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SB100 RPS Policy Implications for CARB

See attached Word document below.

Additional submitted attachment is included below.

SB100 Modeling and Assumptions: Joint Agency Report

Comments to CARB submitted 6 Mar. 2020

Thank you for the 24 Feb. workshop. The slides included valuable data, scenario/pathway options, and an impressive array of criteria that RPS electricity policies are to meet. I look forward to future policy releases and workshops on this topic from CARB.

Future CARB workshops, policies, and rulemaking could be improved by maintaining conformity with SB100. Some of the scenarios for the next decade include energy sources that are neither renewable (RPS) nor zero-carbon.There are advantages of transitioning to RPS sources as soon as feasible. Per SB100, RPS includes only wind, solar, biomass, ocean waves and tides, geothermal, fuel cells using renewables, hydropower that generates <30MW, landfill gas capture, and waste conversion.

Life cycle analysis (LCA) is not mentioned in the slide presentations. This is essential for evaluating the cost:benefit and emissions profile of each energy source.

NUCLEAR REACTORS

Nuclear energy is neither RPS nor zero-carbon. The only operating reactor (R) in CA, Diablo Canyon, is scheduled to go off line in 2025. PG&E has stated for over a year that it will be replaced by renewables, for economic reasons.

LCA of R includes the following components: a) mining of uranium entails fluorocarbon emissions (which are orders of magnitude more potent than C in its GHG effect), b) manufacture of thousands of tons of carbon-intensive concrete and steel for each R, c) during operation small amounts of CO2 are vented from Rs, d) mining and manufacture of heavy equipment for construction, demolition, and transportation, e) emissions from externally-sourced electricity during offline periods (construction, maintenance, demolition, and overheating condition)s, f) construction and maintenance of long-term storage steel&concrete cannisters and sites, g) emissions from transportation in all phases (Rs require continuous on-site security staff and monitoring by crews).

One of the criteria you propose for energy sources is safety. Due to daily releases of ionizing radiation and the risk of failure, terrorism, targeting by adversaries, theft of fissile material, etc., Rs are the most hazardous source of electricity that is currently in commercial use and thus do not qualify as safe.

Another criteria you propose is that sources be economical. Nuclear electricity has a cost/kW 3 to 4 times that of renewables. This does not factor in subsidization by Dept.of Energy and customers, liability waivers backed by federal government, long-term storage costs, the Social Cost of GHGs emitted over the life cycle of Rs, or R site remediation and restoration. Current and proposed R designs fail the test of being economical.

Rs require cool water intake at a rate of millions of gallons per hour. Rs release ionizing radioactivity into our water resources. Drought and heat waves may create deficiencies of water or elevated water and air temperatures that require Rs to be taken off line.

Construction of Rs typically takes at least a decade, with delays and large cost-overruns being the norm. The SB100 target date for 100% zero-carbon and RPS is 2045. If a fleet of new Rs is constructed in CA ASAP (by 2031), these would need to be taken offline and decommissioned by 2045. The operating period of less than 15 years is only a fraction of the 40 - 50 year lifespan of Rs. This is grossly inefficient and exorbitantly expensive when considering that the fixed costs are divided by less than 15 years instead of 40 - 50 years. Furthermore, Rs are clearly unpopular in environmentally-progressive CA, creating permitting and construction delays - with added costs.

https://thebulletin.org/2019/08/the-false-promise-of-nuclear-power-in-an-age-of-climate-change/

https://beyondnuclearinternational.files.wordpress.com/2018/08/climate-change-and-why-nuclear-power-cant-fix-it.pdf

https://www.forbes.com/sites/amorylovins/2019/11/18/does-nuclear-power-slow-or-speed-climate-change/#34ab924d506b

https://www.worldnuclearreport.org/Costly-and-unavailable-Report-condemns-nuclear-power.html

https://www.worldnuclearreport.org/The-World-Nuclear-Industry-Status-Report-2019-HTML.html

https://www.psr.org/resources/?_sft_resource_category=nuclear-power

REGIONAL TRANSMISSION

The slide presentations mention that import of electricity is currently not available. Please address this problem and further policies to create a regional smart grid. Smart grids are essential for the scaling-up of distributed renewables.

https://calmatters.org/projects/california-smart-grid-future-of-energy/

OFFSHORE WIND

The slide presentations mention that this is currently not available. Please address this limitation and further policies to develop offshore wind.

GAS CCT

The slide presentations include gas with carbon capture technologies (CCT). According to a recent article from Dept. of Energy, CCT is not currently commercially cost-effective. The cost per ton of C has recently fallen to $100. However, this does not include the cost of long-term storage in repositories. LCAs have not been published re. CCT. A 2019 study by Professor Mark

Jacobson of Stanford University calculated that it is more economical to construct towering wind turbines than to equip a coal incineration electric plant with CCT.

To sequester C, and many other GHGs, trees are much more cost-effective than CCT, which only captures C. More forest protection policies are needed in CA.

Most gas is currently extracted via hydraulic fracturing, which is the most environmentally-destructive extraction technology in use. This releases methane via flare and vent that traps 85 times more heat than C during its initial 20 years in the atmosphere. It contaminates our land and water resources with a slurry of over 1,000 chemicals. Its health hazards are well-proven.

https://www.psr.org/blog/resource/compendium-of-scientific-medical-and-media-findings-demonstrating-risks-and-harms-of-fracking/

BIOMASS

Using biomass for electricity generation emits a quantity of GHGs (including hazardous copollutants) that is 50% greater than the amount emitted from using coal. Biomass electricity generation releases 350% more GHGs than natural gas (97% methane). The combustion of biofuels, e.g., for transportation, also immediately releases GHG emissions.

