

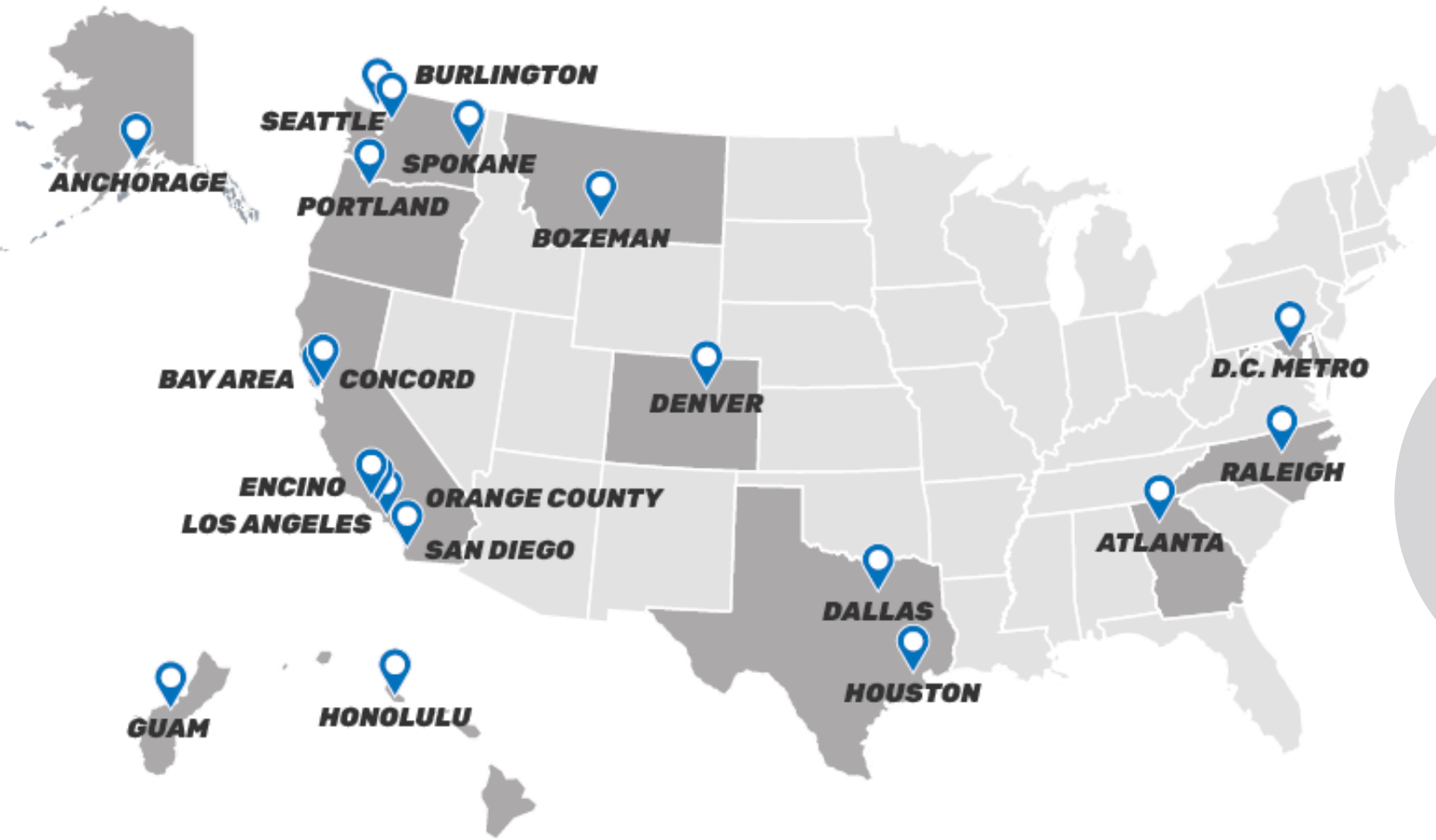


# NWCCC Managing Carbon

27 April 2022



# Coffman Stats



Coffman Staff  
Companywide  
**600+**

Total Offices  
**20**

Years in  
Business  
**43**



# Industries

- Civic & Government
- Commercial & Retail
- Education
- Energy & Utility
- Healthcare
- Hospitality & Housing
- Industrial
- Military
- Oil, Gas, Refinery, & Petrochemical
- Renewable Energy & Battery Storage
- **Carbon Capture Utilization & Storage**
- **Hydrogen**

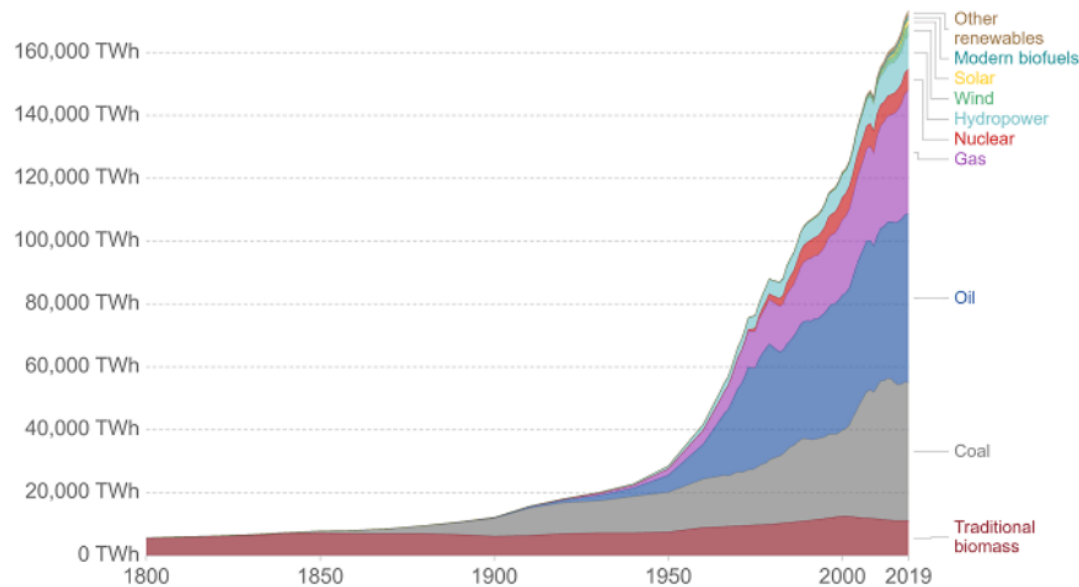


# World energy demand will continue to grow

## *How do we increase energy access while decreasing GHG emissions?*

### Global primary energy consumption by source

Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.



