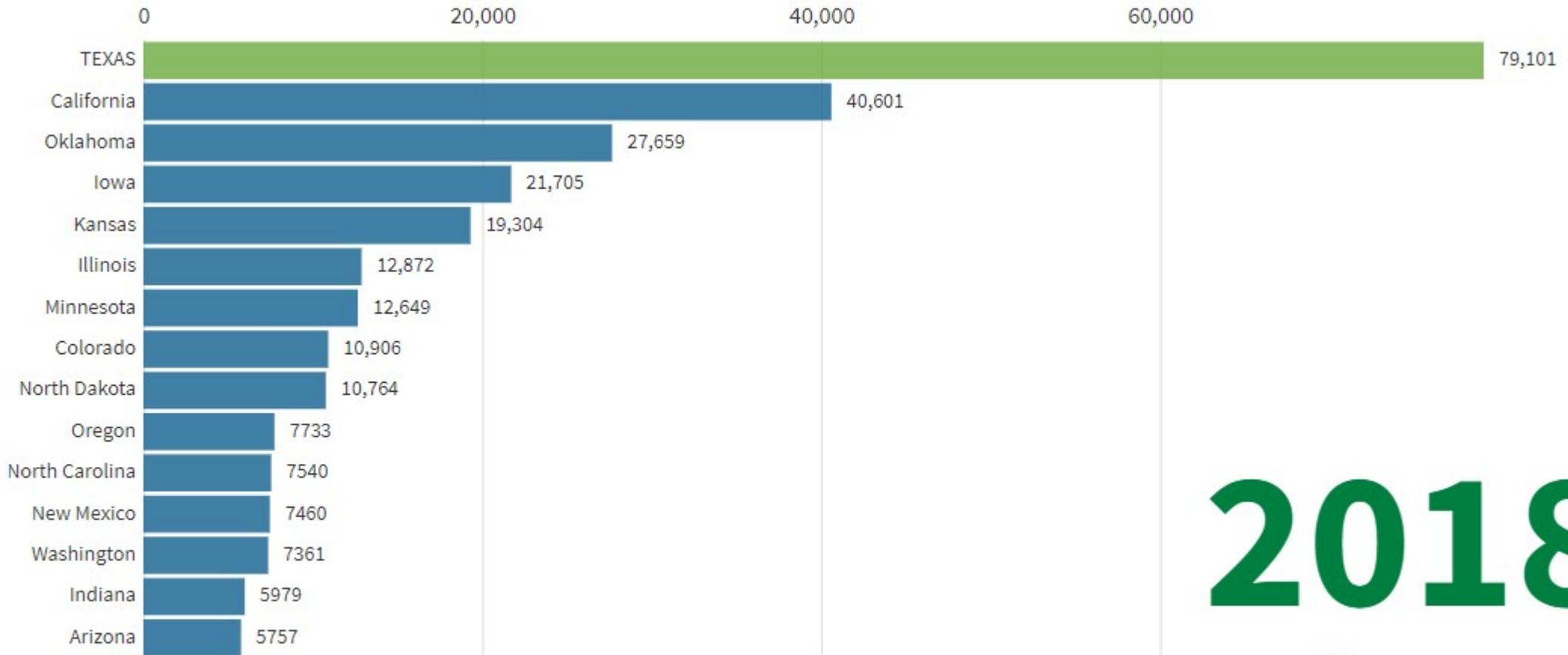
Source: Carlos St James, [TREIA](#) • using U.S. Energy Information Administration (EIA) data

