

*Grid Services from Responsive Loads  
and Electric Drive Vehicles in the  
Next Generation Utility*

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IEEE PES T&D Conference, 2008

Special Interest Session #2  
Rethinking T&D Architecture for DER: WHY?

Rocky Mountain Institute

Our current utility system has not kept pace with our  
modern society



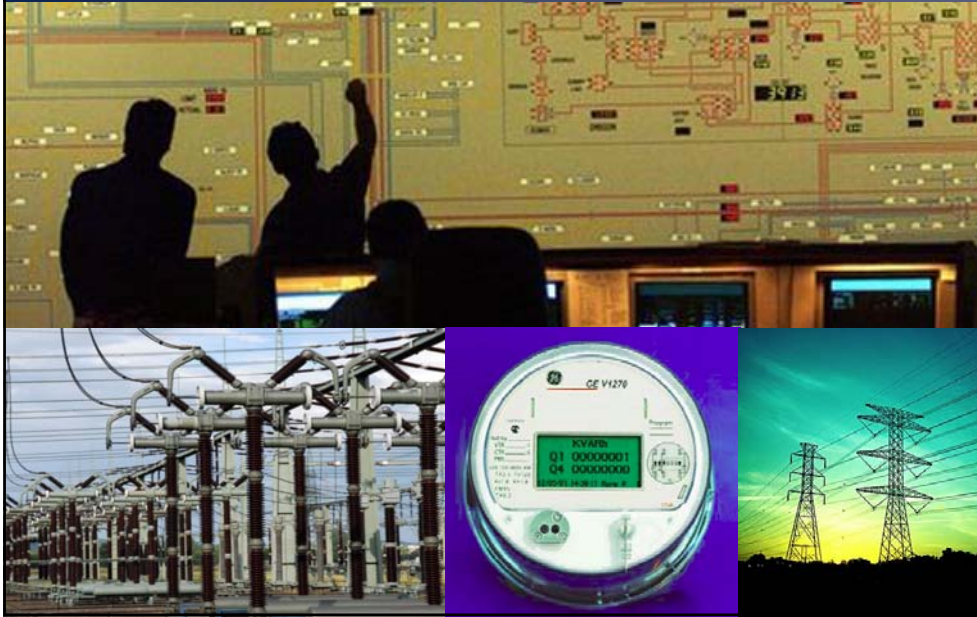
Today's ancillary services will not be sufficient for the future electricity system



Industry professionals have an opportunity to make change and succeed in the market



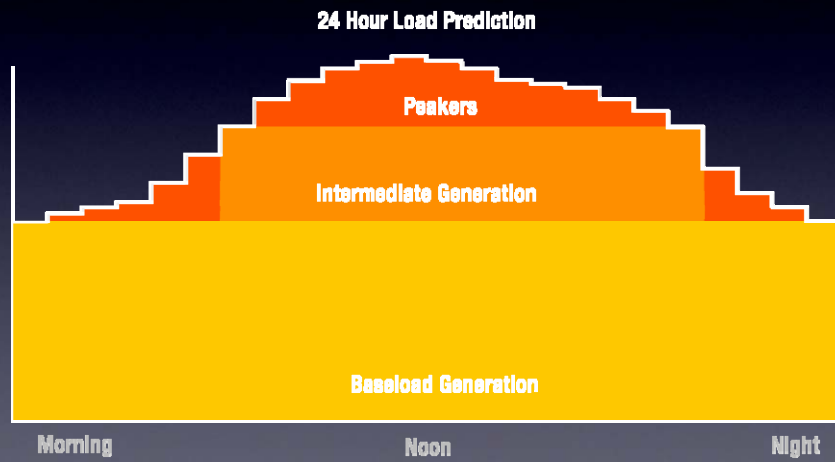
Future utility systems will require expanded *grid* services



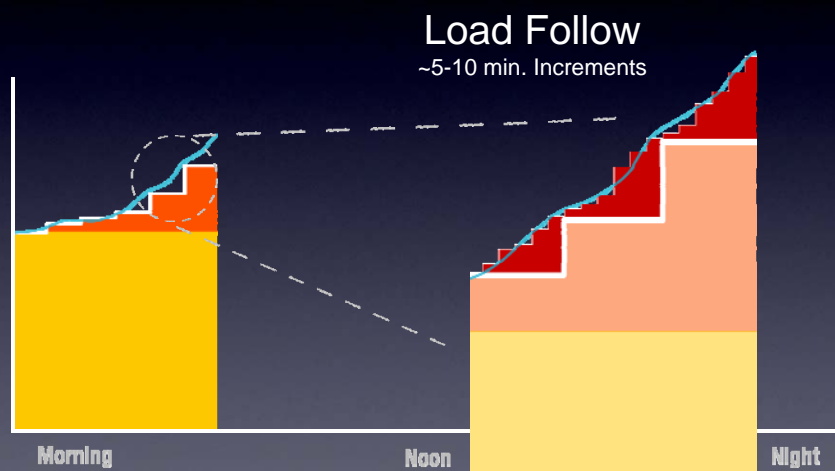
Responsive loads and electric drive vehicles will provide expanded grid services in NGU



