Developing a Toolkit to Optimize Community Choice Energy Programs

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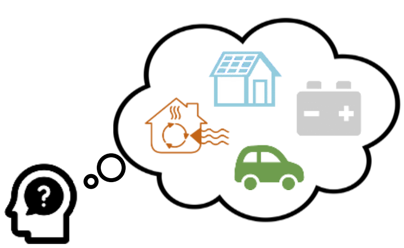
What is Community Choice Energy?

Community Choice Energy (CCE) agencies are local or regional governmental bodies that supply electricity to their constituents as alternatives to investor owned utilities. Through their energy procurement, community-serving programs, and other activities, CCE agencies can advance renewable energy, local energy, and energy efficiency development, and alleviate stress on the electric grid. They can also reduce energy costs, improve public health, foster environmental justice, and provide other benefits to the community.

Project Motivation



Although CCE has the potential to serve as a test bed and accelerator for clean energy innovation, CCE agencies lack adequate tools to evaluate cost-effectiveness and other outcomes of potential program configurations. This makes it challenging for agencies to implement programs in ways that will be most beneficial to their communities.

Project Significance

This project provides CCE agencies with tools and information to evaluate the costs and benefits of two potential community-serving programs. Agency staff can use our toolkit to predict customer responses to and resulting effects of the programs, rather than relying on anecdotal evidence or performing extensive research. They can find further information on program design factors in our successful practices guide. The two complementary parts of our project will help agencies choose and design effective programs that minimize costs and maximize societal benefits.

Objectives

1. Build an interactive toolkit that CCE agencies can use to predict costs and benefits of two potential programs:

Electric Vehicle (EV) Rebates: Agencies offer their customers monetary incentives to subsidize EV purchases.

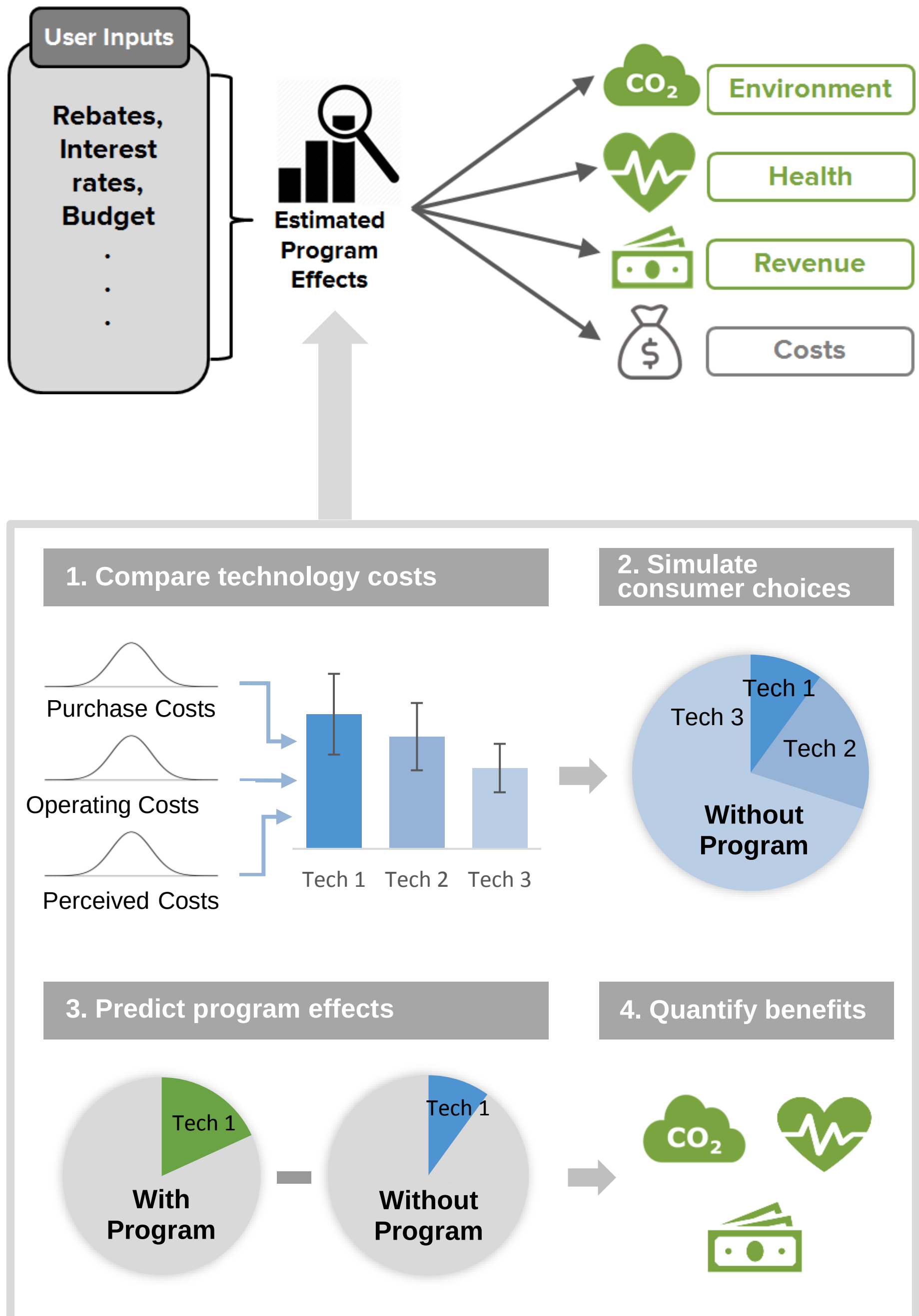
Residential Solar Financing: Agencies offer loans to their customers seeking to install a solar photovoltaic (PV) system for their homes.