2018



<https://public.flourish.studio/visualisation/905869/>

Combined Wind + Solar Power Generation by State, 2018



2018

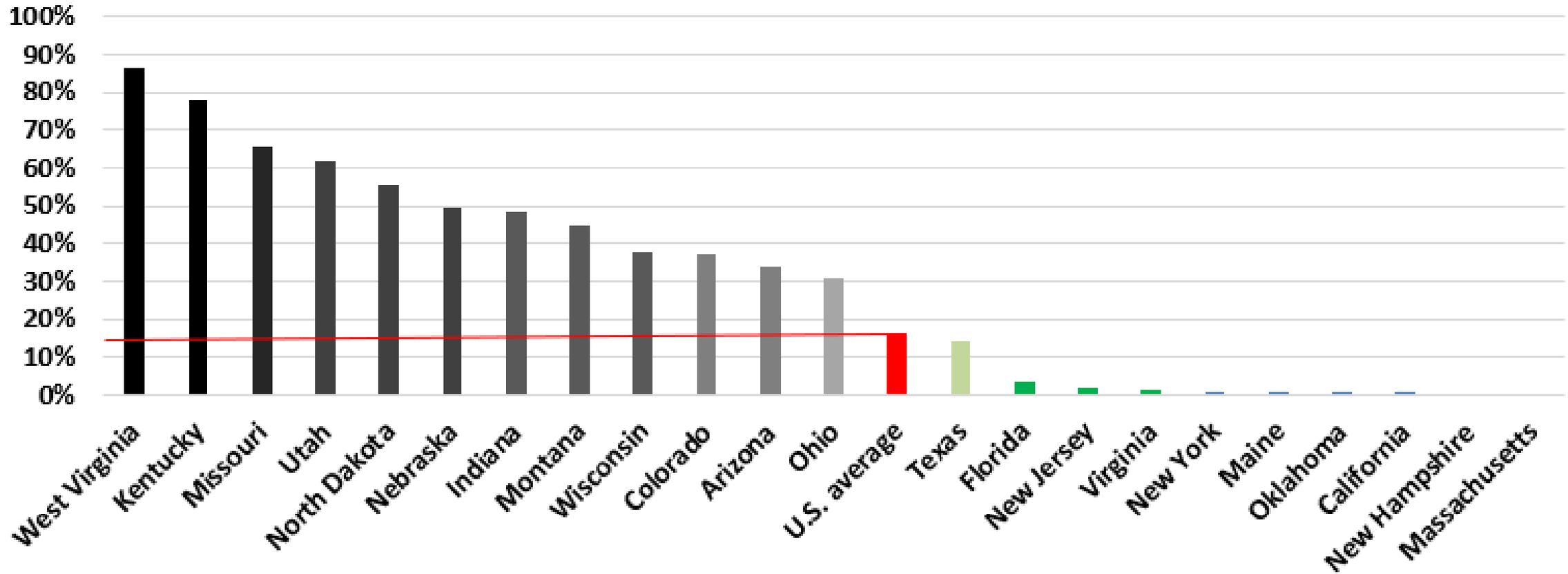


Carlos St James, [CleanTX](#) • using U.S. Energy Information Administration (EIA) data

<https://public.flourish.studio/visualisation/393637/>

Texas' Coal Power Generation About Same as Nation as a Whole

Percent of Power Generated with Coal, March 2020

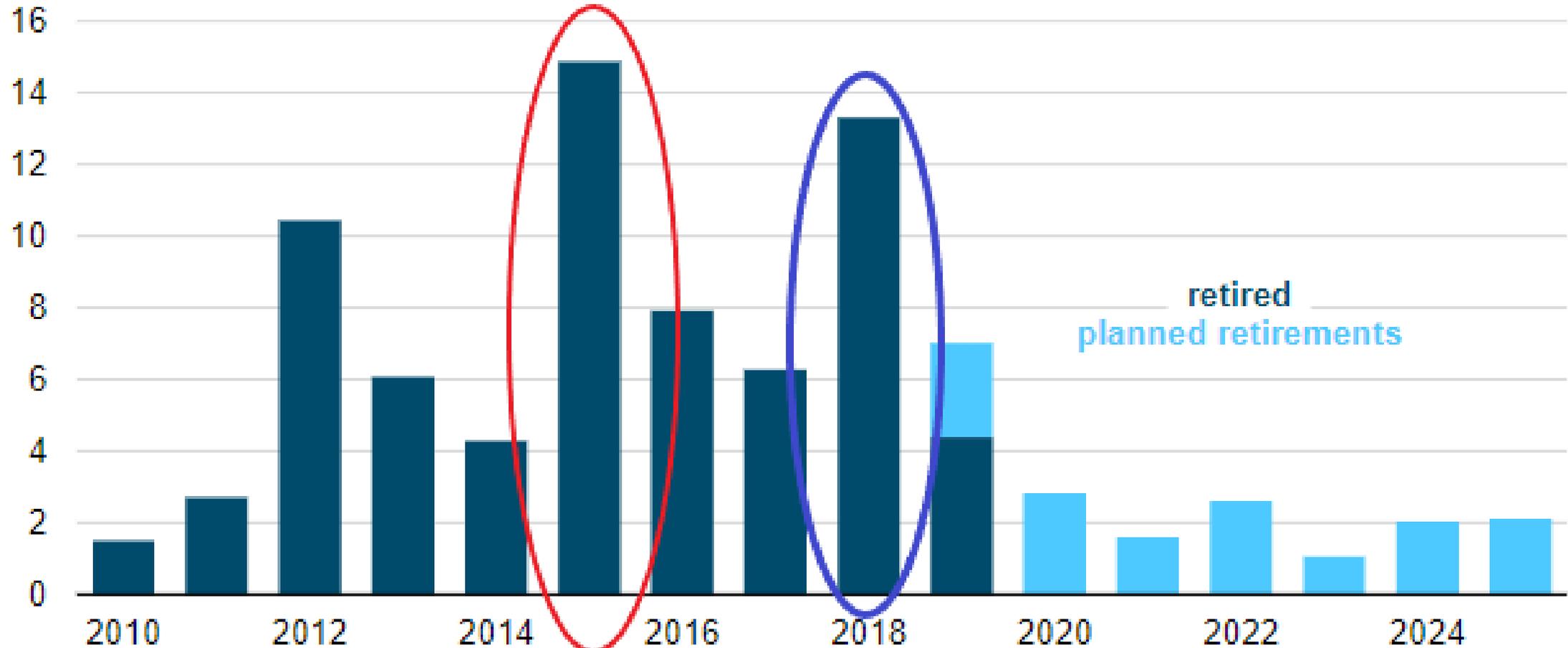


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U.S. Coal Generation Will Continue to Drop