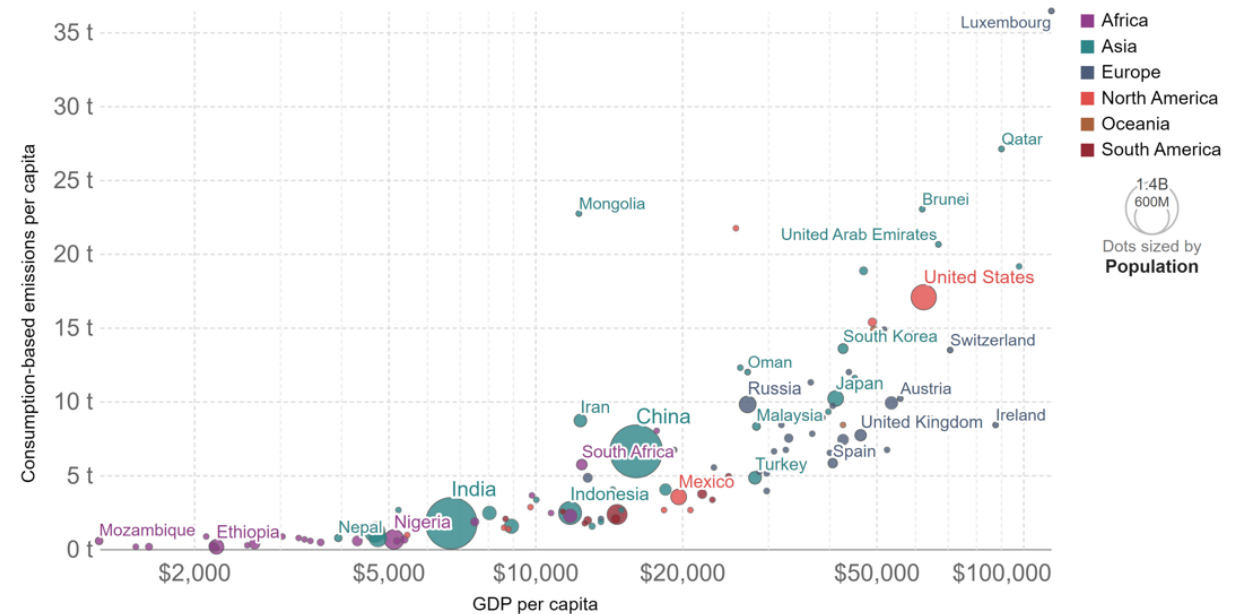
Source: Vaclav Smil (2017) & BP Statistical Review of World Energy

OurWorldInData.org/energy • CC BY

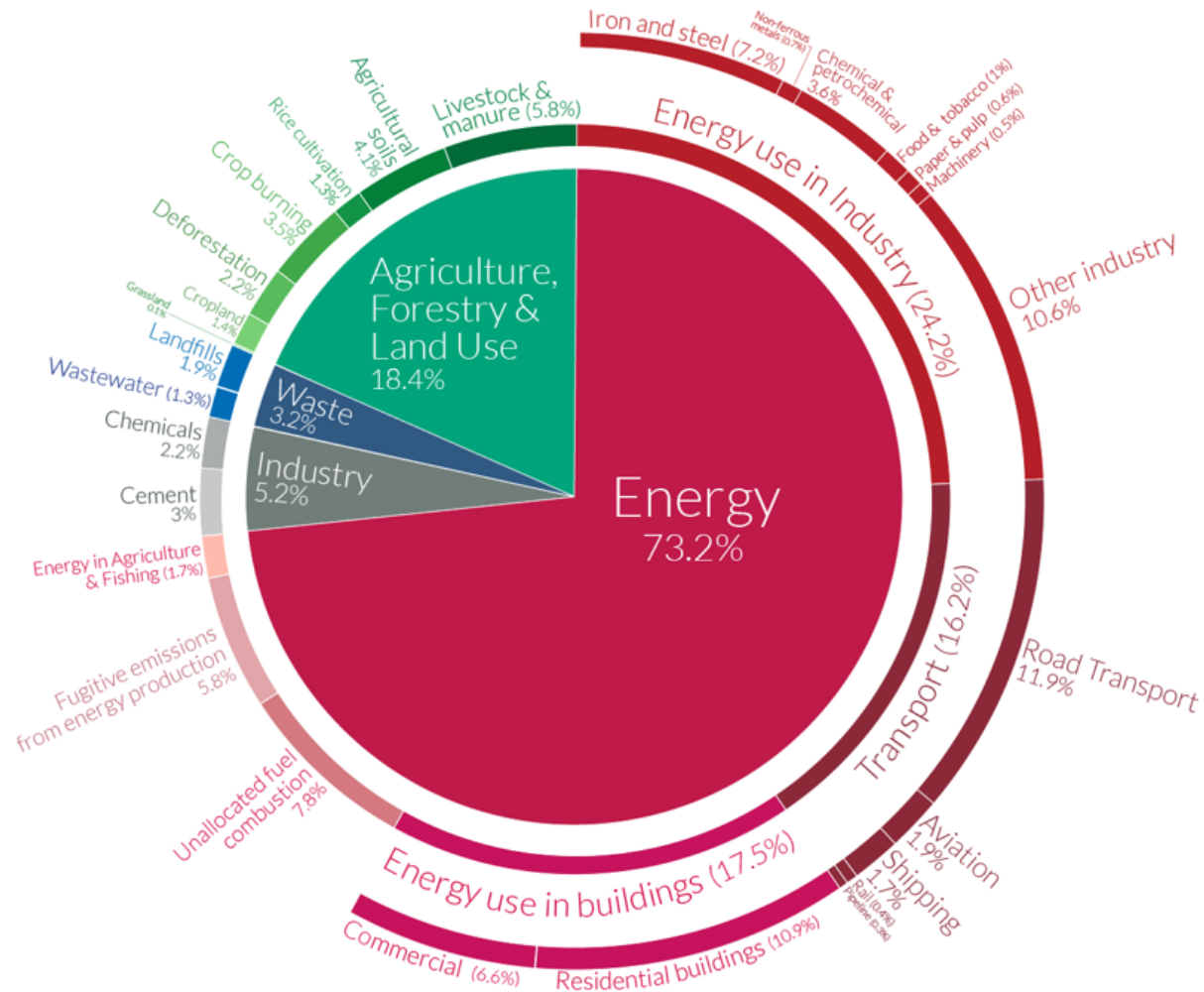
### Consumption-based CO<sub>2</sub> emissions per capita vs GDP per capita

– Consumption-based emissions are domestic emissions adjusted for trade. If a country imports goods the CO<sub>2</sub> emissions needed to produce such goods are added to its domestic emissions; if it exports goods then this is subtracted.

– GDP per capita is adjusted for price differences between countries (PPP) and over time (inflation).



