| Webinar: System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies | |
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| **Question** | **Answer** |
| The study's conclusion hinge on the finding that REC markets are slack. Did you explore the sensitivity of this finding to costs, qualification rules, etc? | We did not explore this sensitivity in great depth here, but we note that the total compliance REC demand for non-hydro renewables from state RPS policies was around 34% of WECC total demand. Total REC supply from qualifying resources was 43% of WECC total demand in our base case, so significant increases in clean energy costs (or increases in compliance and localized voluntary REC demand) would be needed to bridge this gap in the WECC. In some areas of the country (e.g., much of the wind belt) the lack of strong RPS policies makes a REC oversupply almost guaranteed. In others (e.g., PJM, NYISO, ISONE) there may be significantly less slack. For reference, NREL's 2022 Cambium modeling has NYISO as the only region of the country with non-zero compliance REC prices in 2030. |
| Net metering of rooftop solar is essentially volumetric matching. Would your results correspond to this case? | Net metering is a cost issue while we are focused on CO2 impacts, so I won't speculate on whether our results have meaningful implications for net metering. But both situations do involve annual averaging of what is in reality a highly time-variable metric. |
| Is there evidence that voluntary C&I will pay the cost premium of $20/MWh in order to effect these carbon reductions? | We did not assess the willigness-to-pay or price-elasticity of voluntary clean electricity demand as part of this work, but we will note that the $20/MWh figure was the cost premium for *100%* temporal matching, the most ambitious possible target. Voluntary buyers with less ambitious matching goals would pay lower cost premiums. It's also worth noting that current REC prices in tight compliance markets are in the $10-30 range. Having additional impact beyond BAU will always require paying more. |
| For a purchase program to have additionality, they must target levels of clean energy much greater than that already economic for the local utility? | In a nutshell, yes. To have additionality (in a scenario without binding EAC demand) you must procure power that would not otherwise have been economic. |
| Do you have evidence for the assertion that the projects procured by organizations would displace other competing projects? | This was not an empirical study (and these outcomes are inherently unobservable empirically), but the explanation for the modeled outcome is that a certain set of projects would be economic regardless of voluntary demand for their EACs, and the voluntary buyers just lay claim to some of those projects without having an impact on the total buildout. |
| Why do advanced technology scenarios perform worse against the benchmark under the temporal matching strategy? | We believe that this is in part a result of renewables overbuilding being more heavily relied on in the 'established technologies' cases, leading to greater total clean generation than is necessary in the cases with advanced technologies. |

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| E3 has criticized the 24/7 hourly accounting methodology, in part by questioning your assumptions. Do you have a response to their criticism? bit.ly/3ZerQMa (edited) | Yes, you can find a response here: https://x.com/JesseJenkins/status/1700235745452294642?s=20 |
| Study notes caveats (load+RE perfect foresight vs. uncertainty, load diversity from aggregating 10-25% C&I loads, etc.). How much do these impact conclusions? | It is difficult to quantify the precise impacts of these simplifying assumptions, and they should be the subject of future investigation. But in general they are likely to lead to us underestimating the cost of compliance for a given matching strategy. |
| How would time-matching address persistent emissions w/o simply overbuilding wind/solar & exacerbating congestion / transmission constraints? | Time-matching reduces emissions primarily by encouraging clean generation in hours when this would normally be economically uncompetitive with fossil fuels. |
| what about effects of the relative losses due to location of clean energy resources versus displaced fossil fueled resources? | In this study we assumed that the procured clean resources were perfectly deliverable, but transmission lossess and congestion do exist at all spatial scales in the real world and will affect emissions outcomes. Our recent paper on the emissions impacts US hydrogen subsidies includes some analysis of this 'deliverability' issue, but it likely deserves further research. |
| This session that electricity cost premiums for volumetric and emissions matching strategies are zero. What cost assumptions were made to support this finding? | One endogenously-calculated output of the model was the effective EAC price that the voluntary participant would need to pay a given clean generator in order for that generator to be built. In cases where the overall matching cost is zero, this is because the procured clean generators in these cases would have been in the money even without any EAC sales. Note that we do not assume any transaction costs for EAC purchases here. |
| Which entities will finance the new CFE projects deployed by the model in this research? | The model is agnostic to the financing structures or offtake agreements used to deploy clean energy. If a given generator would be profitable in the electricity market, then it will be deployed by the model. The underlying assumption is that if there is money to be made, someone will figure out how to get that generator built. |
| Is there any global database for PPA contracts of all the | To our knowledge there is not a comprehensive global PPA database. Country-specific |
| If EAC demand > supply, doesn't that imply that new builds would occur regardless, and voluntary procurement is not generating carbon reductions? | If EAC demand is *binding* (i.e. >= supply), then any *additional* EAC demand will naturally require additional supply in order to be met. |
| Is it true that you allow 60% of certificates to count both towards California RPS and C&I emissions claims? Aren't the RPS certificates non-additional? | Yes, we do this under the assumption that a consumer based in California aiming to meet a 100% matching standard should not need to retire certificates equivalent to 160% of their consumption. They retire 60% to meet the state requirement, and the remaining 40% are retired but *not* allowed to count toward the state requirement. |

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| How you parameter the procurement? For the expansion model, the demand , normally is quite stylized..just like a Demand = TWh, and how to differ and mapping? | A specific set of generators (including multiple 'clusters' of the same resource type per region) are identified as qualifying clean resources for procurement. We create copies of these generators to designate resources procured to meet a matching requirement, and these copied resources share maximum capacity limits with their original counterparts. Generation from these copied resources is what is matched with participating demand under the various procurement strategies. |
| How was the $/ton calculated on p23? | This calculation divides the cost premium paid by the participating consumer (in $/MWh of participating demand) by the observed system-wide CO2 reduction (in tons/MWh). |
| Dr. Jenkins: are you saying generators of electricity would anticipate an increase of EVs to the grid, want to secure a PPA for cheaper (cleaner) electricity? | We were not necessarily talking about PPAs here, but just noting that greater demand for electricity from Evs would incentivize deployment of new generating resources to meet it. |
| When the grid operators release data about electricity generation by fuel sources, do they remove electricity under contract via RECs/PPAs? | Grid operators tend to include generation from all sources, though some may have data available on resources procured via bilateral contracts. |
| Have you also run this model using a national emissions charge/tax per ton of emissions? How do the results compare? | We have not run sensitivity cases including a carbon tax. It is likely that results would be more similar to our central cases than to our '80% CES' cases, since a carbon tax is a price mechanism and doesn't change demand for EACs. |
| Was there any impact on transmission capacity? | We did not observe significant impacts, though this may have been different if we had allowed procurement of resources outside the model zone where the participating demand was located. |
| What are your recommendations on corporate emission accounting and long term PPA approach ? | The aim of this work is to assess the consequential emissions impacts of several popular emissions accounting proposals in this work, and not to make specific recommendations on how such systems should be run. But there is a value judgment underlying this study, namely that we should care about the changes in system-level outcomes that these accounting systems drive. |