2. Create a guide containing successful practices and recommendations for implementing effective programs.

Toolkit Overview

Our toolkit allows users to set a variety of model inputs, depending on their desired program. These include incentive amounts, budget, energy sources, and more. Based on these specifications, the toolkit predicts program effects on the environment, health, and agency revenues.

Users can then compare the predicted effects of changing certain project specifics - such as incentive amount or interest rate - to design more effective programs.



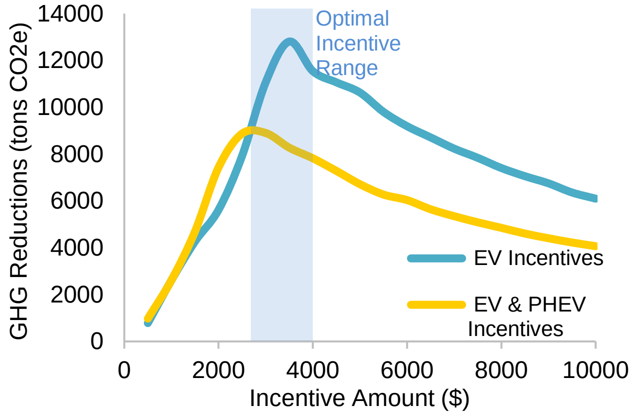
Modeling Approach

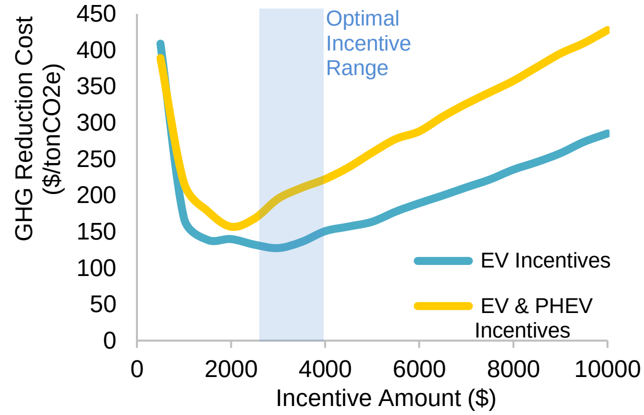
We built this toolkit using the concept of the Technology Choice Model (TCM), an economic input-output model that predicts consumer choices given a number of competing options with distinct costs.[1] TCM simulates consumer choices based on the total perceived cost of each purchase option. Toolkit users can set program parameters that affect the total cost of purchasing an EV or investing in a home solar PV system. The models then predict the change in overall uptake of these options and use this change to calculate environmental and health impacts caused by the program.

Key Findings: Electric Vehicle Rebates

Our EV toolkit module helps users design programs to cause the most cost-effective GHG reductions using EV rebates. Users can choose to offer incentives on EVs, plug-in hybrid vehicles (PHEVs), or both. The graphs below show the results over a range of incentive levels with a sample set of program parameters.

Mid-level incentives caused the maximum GHG reductions possible with the program budget tested.