Total net summer capacity of retired and retiring coal units (2010-2025)

gigawatts

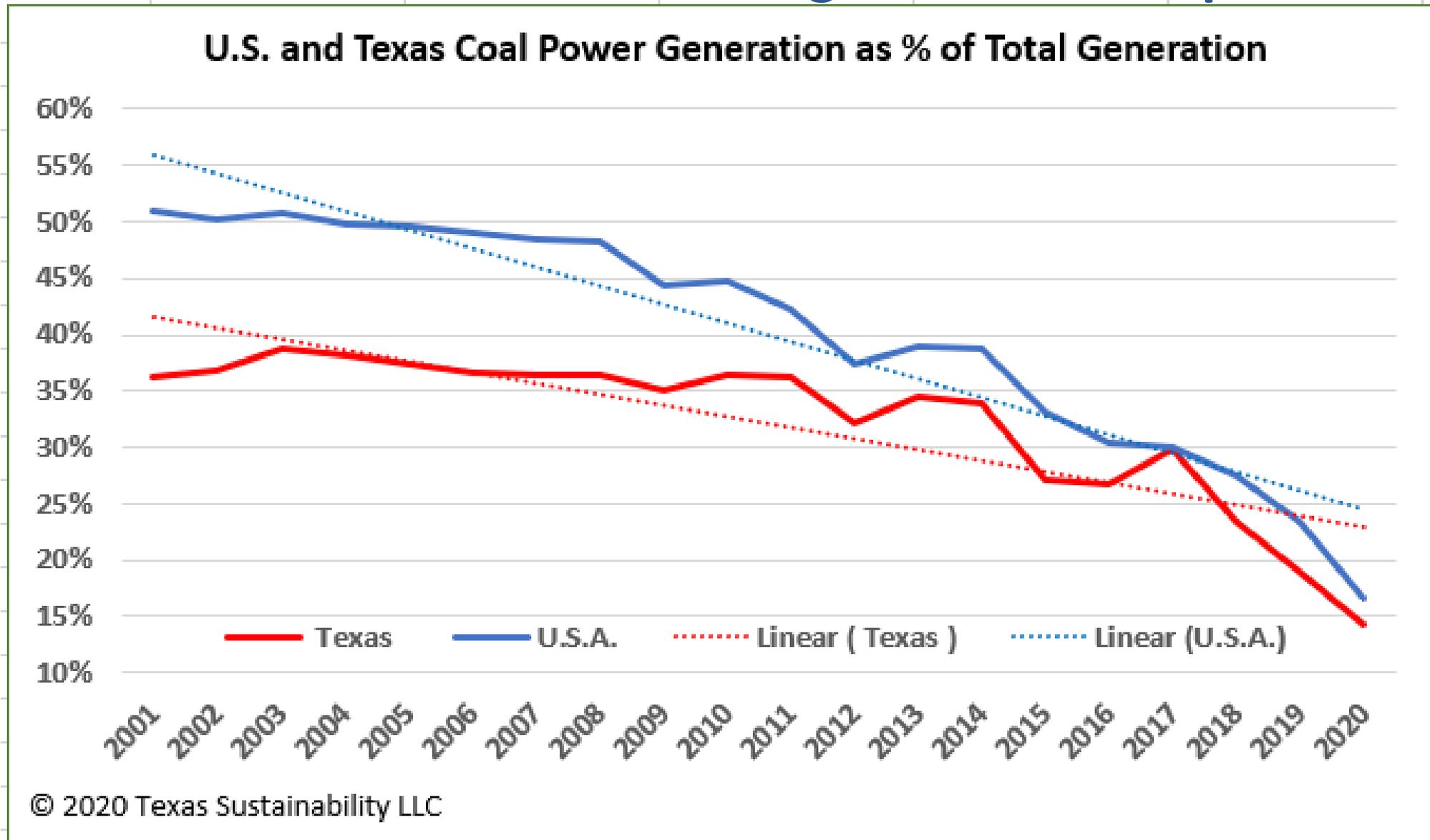


Coal and Storage Plants in Texas

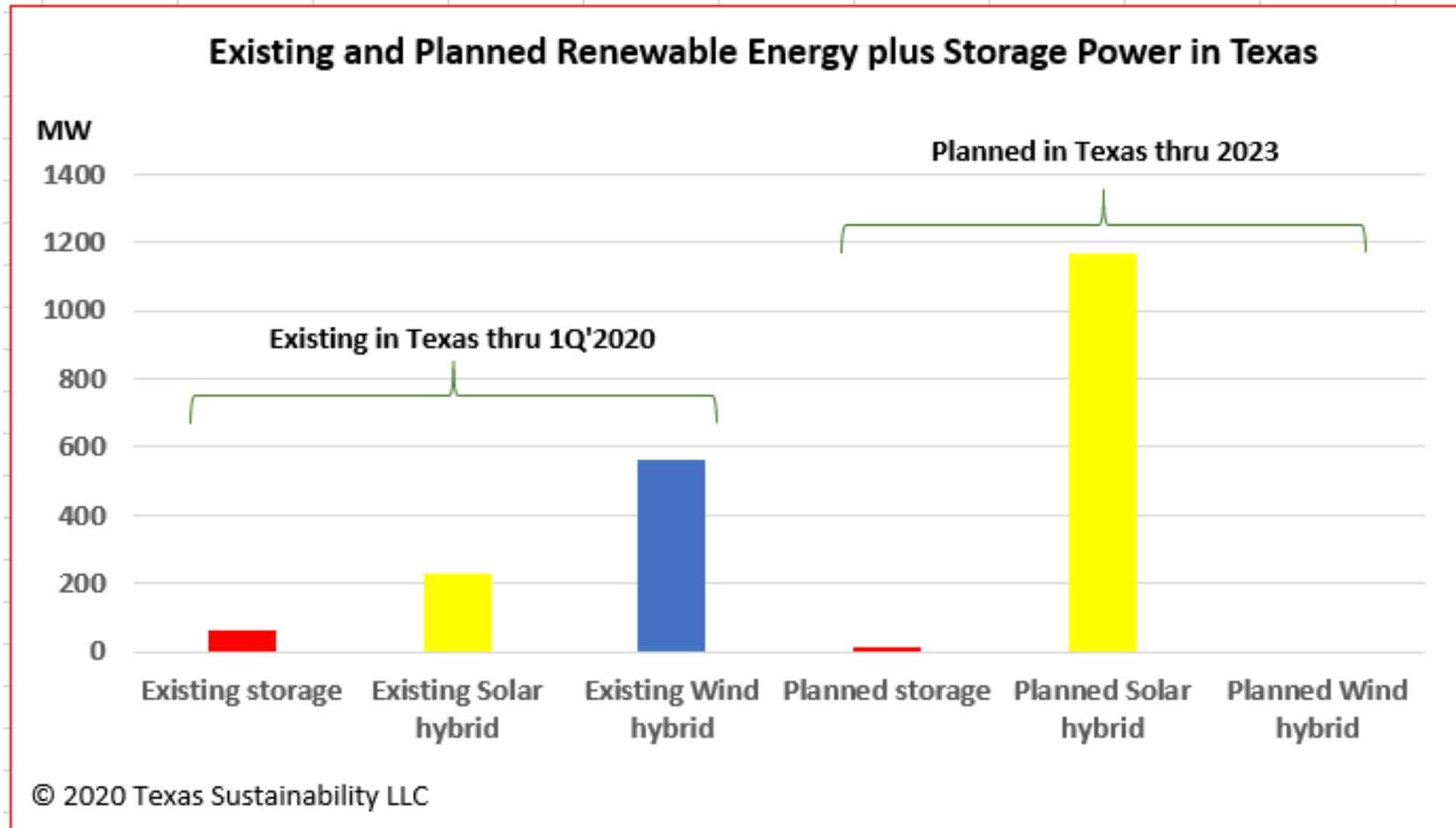
-  Battery storage
-  Coal plant



Texas Coal Generation Has Been Falling at a Rate Comparable to U.S...



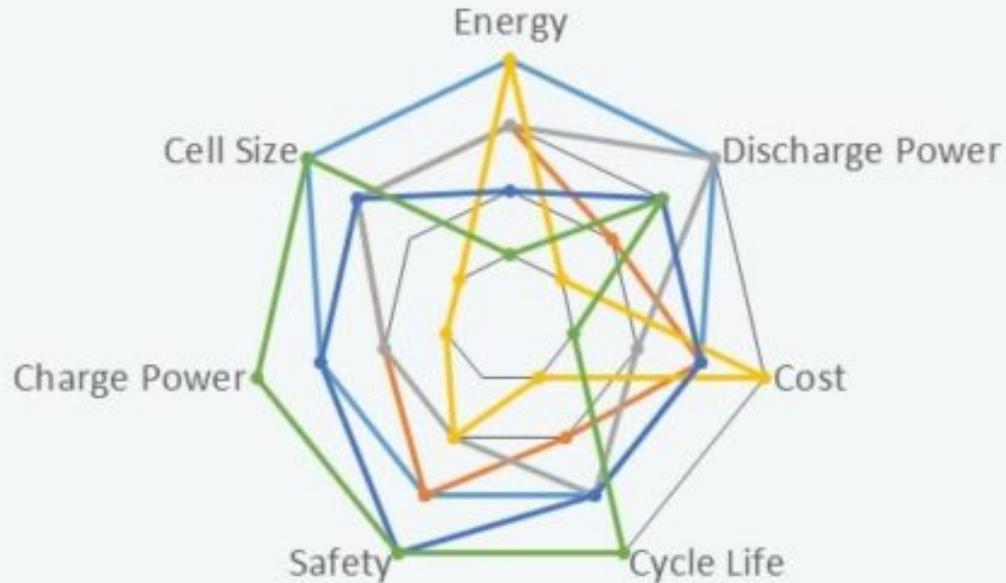
... As Solar Hybrid Begins a Long Run in Texas



Lithium-Ion Energy Storage Comes in Many Varieties

Lithium Ion Cell Chemistries

→ NMC
 → LMO
 → NCA
 → LCO
 → LFP
 → LTO



<i>Acronym</i>	Cathode (+ Electrode)	Anode (- Electrode)	Nominal Voltage (V)
<i>NMC</i>	Nickel Manganese Cobalt	Graphite	3.7
<i>LMO</i>	Manganese Spinel	Graphite	3.6
<i>NCA</i>	Nickel Cobalt Aluminium	Graphite	3.7
<i>LCO</i>	Lithium Cobalt Oxide	Graphite	3.6/3.7
<i>LFP</i>	Lithium Iron Phosphate	Graphite	3.2/3.3
<i>LTO</i>	NMC, LMO, NCA, or LFP	Lithium Titanate	2.3

Chemistry Performance Attributes

Energy - specific energy (mass) & energy density (volume)

Discharge Power - maximum continuous discharge rate

Cost - production volume cell cost. Farthest out along axis = lowest cost

Cycle life - Number cycles at the same DOD and temperature to end of life (EOL)