## Let's take a closer look at today's ancillary services



## Normal operations: load following and regulation





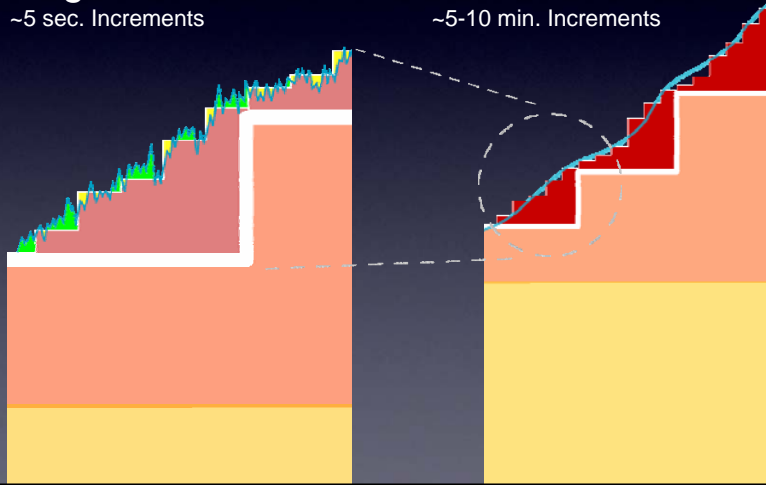
## Normal operations: load following and regulation