# GHG emissions by sector



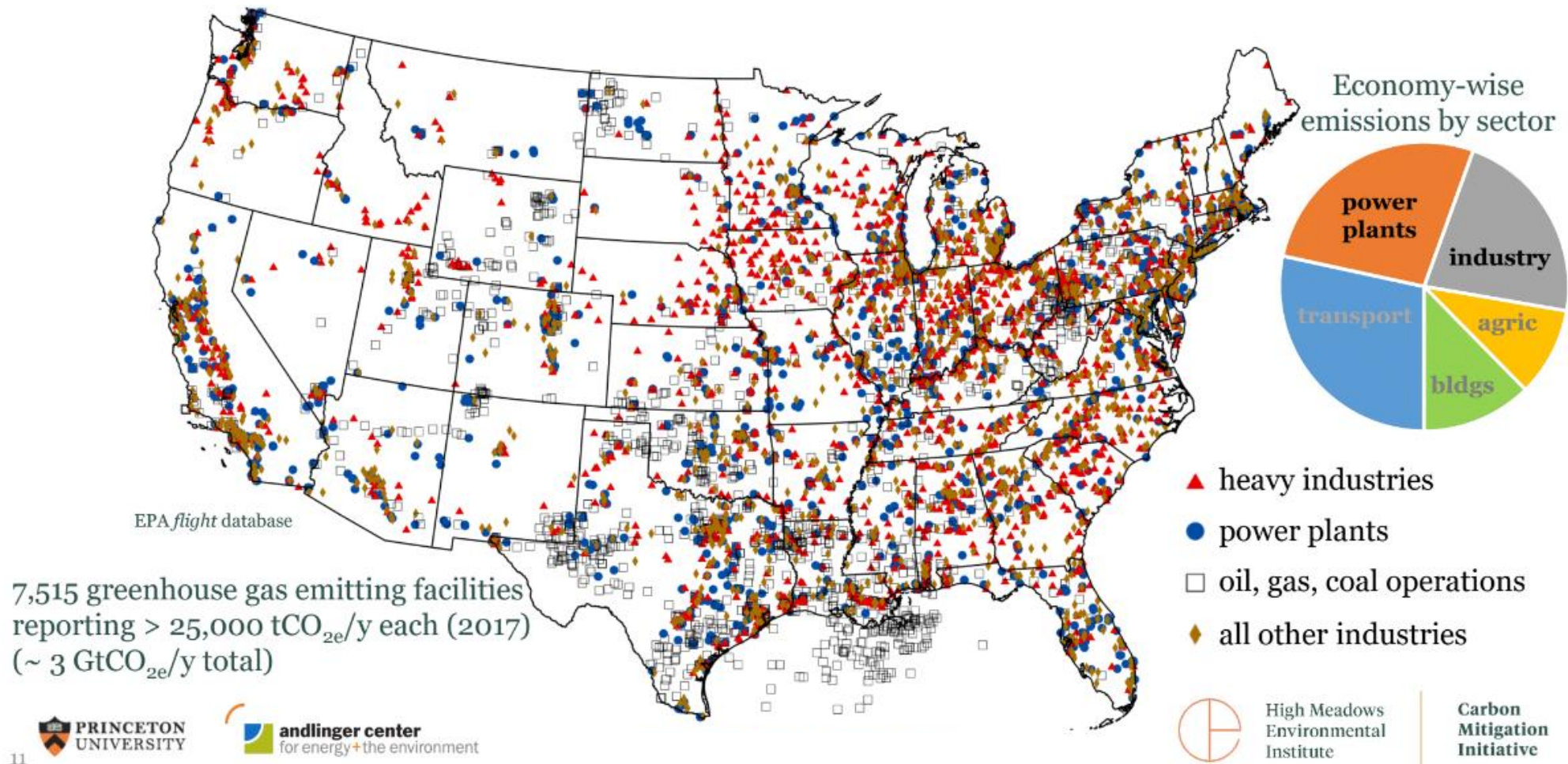
OurWorldinData.org – Research and data to make progress against the world's largest problems.  
Source: Climate Watch, the World Resources Institute (2020). License: CC BY-NC-SA

Licensed under [CC-BY](#) by the author Hannah Ritchie (2020).

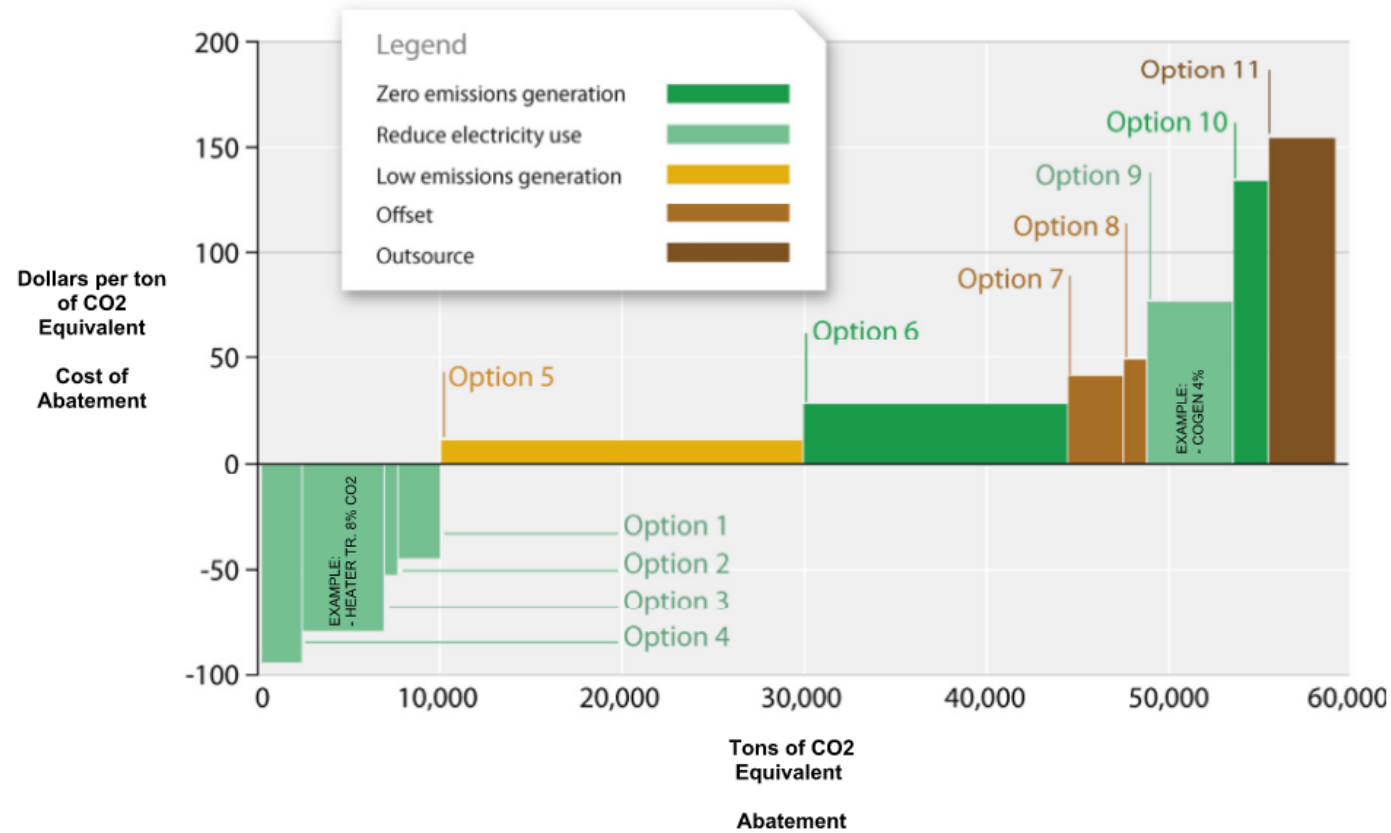


# U.S. Emission Sources

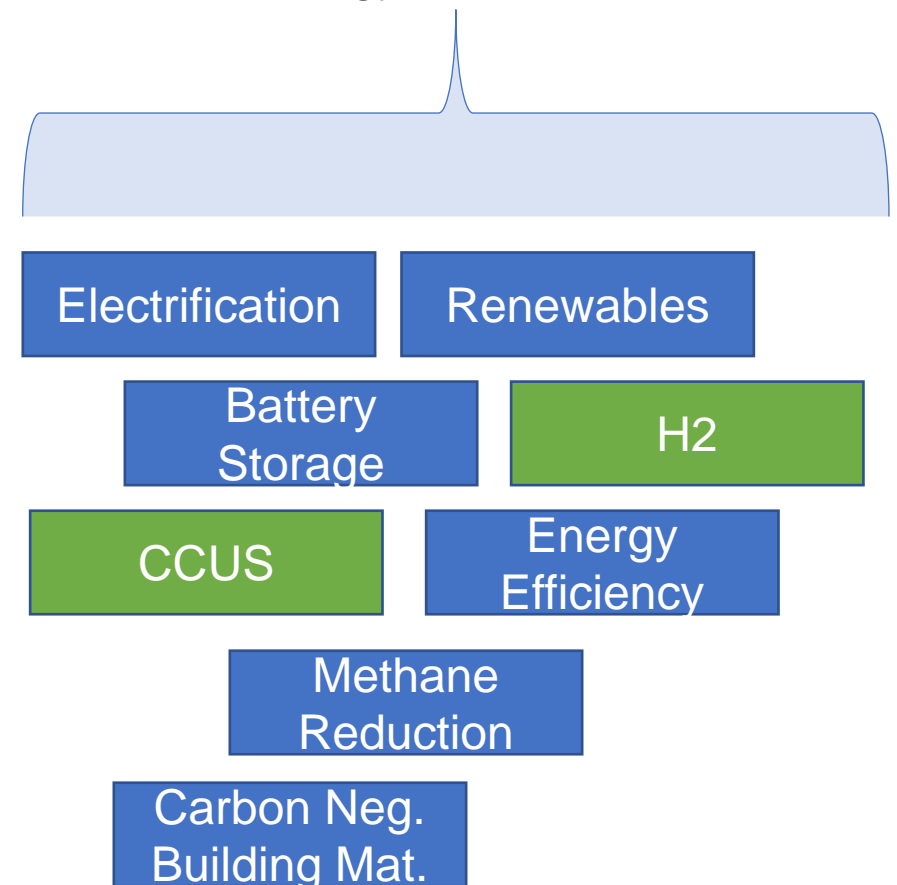
(excluding Alaska & Hawaii)