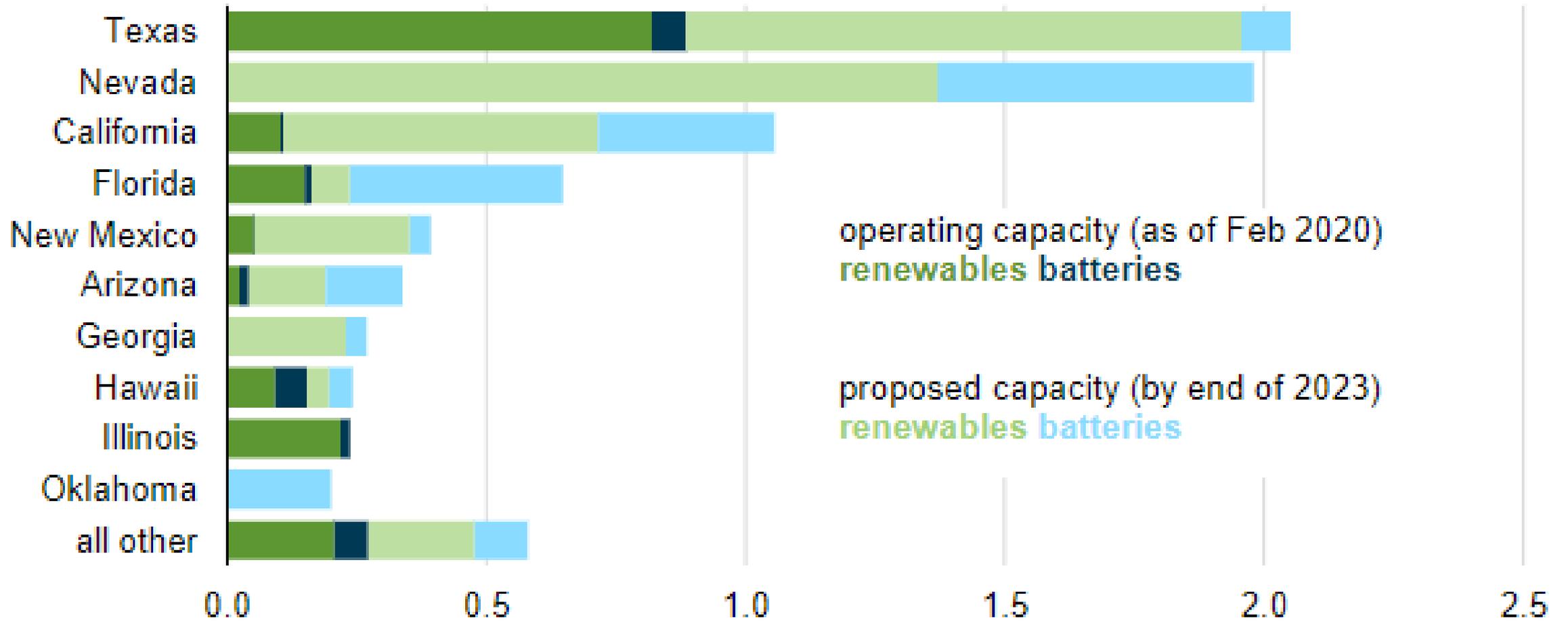
Safety - aggregate of the cell's ability to tolerate destructive overcharge, short circuit, heating, or mechanical abuse.

Charge Power - maximum continuous charge rate

Cell Size - maximum capacity cells commercially available in high quality serial production

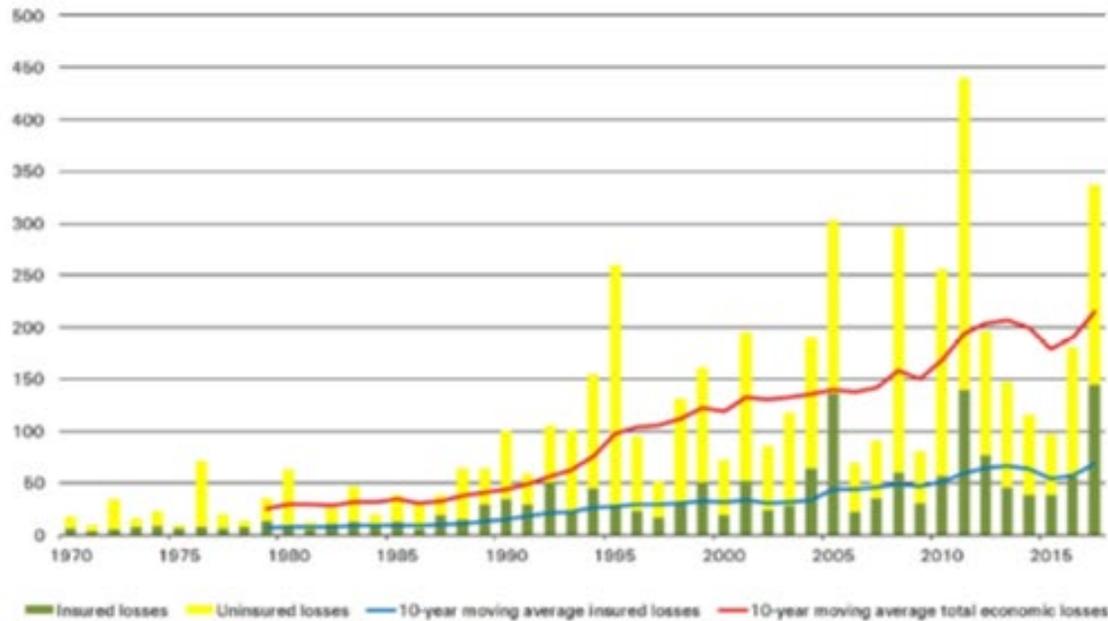
Texas Will Dominate in Hybrid Energy too

