

## Optimization of Wind, Diesel and Battery Systems for Remote Areas

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Consider the problem of providing electrical power to an isolated site such as a village or a mine in northern Canada that is hundreds of kilometers from the closest point on the power grid. The high extension cost of the grid means that electrical energy must be produced locally and autonomously. Electricity may be supplied using diesel generation. This technology is easy to implement but is also expensive. The use of wind turbines in remote areas to reduce fuel consumption was proposed in the 1990s. This technology is now widely used in off-grid sites. The recent developments in storage technology mean that batteries may further reduce the use of diesel generators. The challenge in optimizing such hybrid energy systems is to find both the optimal sizing of the systems and the optimal operational strategy: the two are linked and impact each other. Because hybrid systems are often designed by simulation, dispatch rules must be set a priori, and this necessarily influences the outcome. We present an integer linear optimization model to find the optimal design and dispatching scenario without the need for dispatch rules. The best implementable rules are then deduced from the optimal solution. Because our solution represents an ideal dispatch, it provides a reference to benchmark dispatch strategies.