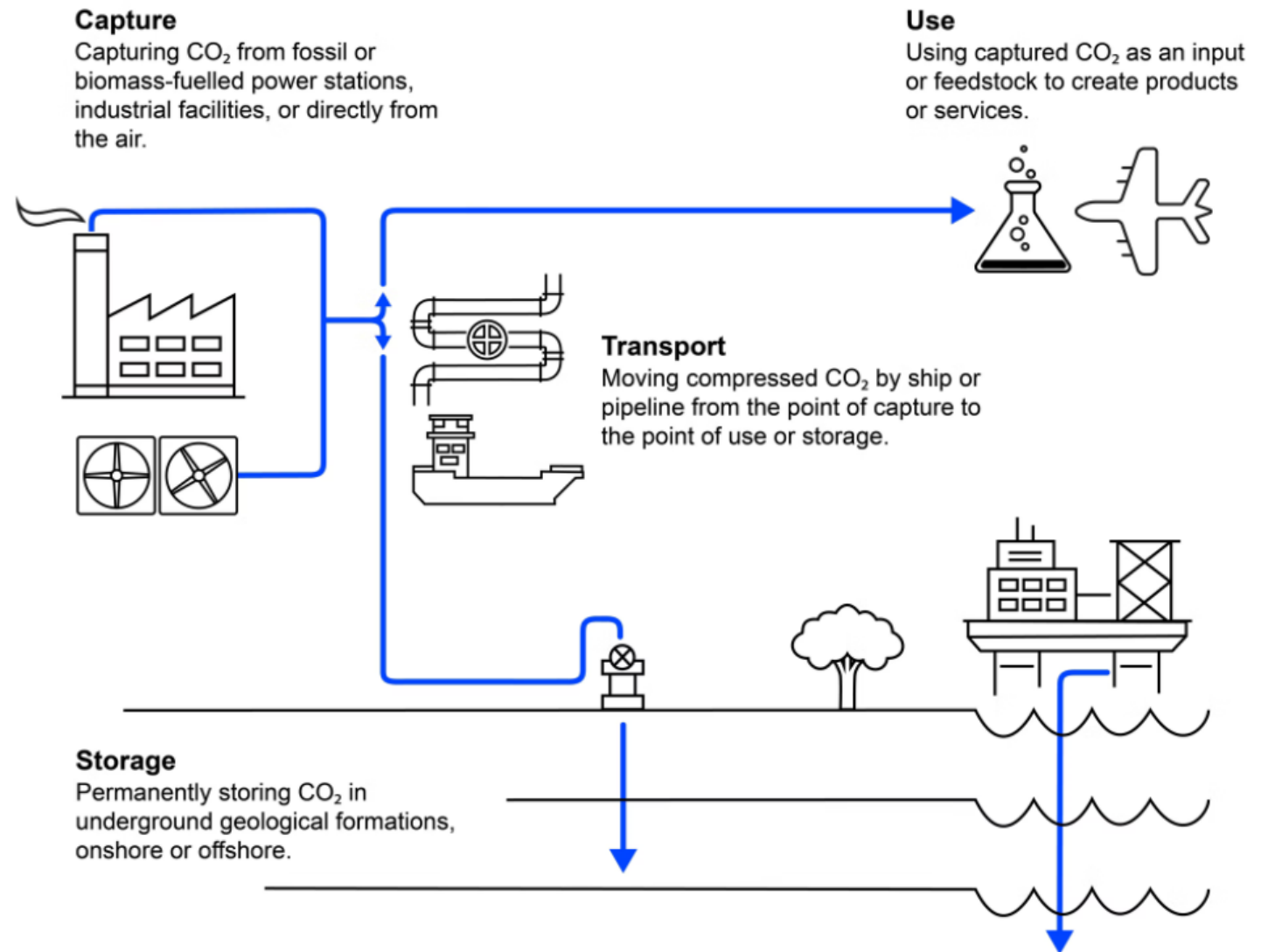
# Marginal Abatement Cost Curve (MACC)



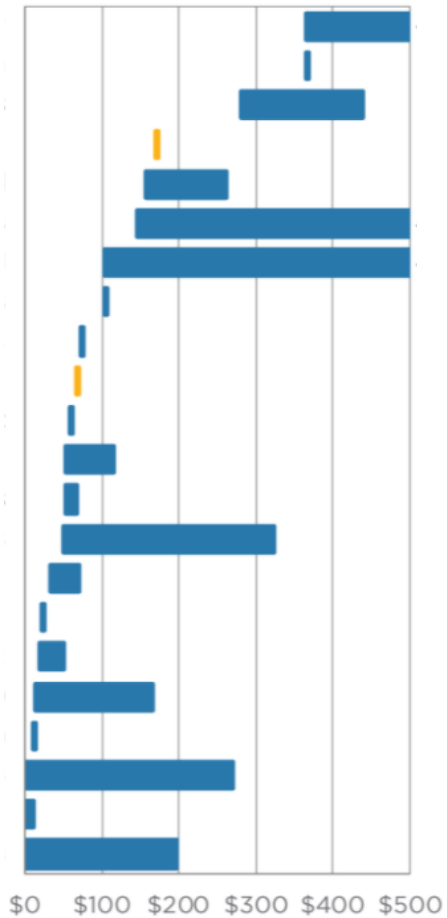
## Energy Transition



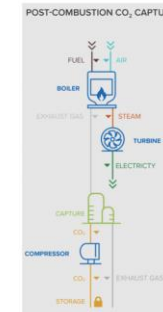
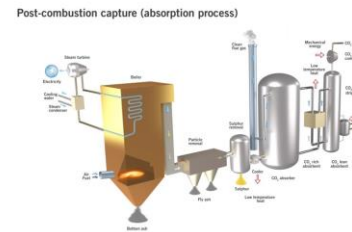
# What is CCUS?



