

INTRODUCING

# WindStore

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**Delivering significant savings to the customer.**

**Preserving operational benefits and resources for you.**

The WindStore Model uses renewable energy optimization algorithms to support wind energy resources and customer thermal storage systems without incurring battery storage expenditures. WindStore shows you exactly how much financial value exists within the marriage of intermittent wind and customer heating and cooling. By simulating and valuing the real-time price arbitrage, intermittent renewable resource firming and sinking, and dynamically dispatched load control benefits together, WindStore helps manage the uncertainty between the supply and demand systems.

**Measuring the benefits of operational control strategies**

- Capacity benefits of using thermal storage with wind firming to reduce system peak demand, or to shift load in response to costs
- Conservation benefits of peak to off-peak arbitrage of energy prices, optimally determined
- Wind energy sink during hours of low system demand, and mitigation of depressed wind value
- Real-time firming of intermittent wind energy
- Real-time load following for wind or other supply
- Spinning or non-spinning ancillary service benefits
- Carbon management

**Maintaining customer preferences. Respecting storage limits.**

The WindStore model measures the value and cost-effectiveness of price shifting (buying low and selling high) and load following while adhering to customer comfort preferences and storage technology limits. Both the inherent end-use value and the options of dynamic dispatching are valued for the wind-to-thermal storage mix combination potential. In some cases, this model can provide significant savings to customers and still preserve major operational benefits to the system and wind resources.

## How can we do this?

Integral Analytics (IA) borrows many of the operational and valuation algorithms from its award-winning DSMore™ software to accurately value avoided supply costs. It then marries supply-side valuations with IA's sophisticated array of dynamically dispatchable optimization commands housed within its IDROP™ real-time optimization engine. This renders valuation results which closely match the real-world operational value of virtual storage strategies.

Before you spend big dollars buying expensive storage batteries, consider the smarter route of virtual storage. You may find that your customers are much happier with free heat or large rebates than paying higher rates to subsidize storage systems.

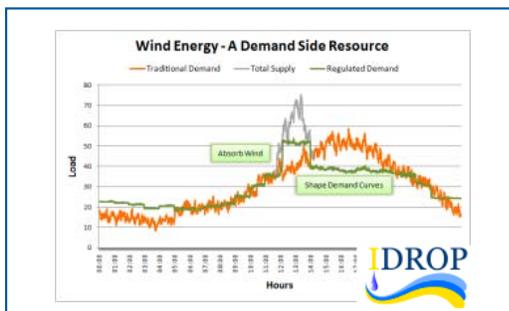
## Value of Wind to Thermal Arbitrage



Peak to off-peak load shifting can be specified, or the model can choose the best hours to charge given a price forecast and the limitations of the thermal storage technology. Also shown: optimal charging during low cost hours and dissipation during high cost hours.



## Interactive Space and Water Heater Load-Shaping Controls



A distributed array of thermal storage furnaces and residential water heaters controlled by IDROP is capable of absorbing power and storing energy.

"Integral Analytics' WindStore model really demonstrates the win-win opportunity of combining thermal storage technology with renewable wind generation. Using the WindStore smart-control analytics, we were able to demonstrate significant financial and operational benefits. It helped us to intelligently optimize our resource portfolios with dynamic dispatching and smart-charging."

Kim Pederson  
Manager, Market Planning  
Otter Tail Power Company

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