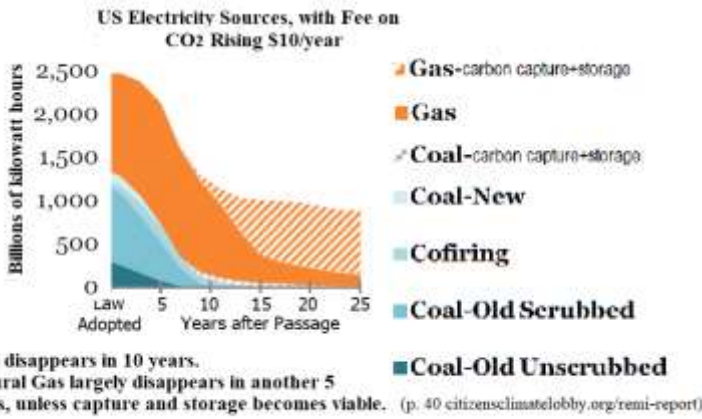


1. REMI report counts on nearly all electricity generated by natural gas switching to carbon capture and storage within 15 years

citizensclimatelobby.org/remi-report/ p.40

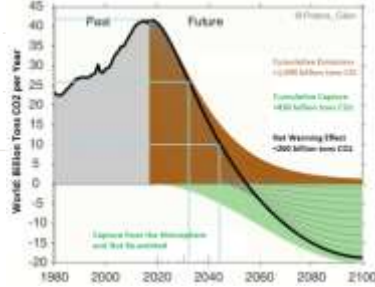
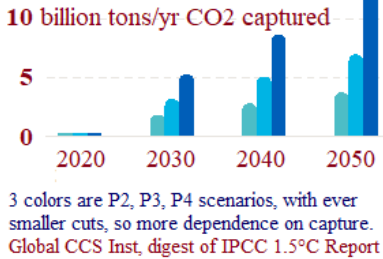


2. Worldwide, IPCC counts on billions of tons of CO2 captured and stored by 2030, then rising. Amount of storage depends on emission cuts.

globalccsinstitute.com/resources/global-status-report/ p.10

ipcc.ch/sr15/chapter/2-0/

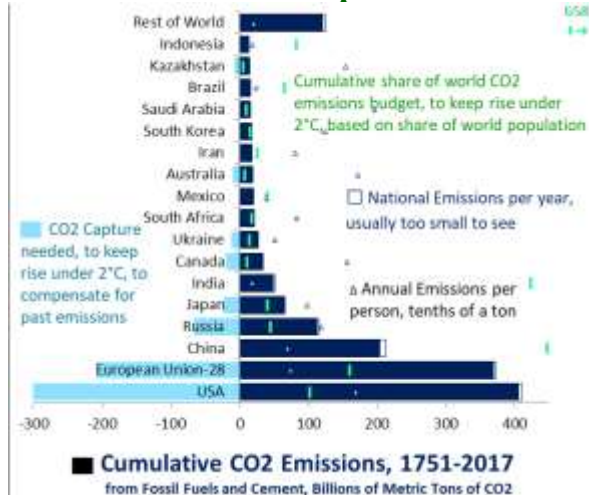
Alternate: energiogklima.no/blog/stylised-paths-to-well-below-2c/



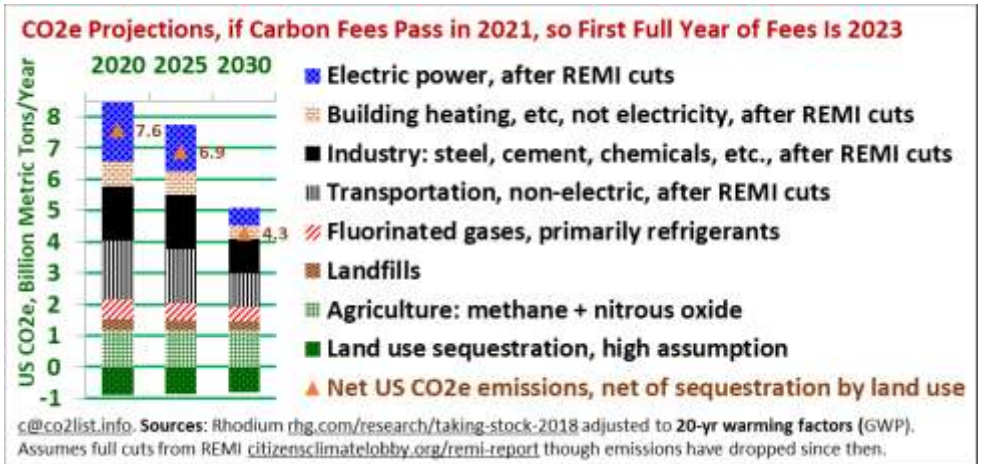
3. Growing plants would need 214,000 square miles per billion tonnes/year of CO2 captured (Contiguous USA has 3,000,000 square miles)