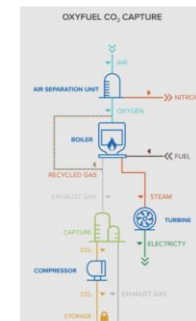
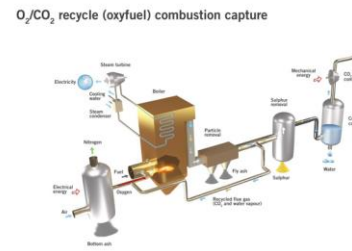
# Carbon Capture Processes



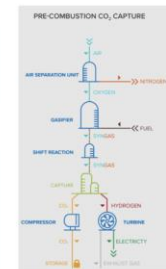
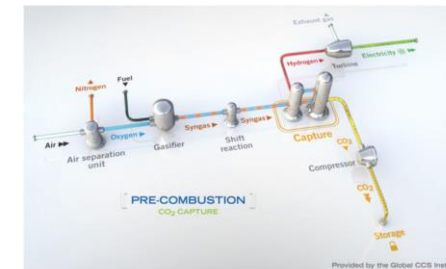
## Post Combustion



## Oxyfuel combustion



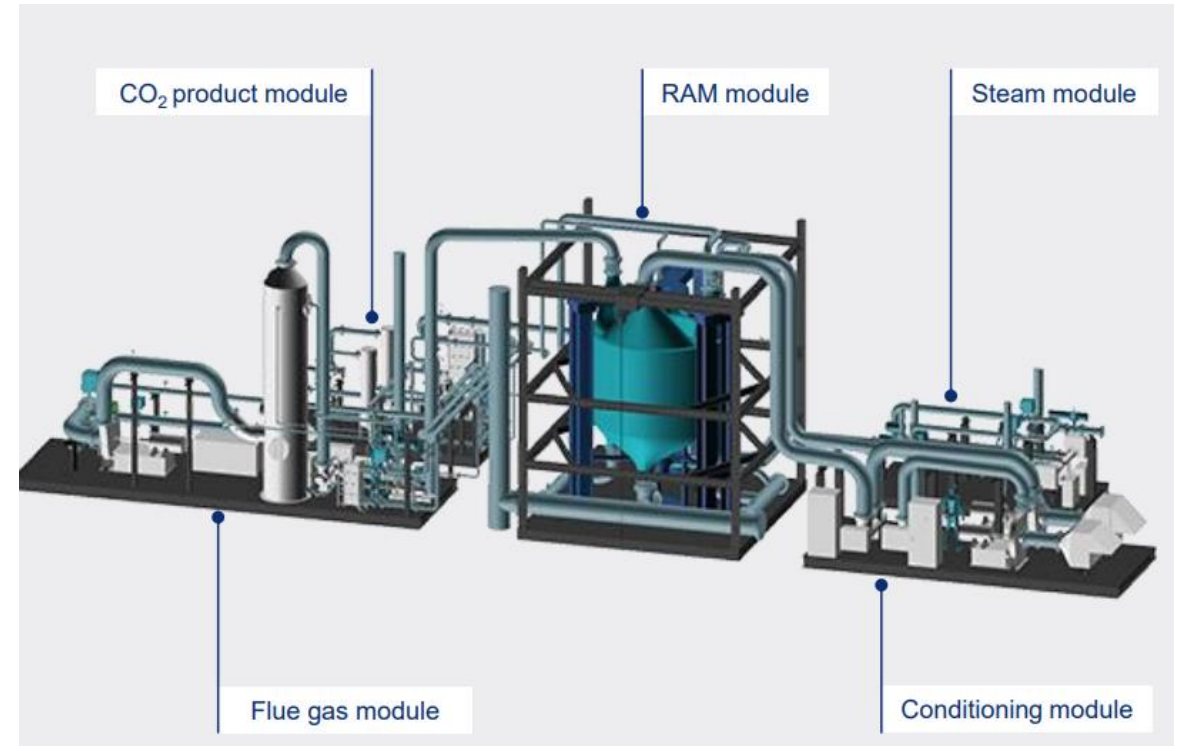
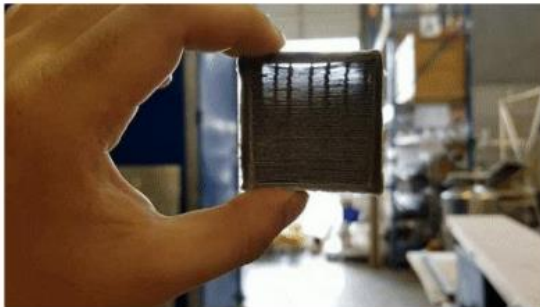
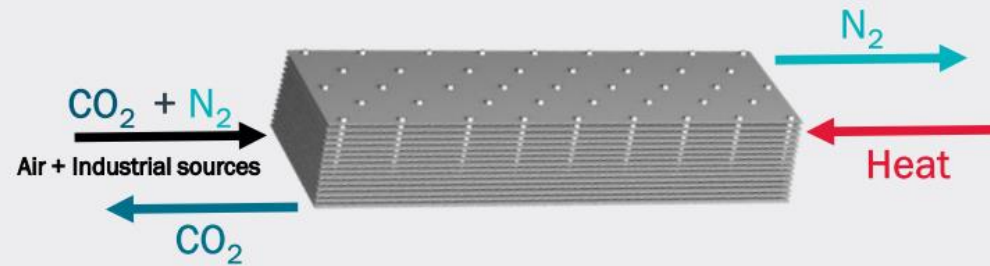
## Pre-combustion



