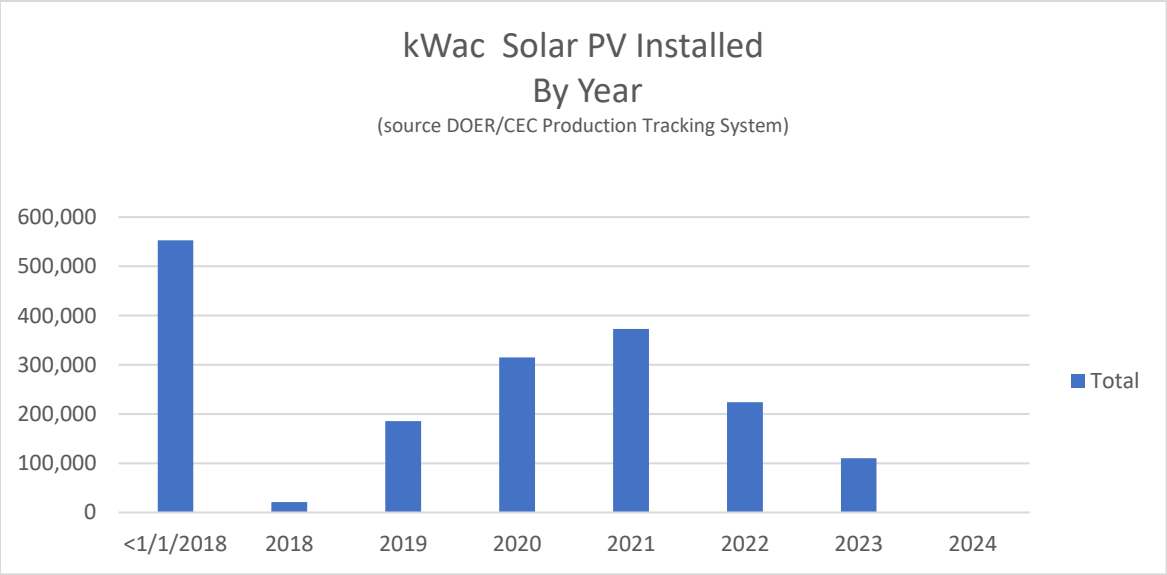
Comments and Discussion of Question 1 of the DOER SMART Review

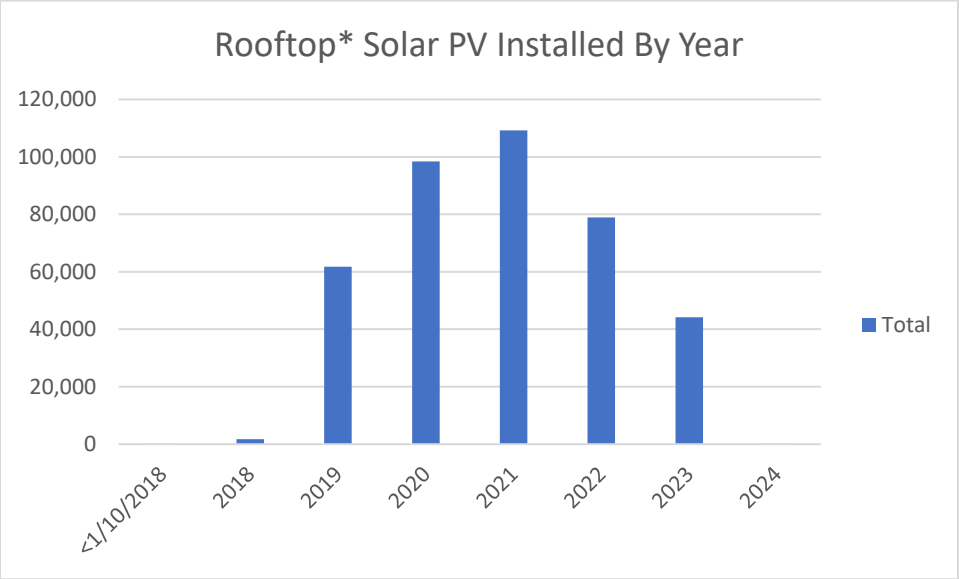
1. *"The SMART program currently provides added incentives for certain project types, including building mounted, canopy mounted, landfill, brownfield, agricultural, floating, community solar, and projects serving low income or public entities, projects with energy storage, and axis tracking. DOER seeks additional feedback on changes or improvements that will advance achievement of the Commonwealth's 2050 GWSA mandates while balancing land use, equity, and economic considerations. A. What project type incentive changes could improve program outcomes? b. Should other project types also be prioritized?"*

   CECP 2050:
   The CECP plan correctly notes that the recent rates of solar capacity installation need to be tripled to attain 2030' - 8.4 GW target for grid decarbonization. Analysis of the SMART program Production Tracking System indicates that, if anything, total installed capacity rates shrank for 2 years from 2021 rather than grew. If it hasn't already been evaluated, it should be.



