Top 3 questions for the RPS Study

1 – What is the purpose?

2 – What is the cost?

3 – What is the risk?

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#1 - What is the purpose of the RPS?

Maryland's energy goals are inconsistent. The Greenhouse Gas Reduction Act (GGRA) should supersede the Renewable Portfolio Standard (RPS) because the GGRA is a technology neutral emission goal while the RPS mandates technology without system justification.

*P*rofessional system development begins with sound goals. A sound goal specifies a performance level (what to do) not a technology (how to do it). Kennedy stated we will put a man on the moon in 10 years (what to do). The Apollo Moon Project was successful in part because NASA had the discipline to spend one year up front to figure out how to achieve the goal (lunar orbit rendezvous). Likewise Maryland today needs the discipline to figure out how to build a reliable, sustainable, electric power system without fossil fuel.

Maryland's 2016 Greenhouse Gas Emissions Reduction Act requires a 40% overall reduction in greenhouse gas emissions by 2040. It also states {§ 2-1205(c)(3)} "That plans shall be developed in recognition of the finding by the IPCC that developed countries will need to reduce greenhouse gas emissions by between 80% and 95% from 1990 levels by 2050." The GGRA is a sound, technology agnostic, performance goal. Since some sectors like the chemical industry will be expensive to decarbonize the GGRA implies the need for zero (<5%) emission electric power. The ultimate requirement is essential to avoid committing big long term investments to permanent structures that may be a reasonable way to reach an interim stage but interfere with the ultimate goal (80-95% overall).

In contrast to the GGRA, the 2017 Renewable Portfolio Standard requires 25% of retail electricity sales to come from specified generator technologies by 2020. The RPS is a technology mandate with no system goals. While wind and solar are certain to have some role in a post fossil fuel economy, that role is unclear. There is no competent evidence that renewables are a practical way to achieve the GGRA goal. Stakeholders have the right to choose any technology they want, to reject nuclear power or even to compromise goals; but a rational choice is based on the cost/performance/risk of trustworthy options. These options do not exist today; Maryland needs to do its homework.

Given a clear and stable GGRA goal (80-95% by 2050), the traditional low-risk development method is to first conduct a PJM Concept Definition Study (analogous to first year Apollo tradeoffs). Ignoring legacy constraints the first question is: What will reliable power systems look like without fossil fuel? This concept study estimates the cost, performance and risk of electric power whole system alternatives as system emissions approach zero. Complexity and constraints are then added step by step to develop real system designs.

Based on the PJM Concept Definition Study, stakeholders then choose a path and a pace by balancing cost and risk. Interim goals are not guesses but are derived from informed choices. This PJM Concept Definition Study becomes the basis for a Clean Electric Power Plan.

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Maryland should have a Clean Electric Power Plan before making large irrevocable investments. To create that plan, stakeholders need to see trustworthy practical options; a PJM Concept Definition Study.
It is prudent to delay or suspend the RPS until the completion of a Clean Electric Power Plan.

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#2 - Household cost of 50% onshore wind

The purpose of this memo is to develop a simple Rough Order of Magnitude (ROM) cost: a sanity check, a back-of-the-envelope estimate of magnitudes for the purpose of clarifying cost drivers. It includes important factors and ignores detail that can obscure fundamental relationships.

The ROM is based on published U.S. Department of Energy (EIA) levelized cost for onshore wind. Levelized cost is the sum of the annual operating cost plus the discounted capital investment (the equivalent annual mortgage payment). EIA's 2018 capacity weighted average number for onshore wind is $48/MWh (4.8 ¢/kWh). The ROM household cost is simply this cost times 50% of Maryland's total electricity consumption divided by the number of households.

Inherent in this perspective is that there is no "other guy" to help Maryland households pay the bill. Households cannot pass through costs and must pay the whole bill through standard of living adjustments. Tax credits, subsidies and indirect costs all come back to households through various paths. Other economic sectors such as government, industrial, and commercial users pass through their costs plus overhead to households in the form of higher charges. Households pay the whole bill.