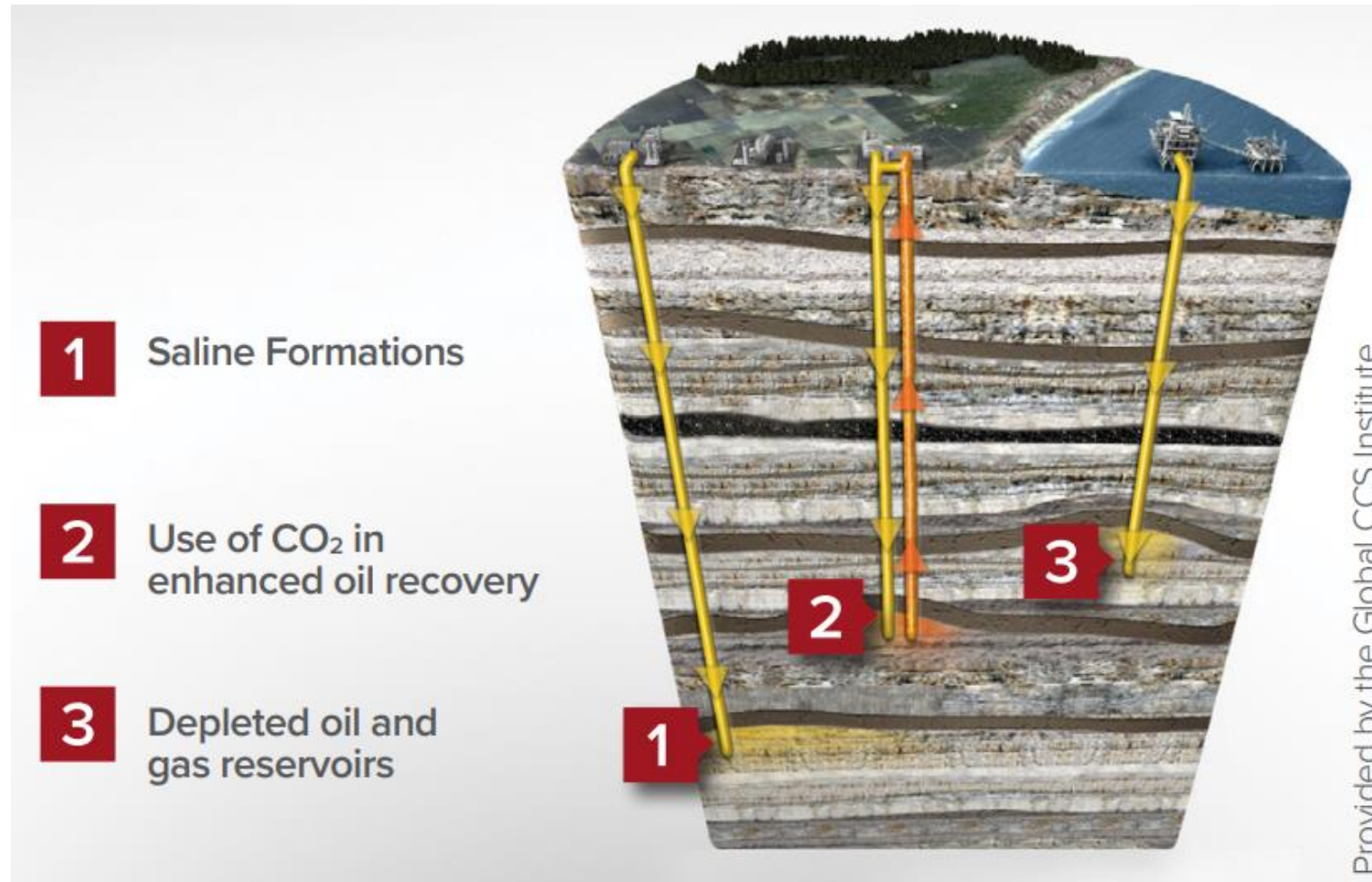
# Svante DOE Pilot

## Engineered CO<sub>2</sub> filter

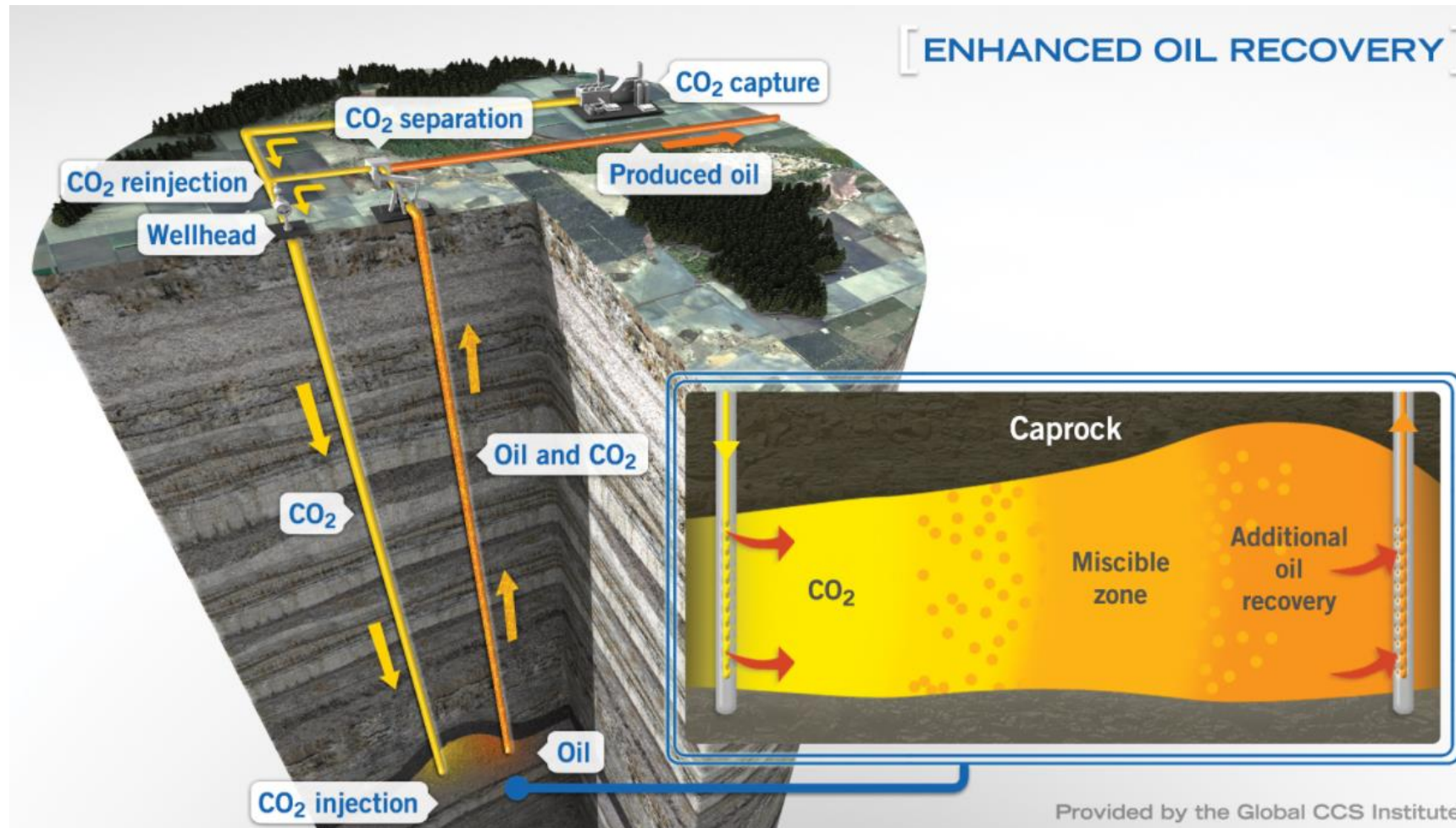
Structured Adsorbents with low pressure drops, fast mass transfer, high surface area, enable Rapid Cycling TSA process (RC-TSA)