Row Labels	Sum of 1
<1/1/2018	552,767
2018	20,969
2019	185,589
2020	314,871
2021	372,991
2022	224,087
2023	110,296
2024	581
Grand Total	1,782,151

In concert with a team of local climate policy analysts, I have closely reviewed the assumptions and methodology of the Mass Technical Potential of Solar Study (TPS). We have discussed our findings with the Synapse Project Manager (author of Mass. Technical Potential of Solar) who has been unable to dispute our conclusions. The Mass TPS overestimates the total Mass rooftop solar PV capacity by a factor of 2-3. Rather than 40+ GW of rooftop capacity, Mass. should have approximately 16 GW of rooftop solar technical capacity (*NREL 2016 TPS in the US*, with NREL's 22.5 GWdc derated to 16 GWac @ the 1/1.71 ratio used by Synapse). It appears that the Mass Audubon/Harvard Forest Growing Solar - Protecting Nature Study also chose to use the NREL estimates for Mass. However, neither the NREL or Growing Solar accounts for the estimated loss of 25-26% of suitable technical rooftop potential as a result of the ongoing implementation of the national fire prevention standards. Neither does the 16 GW (now 12 GW) address roof structural deficiencies which will make a substantial percentage of rooftops unsuitable for solar without potentially costly (if not prohibitive) roof repairs. There is also the probability that it will require increasingly dramatic carrots or sticks to motivate/enable the lower one-third to one-half of the state income bracket to commit $10-20k (per household -post current solar incentives) in discretionary(?) resources or borrowing. This should give pause to serious climate advocates who believe that Mass. can reach its goals with primarily rooftop and canopy solar.



Row Labels	Sum of Capacity (kW AC)
<1/10/2018	13
2018	1,757
2019	61,742
2020	98,446
2021	109,212
2022	78,970
2023	44,195
2024	89
Grand Total	394,423

Rooftop includes all solar PV under 1 MW which falls into the following classes: Commercial (or C)- C- College/Univ., C- C/Office, C- Hospital/Health, C-Religious, C-Rest./Food, C- Retail, C-School K-12, Gov.t – Mun. Schools K-12, Res. 4+units, Res. 3 or less units. Per Production Tracking System

These numbers don't perfectly capture rooftop solar but they are close. What is the reason for this dropoff? Was it the rising cost of PV hardware in recent years or labor scarcity related cost increases? Or is it that SMART incentives and federal tax incentives are inadequate in the context of current electricity and fossil fuel prices? Or is it that the best roofs – owned by financially privileged (top quintile) households and businesses – have already installed solar – if they desired it.

In short, there is good reason to be concerned whether rooftop solar adoption rates will suffice either to achieve (along with equally lagging canopy or brownfield/landfill ground mount solar) the 2030 CEECP target of 8.4 GW or to supply even half of the 2050 solar capacity target of 27 GW. Mass. needs to either up the ante for rooftop solar incentives or refrain from significantly disincentivizing ground mount solar in so called "greenfield" areas. Possibly it needs to do both. The Mass TPS review work with my local team also points to miscalculations (orders of magnitude in size) for the technical capacity of solar in the canopy and ground mount environments. One more reason to be cautious when considering proposals to bar and disincentivize solar facility access to hundreds of thousands of acres of Mass. forest.

Finally, there is the not insignificant matter of cost – including opportunity costs in the realm climate mitigation and adaptation. If the project costs figures in the Production Tracking System are accurate (or representative), Mass. citizens, businesses, utilities, developers and homeowners have spent $4.4 billion since 2019 to install 1.78 GWac of solar PV – including all types. However, for the most recent 3 year period of 2021-2023, installations of => 2 MW cost $3.16 W (107 units, $1,330,600,817 and 420,453 kW). For the same period Residential Only Rooftop solar cost $4.93 W (27,011 units, $987,11,991 and 200,086 kW). If residential rooftop only is not a fair comparison, let's take all solar under 1 MW for the same 3 year period. This cost $4.51 W (27,725 units, $1,352,970,309 and 299.687 kW.)

If solar incentive policies seek to achieve the 2030 solar target of 8 GW by reliance on even 2/3 rooftop solar installation (67% of 4 GW needed to achieve 8 GW by 2030, or 2.67 GW rooftop), Mass. will spend $4.7 bil. more than it would spend if it installed all 4 GW as 2 MW or larger solar arrays. If rather than comparing large scale ground mount solar to rooftop, we compare 2+GW ground mount solar to all solar less than 1 MW, the result is still an added cost of $3.6 bil. The $4.7 bil. premium cost for the 2.67 GW rooftop solar to get us to the 8 GW in 2030 is greater than the recorded cost all solar developed under the SMART program to date.

If this is the accepted strategy to achieve the Mass. 27 GW solar target for 2050, then assume a mix of 15 GW rooftop and 8 GW ground mount (27 GW – less 4 GW already installed = 23 GW; 15 GW rooftop and 8 GW ground mount) then the following financial outcome is projected. The people of Mass. would spend an additional $20.25 bil. to $26.55 bil. by 2050. While we do not propose to build exclusively 2 MW and larger solar installations henceforth in Mass., these numbers illustrate the economic dimension of two polar approaches to solar siting. How much direly needed home weatherization or heat pump installation could be accomplished with this money that would otherwise be devoted to a rooftop only (or primarily) strategy? How much of Mass. forest land could be permanently conserved with the program savings from building solar where it is cheaper. Even if only $10 bil. of the above savings were achieved, this could finance the permanent conservation of potentially 1 million of Mass.' 3 million acres of forests (at $10,000/acre). This while somewhere between 50-75,000 acres of Mass forests (1.5-2.5% of total) are gradually converted to solar PV in the effort to efficiently address the

emergency nature our climate crisis. This conversion does not need to be permanent, it requires government guidance and oversight and it can be focused on the least impactful forest systems identified through application of the suitability criteria from the Mass. Technical Potential of Solar study.

Respectfully,

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