based on 18 tonnes/hectare/yr in *Synthesizing Existing Knowledge* p.8 avoid.uk.net/2015/07 More optimistic than 12-16 tonnes/hectare/yr to store 600 billion tonnes in 84 years on 430-580 million hectares in nature.com/news/emissions-reduction-scrutinize-co2-removal-methods-1.19318

4. Another View of Capture Needs



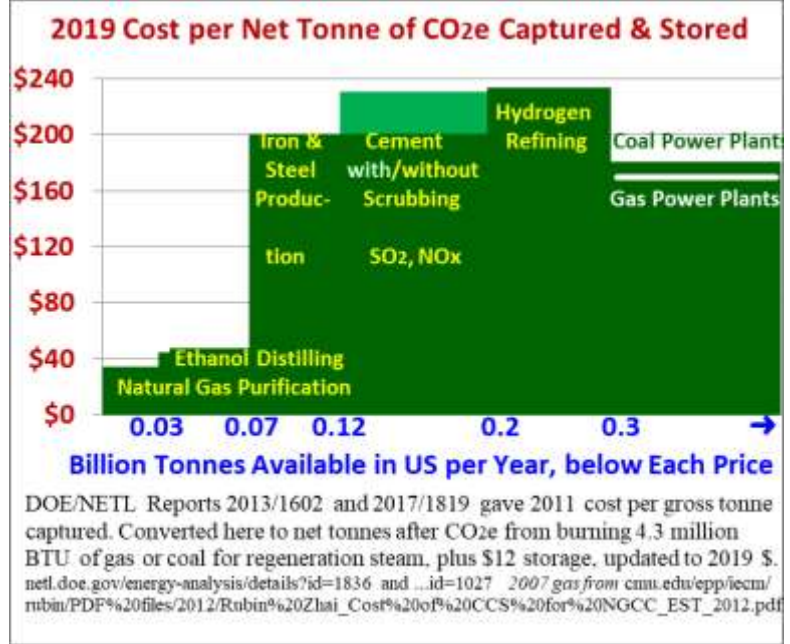
7. Some sectors drop little; their CO2 needs to be captured



5. In the US, billions of tons of CO2 are not available, even at high cost, from current industry, except power plants.

None of these cuts atmospheric CO2, and most don't get any payments from CO2 fee or other.

spreadsheet at co2list.org/ccs.xls, based on netl.doe.gov/energy-analysis/details?id=1836 p.2 netl.doe.gov/energy-analysis/details?id=1027 p.9 cmu.edu/epp/iecm/rubin/PDF%20files/2012/Rubin%20Zhai_Cost%20of%20CCS%20for%20NGCC_EST_2012.pdf p.1



6. Direct Air Capture may capture CO2 for \$94-\$232 per tonne, using a lot of Materials, Chemicals, and Renewable energy. If the life cycle of the materials and chemicals can be addressed, it can be turned on and off to balance intermittent renewables on the grid.

vox.com/energy-and-environment/2018/6/14/17445622/direct-air-capture-air-to-fuels-carbon-dioxide-engineering and blogs.ei.columbia.edu/2014/07/18/10-reasons-why-policy-makers-should-take-direct-air-capture-seriously/

Emissions:CDIAC+UNFCCC doi.org/10.18160/gcp-2018 and cdiac.ess-dive.lbl.gov/trends/emis/tre_coun.html
 Limit=990 billion tons 2012-2100 (270PgC, p.1113 ipcc.ch/report/ar5/wgl1) +1,395 billion tons 1751-2011
 Omits deforestation on all continents. Counts imports+exports where made; ship+plane fuel where loaded