Distributed generation investment strategies for hybrid solar projects in Ontario, Canada

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Overview

In cases where system constraints support the use of distributed electrical generation projects, hybrid solar power plants have been identified as a potential source of reliable, abundant, and environmentally friendly energy (Dennis et al. 2016). By combining energy sources, hybrid power plants are able to overcome issues related to intermittency and excess electricity generation that are typically associated with renewable energy sources. However, significant questions remain concerning the best strategies for distributed hybrid solar projects.

Methods

This research used hybrid modelling software (HOMER Pro) to perform a direct comparative analysis of the performance and efficacy of a series of different hybrid solar power plant designs, with the requirement to meet a typical annual load profile where the peak day demand is 2 megawatts. The study compared a variety of hybrid solar power plant designs (using solar, wind, batteries, and fossil fuel generators) on the basis of three equal factors (GHG emission reductions, power generation and reliability, and cost-effectiveness), under similar environmental conditions and location.

Results

The modelling results showed that the hybrid solar power plant designs that included the use of PV, batteries and either diesel or natural gas performed best across all three primary factors of analysis, while models that added wind technology to those designs produced the lowest quantities of GHG emissions among all of the hybrid solar power plant designs. However, even with the Canadian government's current carbon tax policy, the level of economic benefit is not sufficient to discourage the use of fossil fuel generation as part of a distributed generation design at present. However, with significant increases in global oil and natural gas prices the economic benefit of hybrid solar plant designs has improved and, if sustained, may see an increase in interest for meeting future distributed generation needs.

Conclusions

Currently challenges remain for promoting distributed hybrid solar power projects in jurisdictions where pollution pricing measures remain relatively low. Power generation, reliability and cost continue to have a greater effect on the economic performance of these projects. Future policy strategy will need to recognize that greater performance at a lower cost is required for the renewable energy technology elements of a distributed hybrid power project. For now, and in the immediate future, promoting the most environmentally-friendly distributed generation project will require acceptance of higher electricity rates by the end user.

References

Dennis K, Colburn K, Lazar J. 2016. Environmentally beneficial electrification: The dawn of 'emissions efficiency.' Electr J. 29(6):52–58. Available from: doi:10.1016/j.tej.2016.07.007.