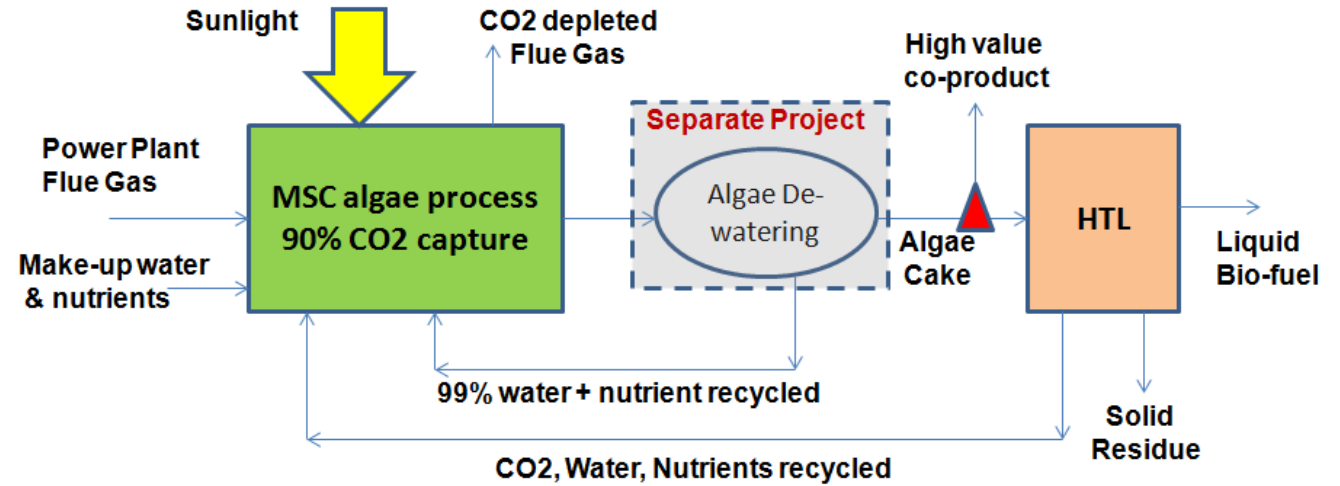
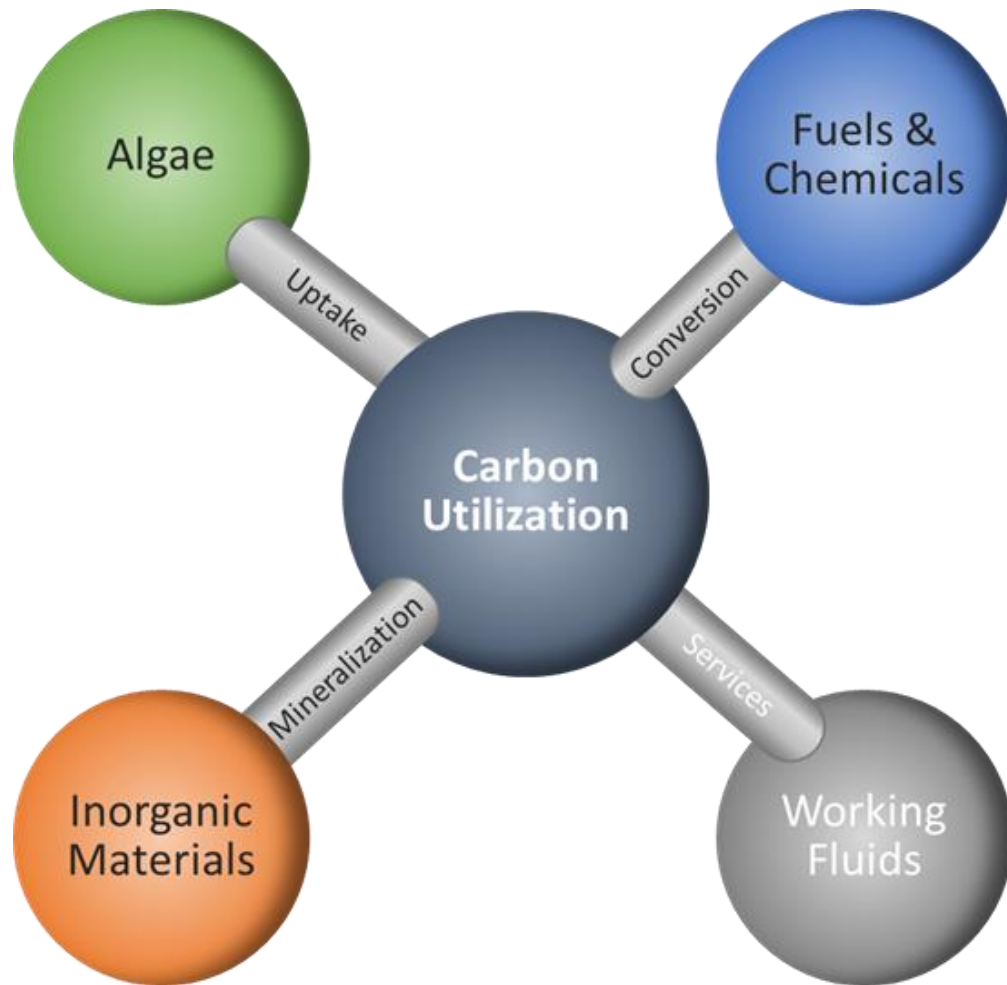
# CO<sub>2</sub> Geological Storage