ROM COST OF 50% MD WIND GENERATION

a	MD electricity consumption 2016 (MWh)	61,300,000
b	Annual wind production = 1/2 consumption (MWh)	30,700,000
c	Wind levelized cost @ $48/MWh ($/year)	$1,473,600,000
d	Number of MD households (census)	1,981,000
e	Wind annual cost risk per household	$744
f	Cost risk/household/month (no electricity sales) ($/mo)	**$62**
g		
h	Annual wind electric sales @ $35/MWh (row b*$35)	$1,074,500,000
i	Annual net cost (row c - row h)	$399,100,000
j	Net cost/household/month (cost risk - sales) ($/mo)	**$17**

The ROM estimate is that 50% onshore wind will increase Maryland household electric cost by $17 per month. This ROM assumes that all wind electric power produced is sold at PJM wholesale market prices ($35/MWh). The cost risk of $62/month is the bill that pays for wind regardless of whether or not electricity is sold, that is, even if the investment eventually becomes stranded.

Transition pace is important. $17/month is consistent with a gradual pace allowing existing power plants to gracefully retire. Forcing more generation on the grid than demand requires stresses existing power plants and increases household cost through shareholder ownership of distressed power plants.

The perspective ignores real complexity including subjective externalities such as health benefits. Policy can redistribute household cost from one class to another. Curtailment (shut down wind), transmission upgrades and storage are required to maintain reliability at high wind penetration. While these costs can be substantial, their impact at 50% penetration is unknown.

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#3 - Overall Risk Assessments

Poor decisions can cause the clean energy transition to stall due to high cost. Citizens rebel at high prices and refuse additional big investments. The government entity becomes a long term emitter.

The transition to a post fossil fuel economy is not simple or risk free. The type-for-type replacement cost of the existing US electric power system is approximately $5 trillion, $15,000 for every man/woman/child. The total conversion of all energy sectors will be multiple times that amount. Long product cycles (50 years for power plants, 100 years for transmission) mean that serious mistakes can take a long time to repair.

Germany's Energiewende appears to have stalled without reducing carbon emissions. While Ontario Canada has successfully cleaned up their power grid , high cost makes it difficult to electrify other energy sectors.

There are many ways to make poor decisions. Important lessons can be learned from a survey of other electric power systems (ISOs) around the world about their emission reduction programs. What are the successes and failures, lessons learned? As a minimum, this critical survey should include direct feedback from ISOs in Ontario, Hawaii, California, Germany, Denmark, Ireland, Australia and PJM...

- EMISSIONS - To what extent have these ISOs reduced CO_2 emissions? Have any ISOs achieved nearly zero (e.g. <40g(CO_2)/kWh) emissions? How? What do ISOs believe will be required to reduce system emissions to <40g(CO_2)/kWh? What generation type is used to supply base-load in low emission ISO's? Why?
- COSTS - What are total systems costs, both direct and indirect, of delivering electricity? What are electricity rates (without social costs and taxes)? Is electricity is being curtailed? By how much? How does curtailment depend on intermittent generator penetration?
- RELIABILITY - Have common-mode failures been experienced: extended periods of low wind, low sun, widespread storm damage, gas pipeline interruption? Have any ISOs received push-back from neighbors over backup demand? Have reliability compromises been experienced. Have reserve margins been increased?
- POLICIES - What are ISO specific policy incentives for clean electricity? How effective are they? To what extent have incentives distorted markets? How effective is demand management? Can general guidelines be developed?
- MARKETS - Have incentives distorted markets? Do incentives raise costs to rate payers beyond the political entity imposing the incentives? How are capacity markets implemented? Does the ISO see a long term shift from energy to capacity based markets?

Risks can also be identified and mitigated through disciplined planning. The purpose of the PJM Concept Definition Study is to clarify the cost/performance and risk of alternative whole system concepts as emissions approach zero. If the chosen goal is to reduce emissions by only 50% there are many technology options available. But the Greenhouse Gas Reduction Act implies the ultimate need for zero (<5%) emission electric power. This constrains the options. Intermittent generators by themselves cannot meet this goal without seasonal storage.

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