Operating and planned renewable plus storage capacity for top 10 states
gigawatts

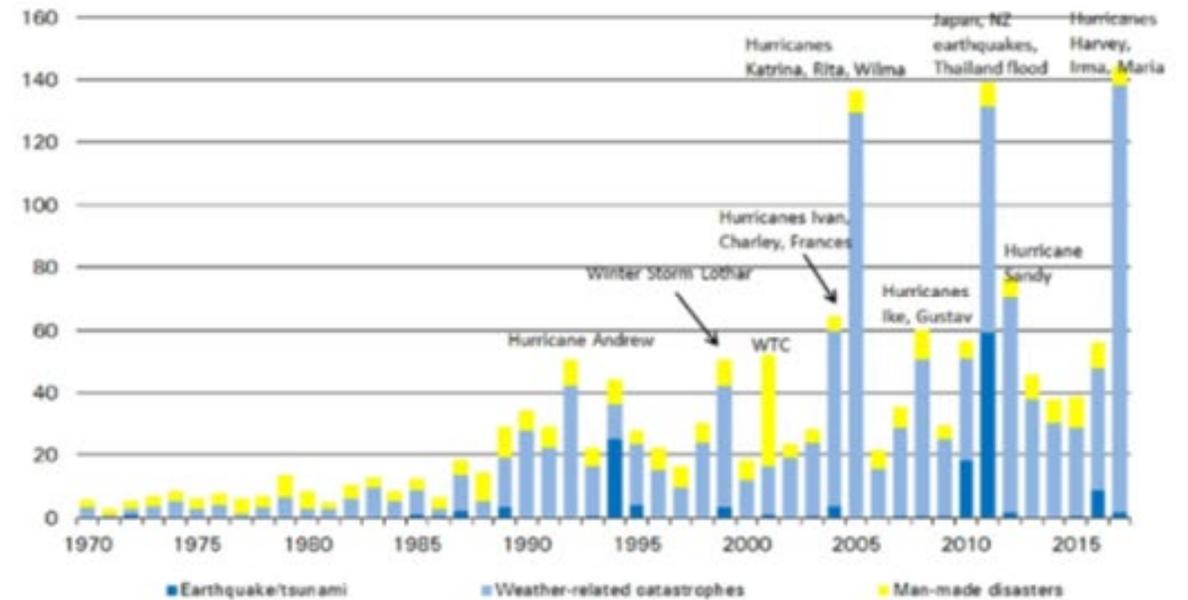


Earthquakes, Tsunamis and Other Weather-related Catastrophes: The Insurance Industry's Perspective

Insured vs uninsured losses, 1970 – 2017, in USD billion at 2017 prices



Insured catastrophe losses 1970 - 2017 in USD billion, at 2017 prices





“Sustainable development is...

...development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

-Brundtland Commission Report 1987

Founding organizations of the Washington, D.C.-based Institute for Sustainable Infrastructure (ISI)



ISI joined forces with Harvard University to create ENVISION



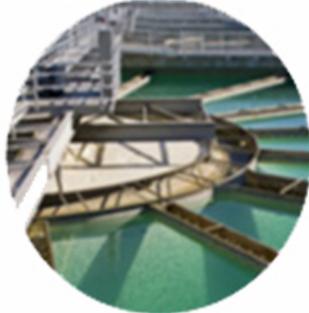
ENVISION provides a consistent, consensus-based framework for assessing sustainability and resilience in infrastructure.

Types of Infrastructure that ENVISION Rates



ENERGY

Geothermal
Hydroelectric
Nuclear
Coal
Natural Gas
Oil/Refinery
Wind
Solar
Biomass



WATER

Potable water distribution
Capture/storage
Water Reuse
Storm Water Management
Flood Control



WASTE

Solid waste
Recycling
Hazardous Waste
Collection & Transfer



TRANSPORT

Airports
Roads
Highways
Bikes
Pedestrians
Railways
Public Transit
Ports
Waterways