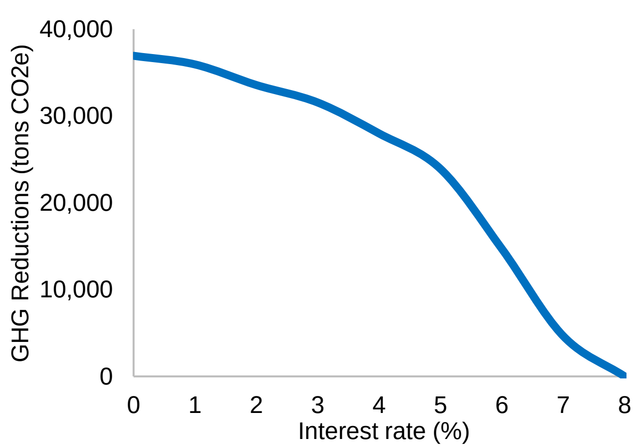


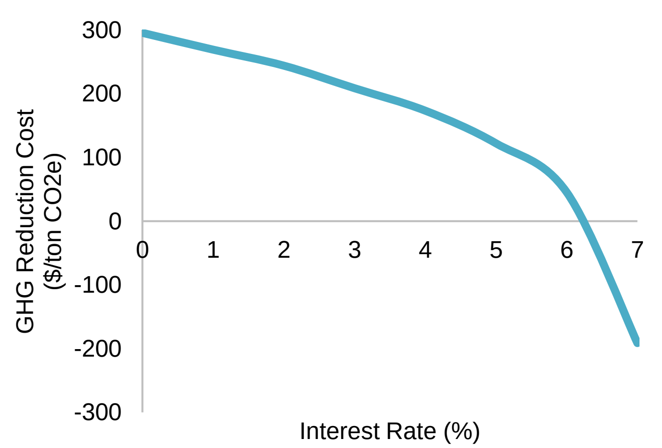
The results indicated that low rebate amounts incentivize few EV purchases and are not cost-effective for reducing GHG emissions. Mid-level incentives in the $3,000-$4,000 range minimized the present cost of GHG emission reductions. Because the model used a set budget, these incentive amounts also maximized total GHG emission reductions. In general, incentives for only EVs resulted in greater emission reductions than incentives for both EVs and PHEVS. Specific model results will vary depending on the user-input program parameters.

Key Findings: Residential Solar Financing

Agencies can use our solar module to predict the effects of offering financing to residents at different interest rates. The graphs below show the GHG emission reductions and net present value of emission reduction costs over a range of incentive levels with a sample set of program parameters.

Lower interest rates caused higher GHG reductions, but higher interest rates reduced the cost.

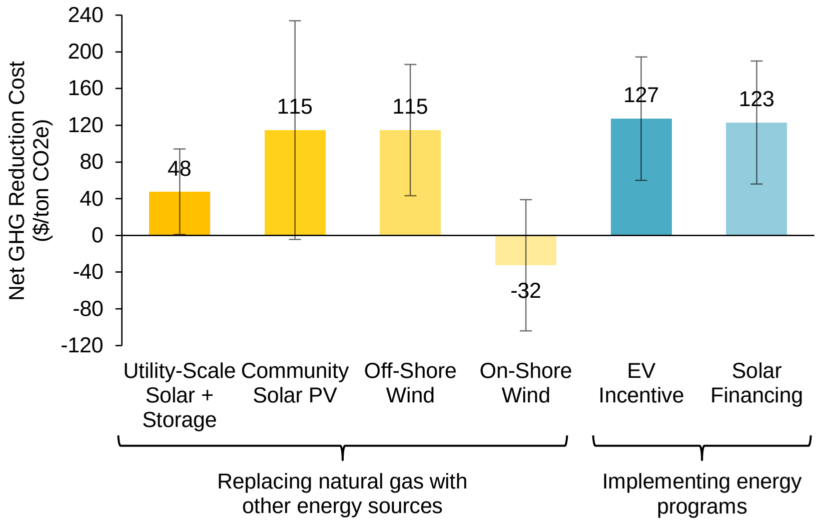




The results indicated that setting the program's interest rate slightly lower than the market interest rate results in the highest revenues, as consumers switch from other financing products to the agency program. However, this causes less GHG emission reductions than lower rates would as residents are less likely overall to find purchasing solar cheaper or more desirable than purchasing grid electricity. An agency can consider the effect of these tradeoffs on its financial and social goals when setting its interest rate.

Conclusions

CCE agencies are looking for effective ways to decide how to best design programs, and which programs to implement. Our toolkit addresses the first need by allowing users to adjust key program parameters to optimally design an EV incentive program or residential solar financing program. Our models capture consumers' non-monetary values to predict how they will respond to economic incentives. As a result, our models accurately predict uptake of an incentivized technology and calculate the resulting environmental, financial, and health impacts. The models are limited, however, in that they can only consider one incentive level at a time. For example, further research would need to be done if an agency wanted to offer different rebates to different income groups or offer different loan rates to individuals with high or low credit scores.



Agencies can also use our toolkit to address their need for evidence-based ways to decide among options: after modeling optimal energy program designs, they can compare the programs' predicted GHG emission reduction costs to each other and to those of replacing natural gas electricity with various forms of solar and wind energy. An example of such a comparison is shown to the left. The error bars for energy sources represent the spread in potential procurement costs, while those for energy programs represent the spread in costs for various EV incentive levels and PV interest rates.

Both programs we studied result in GHG emission reductions, though the impact depends on the agency's electricity mix. For example, the cleaner the electricity mix, the farther EV emissions are below internal combustion vehicle emissions. Agencies should continue to green their electricity mixes when implementing these programs to maximize their environmental and health benefits.

Once agencies decide on a program, they can reference our successful practices guide for recommendations on how to execute it. The guide covers important factors in program success such as marketing effectively and simplifying the participation process. Its principles are useful beyond the programs studied in this project.

Acknowledgements

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References:
[1] Kätelhön, A., Bardow, A., & Suh, S. (2016). Stochastic Technology Choice Model for Consequential Life Cycle Assessment. *Environmental Science & Technology,50*(23), 12575-12583. doi:10.1021/acs.est.6b04270
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