Globally we are harvesting more trees and fallen biomass than we are planting or growing by deferred logging. In the USA, we harvest twice the amount that is added by new growth each year. Harvesting biomass contributes to this deforestation and decreases the ecosystem services of forests. Forests sequester more atmospheric carbon than any other terrestrial habitat. In addition, they capture toxic nitrogen oxides, sulpher oxides, particulate matter - thereby decreasing smoggy ground-level ozone. Natural forests (where there is no active management, logging, or removal of other biomass) retain more carbon in vegetation and soil than tree plantations.

Economics favors solar and wind over biomass energy production. Government subsidies can only prop up biomass energy transiently. Market forces will lead consumers including utility companies, to use solar or wind. The efficiency (energy output to input) is higher and the cost per kW is lower for solar and wind than it is for biomass energy. And the cost of renewables is decreasing. Solar and wind have been more thoroughly researched and widely used than biomass electricity generation. We have a large year-round surplus of untapped wind and sunlight. Most biomass facilities lack state-of-the-art emissions controls and efficient technologies. Biomass energy subsidies are to be discontinued.

Life cycle analyses of biomass electricity and biofuels are needed. This is to include the energy input and emissions from: manufacturing equipment for harvest and incineration, construction and maintenance of processing facilities, and disposal of incinerated remains. Each of these entails transportation, which is to be factored into LCAs.

Due to overpopulation, rising per capita resource consumption, increased ratio of livestock to crop farming, development, water scarcity, biomass harvesting, forest management policies, and climate change; the quantity of biomass in forests is shrinking. Since the colonization of the U.S., 42% of our forests have been logged and replaced with other land uses. There are many profitable alternate uses for biomass other than biofuel and electricity production, e.g., paper, wood, compost, and mulch. Increased use of the latter 2 in crop farming and landscaping would decrease use of synthetic, ammonia-bound nitrogen fertilizers (which pollute our land, air, and waterways) while providing a wide range of additional ecologic benefits.

If biomass energy generation is to continue, it is best to use only non-forest sources of biomass, e.g., food scraps, diversion from landfills, or urban landscape trimmings. Approximately 30% of our food production is discarded. And improved emission control technologies are needed. This minimizes environmental impact. Non-wood plants (e.g., cane, bamboo, rice straw, hemp) are more eco-friendly materials for paper production than timber. Hemp can be used to make HempWood, a lumber substitute for buildings. PCR paper production is to be used instead of timber harvest.

www.pfpi.net

Smith, P. et. al. (2014) Agriculture, forestry and other land use. In *Climate Change 2014* NY: Cambridge University Press.

https://www.fs.fed.us/nrs/pubs/jrnl/2018/nrs_2018_nowak_001.pdf

https://www.sierraclub.org/sites/www.sierraclub.org/files/sce/sierra-club-california/PDFs/SCC_MovingBeyondIncineration.pdf

https://www.southernenvironment.org/uploads/publications/Biomass_Factsheet_0719_F_Pgs.pdf

https://theecologist.org/2019/sep/17/you-burn-our-trees-power-your-homes

http://theconversation.com/to-curb-climate-change-we-need-to-protect-and-expand-us-forests-76380

LARGE HYDRO

This is not included in the RPS or zero-carbon sources in SB100. LCA reveals that it emits significant GHGs from: a) mining and manufacturing of carbon-intensive concrete, steel, heavy equipment, turbines, vehicles, etc., b) flooding of the upstream area above the dam submerges vegetation - which gradually decomposes and emits methane over decades, c) demolition, etc. Water supplies in CA are diminishing as droughts become more common. Stream flow may be insufficient to operate the turbines during droughts.

SOCIAL COST OF CARBON

The social cost of carbon (SCC) includes premature deaths, medical costs, degradation of natural resources, decreased GDP; property damage from climate-induced floods, windstorms, and wildfires; and increased cost of food. It excludes extraction of GHG emissions from the atmosphere. A 2019 meta-analysis by Wang et. al. found the mean SCC to be $55/MT CO2e ($200/MT of carbon). Estimates from more recent peer-reviewed journals exceeded this mean. Projections indicate that the SCC will continue to increase annually unless we achieve deep decarbonization. Per CARB, a total of 424 MMT of CO2e were emitted in 2017. The total annual SCC from CA emissions is at least 424 MMT CO2e x $55/MT CO2e = $23,320,000,000 ($23.32 billion). This excludes the social cost of other fossil fuel emissions. These toxic copollutants include benzene, carbon monoxide, nitrogen oxides, sulpher oxides, ground-level ozone, and particulate matter (black carbon). Each increases incidence of cardiovascular disease, cancer, and respiratory illnesses. Collectively, they drive up costs of public health care, e.g., MediCal.

In 2018, GHG emissions increased from the prior year in CA, US, and worldwide. Increases in CO2, nitrous oxides, and methane were significant. It is imperative that we adhere to the SB100 schedule and attempt to meet targets earlier in order to save lives, public health, and economic costs of climate change.

Helm, D. (2017) Burn Out, New Haven CT: Yale University Press.

Rifkin, J. (2019) The Green New Deal: Why the Fossil Fuel Civilization Will Collapse by 2028, NY: St. Martin's Press.

Harvey, H. et. al. (2018) Designing Climate Solutions. Washington: Island Press.

https://www.motherjones.com/environment/2019/01/it-was-a-bad-year-for-carbon-emissions-even-in-california/

https://www.westerneim.com/pages/default.aspx

Wang, P. et. al. (2019) Estimates of the Social Cost of Carbon. *J Cleaner Production,* 209: 1494 - 1507.