LANDSCAPE

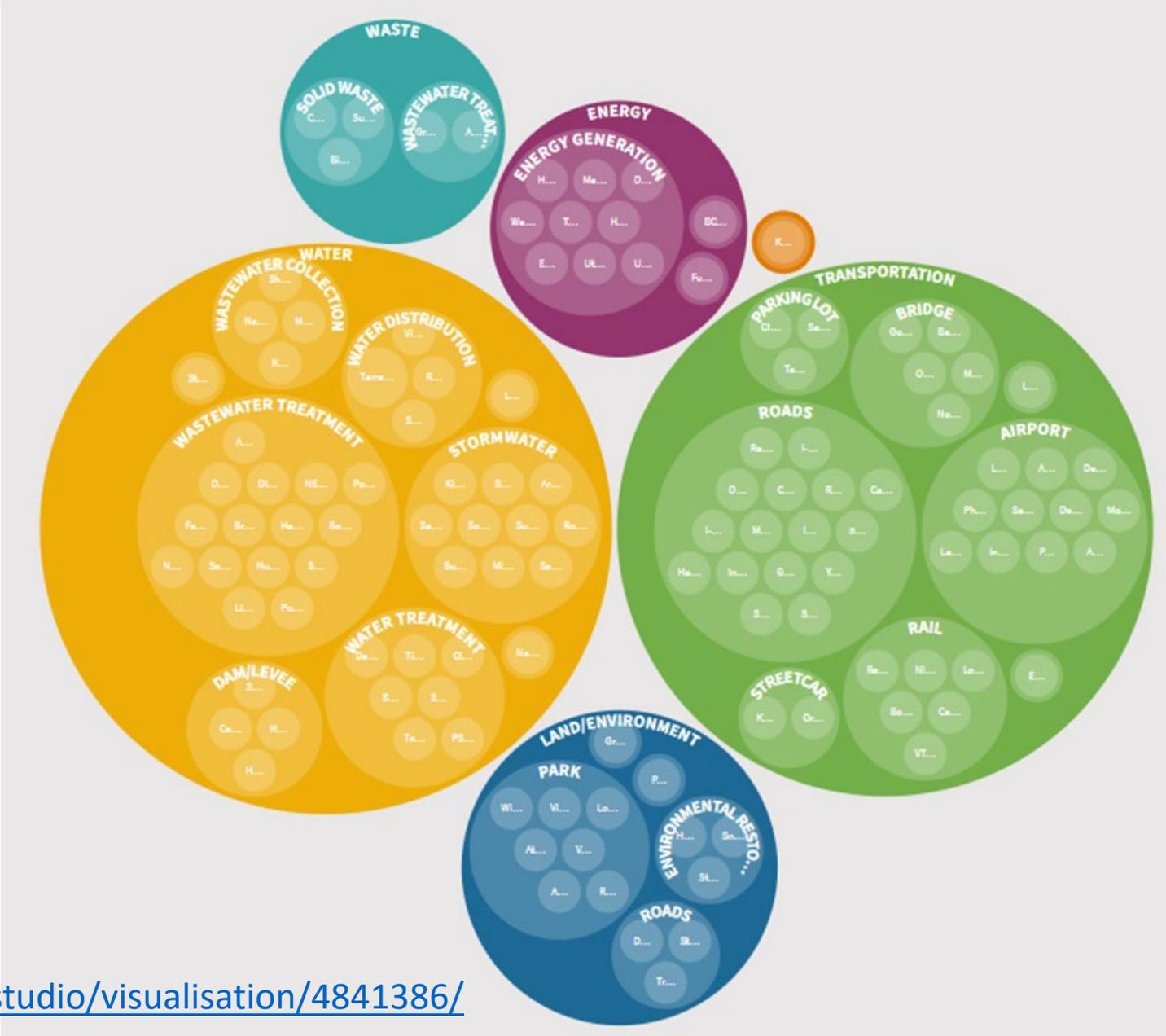
Public Realm
Parks
Ecosystem Services
Natural Infrastructure