# Enhanced Oil Recovery



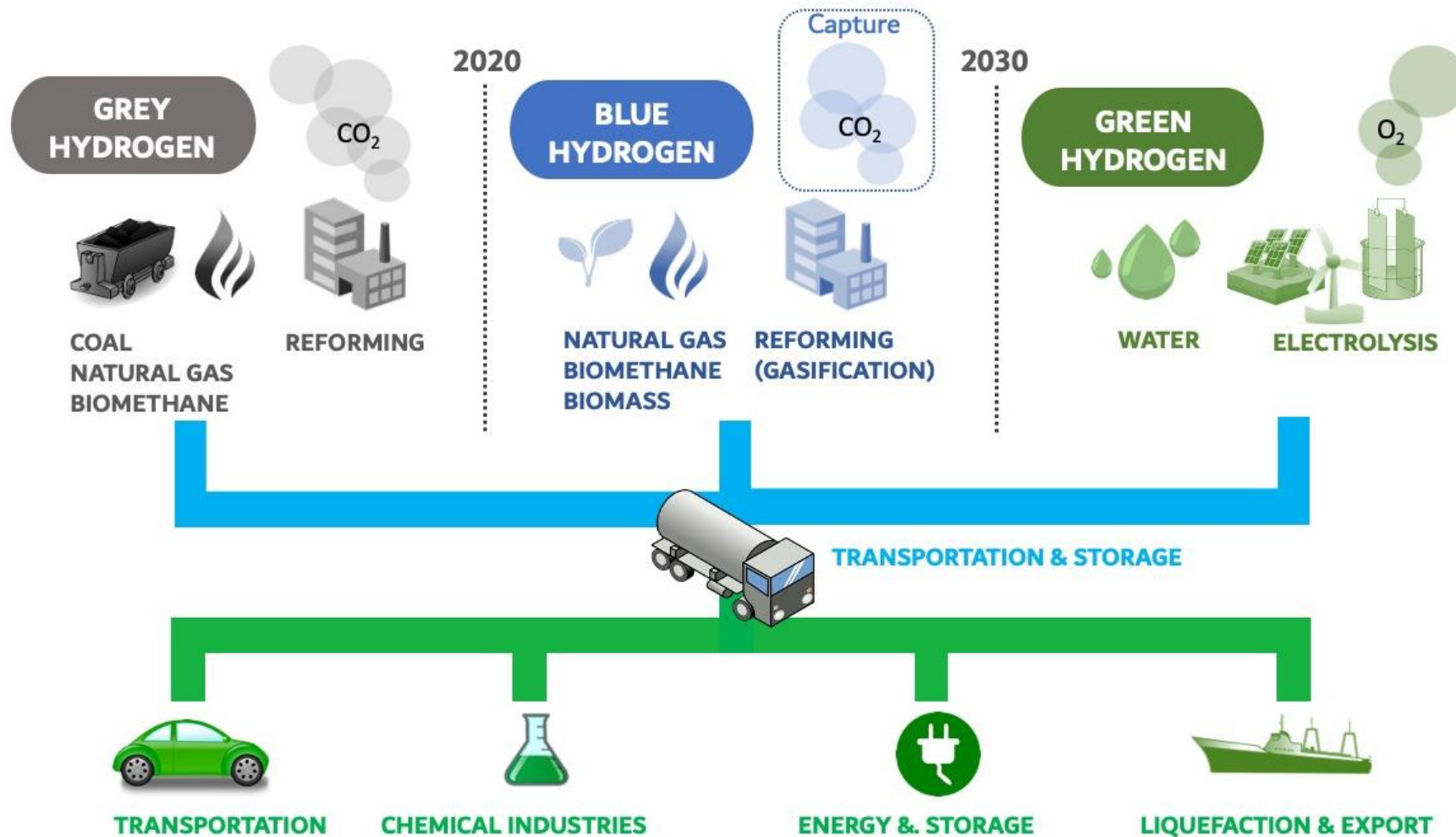
# Utilization



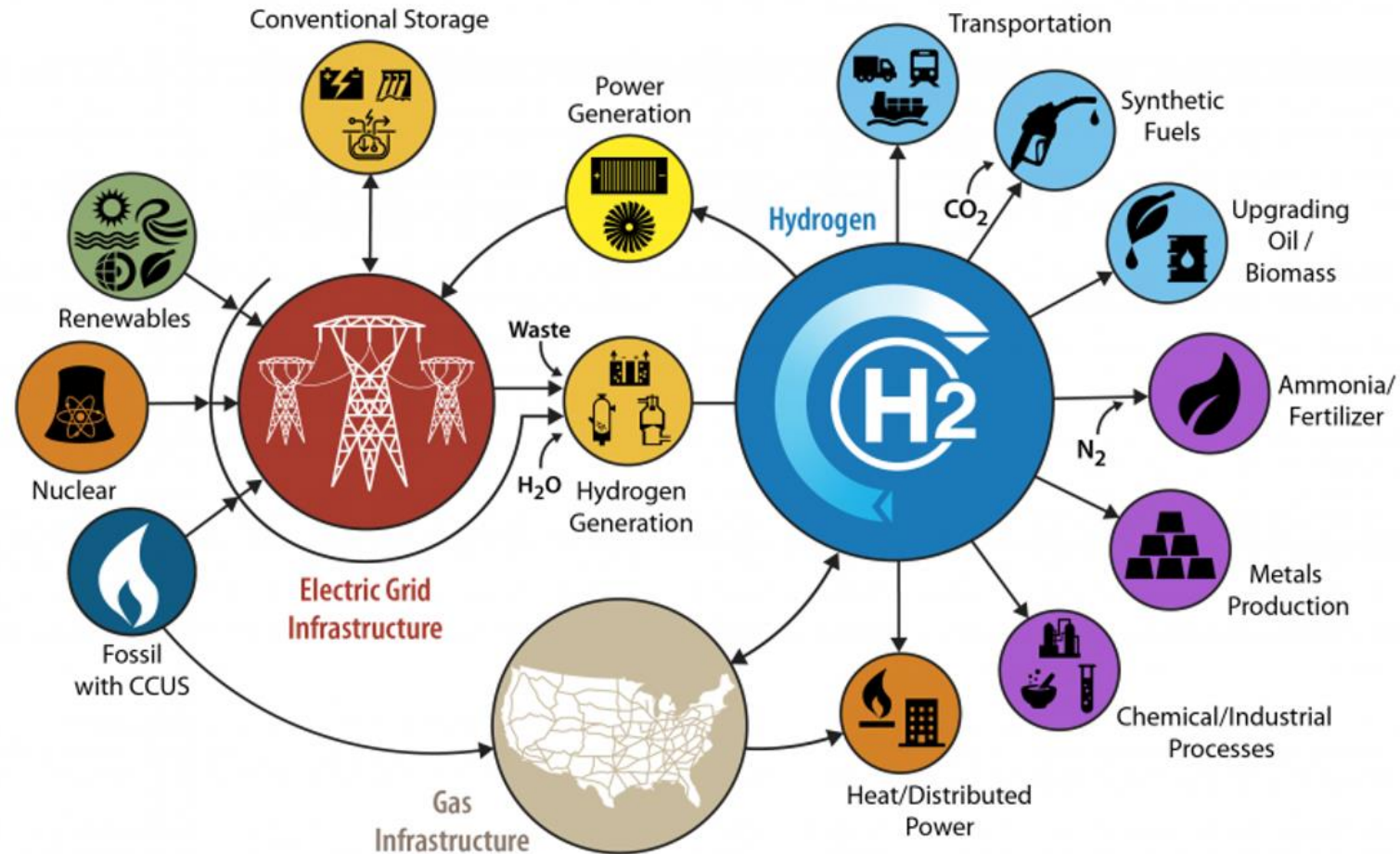
Mineralization – Blue Planet



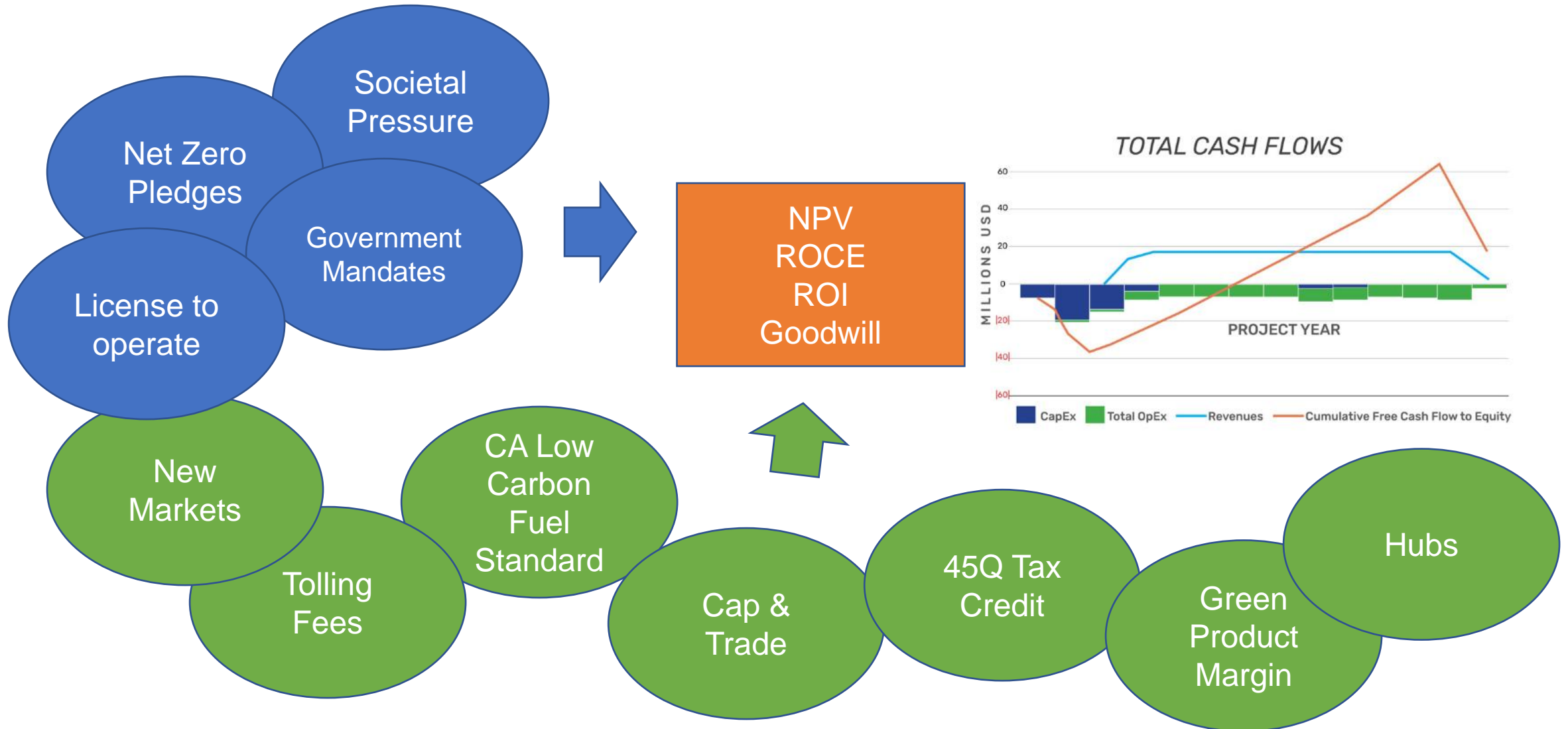
# The colors of Hydrogen



# Hydrogen Economy



# How do you make the economics work?



# Carbon abatement

- Geographic / geology will have major economic implications
- Electrification is one of the easiest ways to decarbonize, but may just shift the location of emissions
- Need to consider the full carbon intensity life cycle of the product manufacturing and use of the product
- Renewable developments paired with battery storage can help address intermittency
- Hydrogen can help decarbonize hard to abate sectors but needs to be Blue or Green
- CCUS has several pathways to help significantly reduce emissions across multiple market segments