INFORMATION

Telecommunications
Internet
Phones
Data Centers
Sensors

Water and Transportation Projects Are The Most Common



ENVISION Measures 64 Credits in Five Categories



Quality of Life

14 Credits

Well-being, Mobility, Community



Leadership

12 Credits

Collaboration, Planning, Economy



Resource Allocation

14 Credits

Materials, Energy, Water



Natural World

14 Credits

Siting, Conservation, Ecology

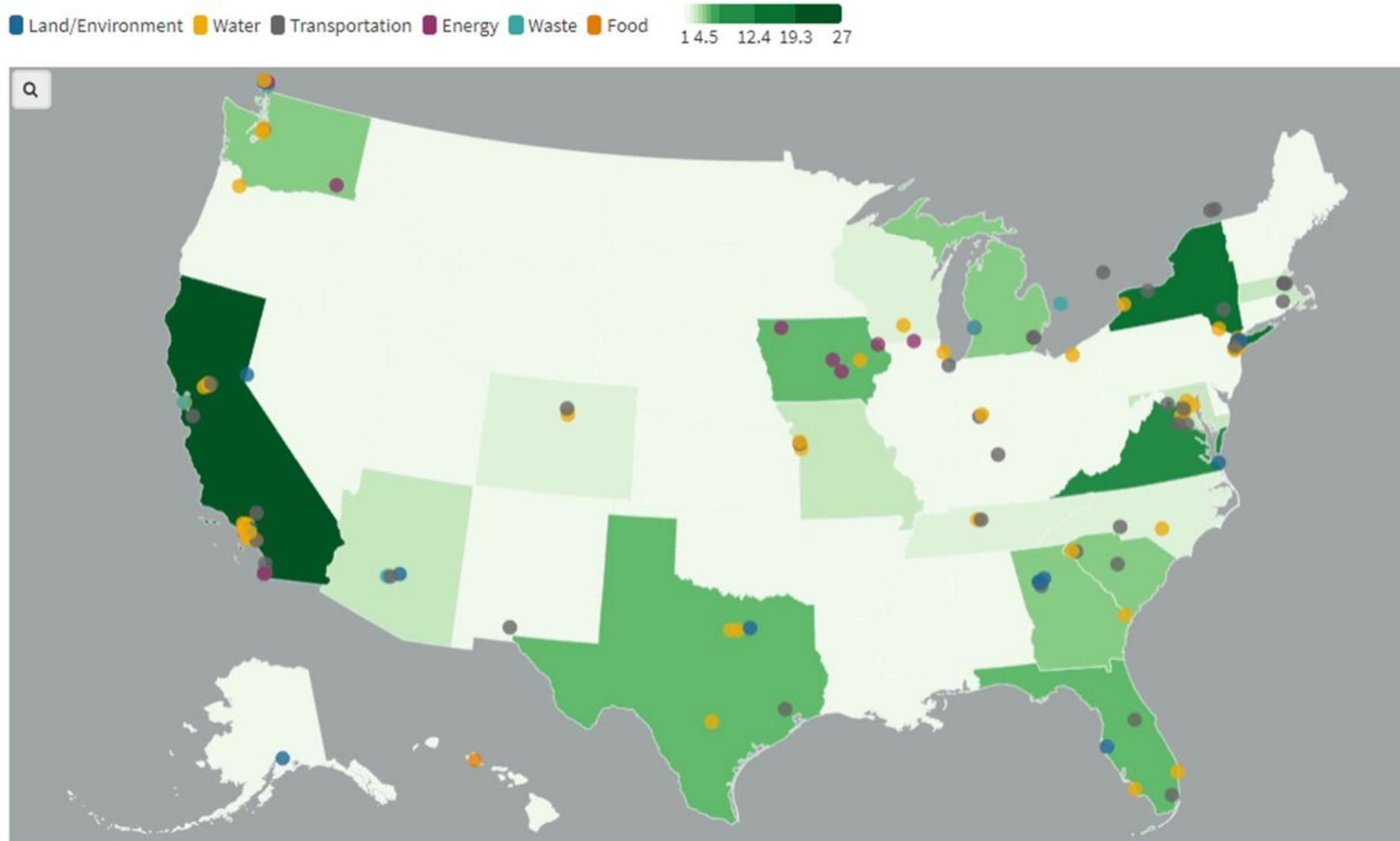


Climate & Resilience

10 Credits

Emissions, Resilience

... With CA, NY and VA The Most Successful To Date



Institute for Sustainable Infrastructure (ISI), Texas Sustainability, LLC • Data visualization prepared by Texas Sustainability, LLC using ISI data as of January 2021
Comments/corrections to info@TXsustainability.com please



<https://public.flourish.studio/visualisation/4732958/>

Envision Supported Agencies

Envision Supported Agencies are public sector organizations who use Envision and employ an ENV SP within their organizational workforce. Member agencies are able to track and manage their staff's involvement and progress Envision. There is no annual fee.

Add Your Agency

- Adams County
- Aéroports de Montréal
- AlexRenew Enterprises
- Argonne National Laboratory U.S. Department of Energy
- Barbados Water Authority - Human Resource Dept
- California Department of Transportation District 11
- California Department of Water Resources
- Caribbean Community Climate Change Centre
- Cedar Rapids Public Works
- Charlotte Water
- City of Atlanta - Department of Watershed Management
- City of Atlanta Department of Aviation - Planning and Development Bureau
- City of Austin Texas
- City of Bellevue
- City of Carlsbad California
- City of Coral Gables
- City of Dallas
- City of Eugene
- City of Fort Wayne City Utilities
- City of Miami Beach
- City of Newport News
- City of Palmdale
- City of Red Deer
- City of Roanoke, VA
- City of Santa Barbara
- City of Santa Monica
- City of St. Petersburg
- City of Tempe
- City of Treasure Island
- City of Westminster
- County of Orange, California
- Denver International Airport
- Fairfax County Government
- Hampton Roads Sanitation District
- Harris County Engineering Department
- Holland Board of Public Works
- Indianapolis Airport Authority
- King County Wastewater Treatment Division
- Los Angeles County Metropolitan Transportation Authority
- Los Angeles County Public Works
- Los Angeles Department of Water and Power
- Milwaukee Metropolitan Sewerage District
- Ministry of Regional Development and Infrastructure of Georgia
- Montgomery County
- MTA New York City Transit
- MWRA
- New York City Department of Design and Construction
- New York City Department of Environmental Protection
- New York City Department of Parks & Recreation
- Norwalk, CT Public Works
- Pinellas County Public Works
- Port Authority of New York & New Jersey
- Port of Long Beach
- Port of Seattle
- Salt Lake City Municipal Corporation
- San Antonio River Authority
- Santa Ana Watershed Project Authority
- Société de transport de Montréal
- Sound Transit

In Texas, a Handful of Cities, Agencies and Counties have Embraced ENVISION

ENVISION Verified and Registered Projects in Texas

Verified (certified)

Martinez IV Wastewater Treatment Plant

San Antonio River Authority
San Antonio, TX

Envision Silver 2019

Integrated Pipeline Project

Tarrant Regional Water District
Dallas, TX

Envision Platinum 2016

Line J Section 1 Pipeline

Tarrant Regional Water District
Dallas, TX

Envision Silver 2014

Registered

(in process of becoming certified)

Kowis Street Improvements

Houston, TX

South Lamar Street Improvements

Dallas, TX

Why Verify an Infrastructure Project?

- a) Helps to instill community confidence that the project addresses their needs and concerns
- b) Helps to instill rate-payer or tax-payer confidence that their money is being spent in their best interest
- c) Demonstrates that the sustainable achievements of the project are recognized and considered noteworthy by an independent internationally recognized system
- d) Motivates project teams to collaborate to achieve better outcomes
- e) Provides an objective measure of sustainable performance and draws attention to the good work being undertaken



GRIDNEXT conference: April 20-21, 2021

www.CleanTX.org

Thank you

The Future of Renewable Energy & Sustainable Infrastructure in Texas



Bryan, TX 2-FEB-2021



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