### Regulation

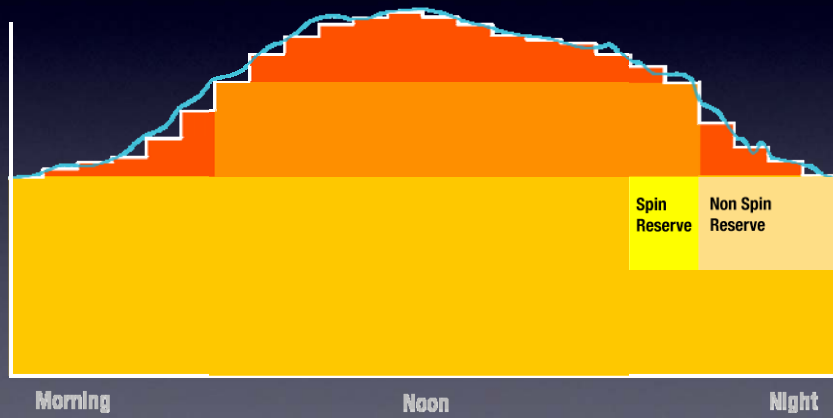
~5 sec. Increments

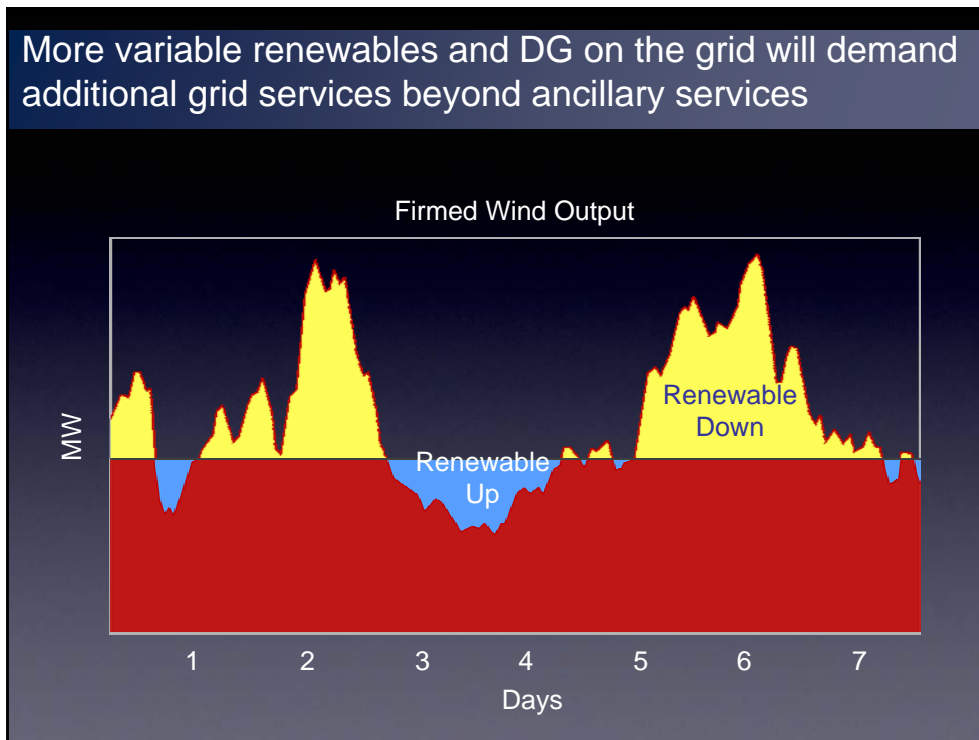
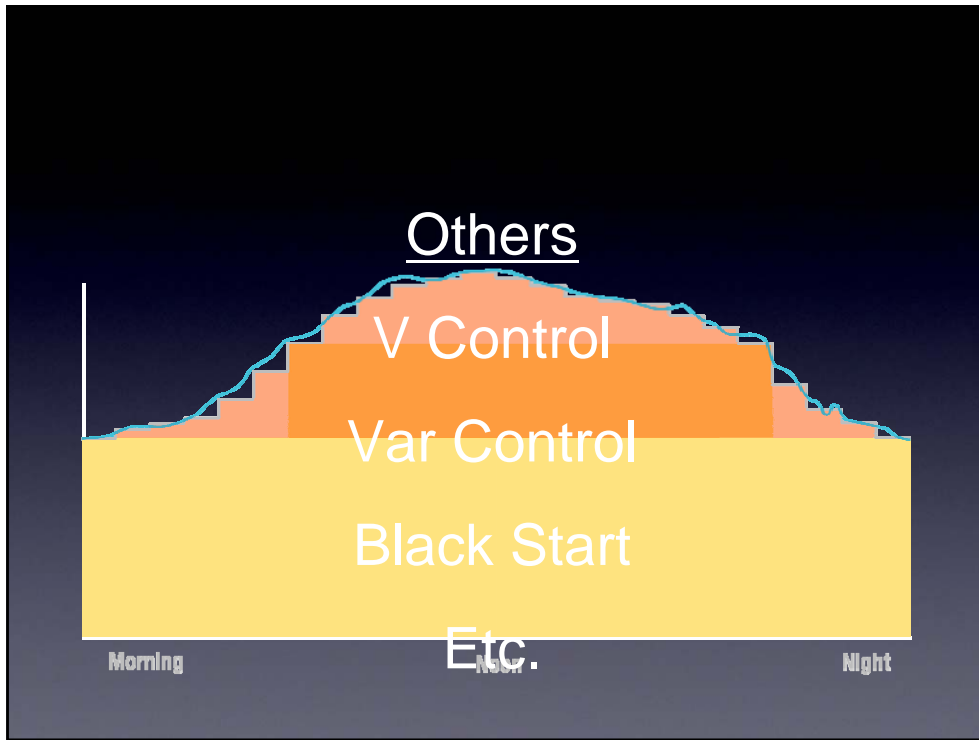
### Load Follow

~5-10 min. Increments

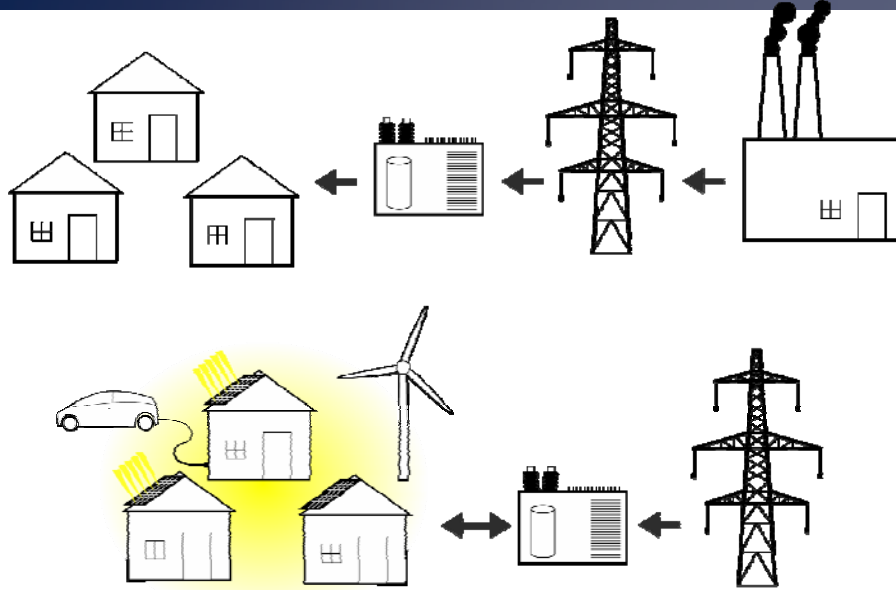


## Contingency operations: spinning and non-spinning reserves

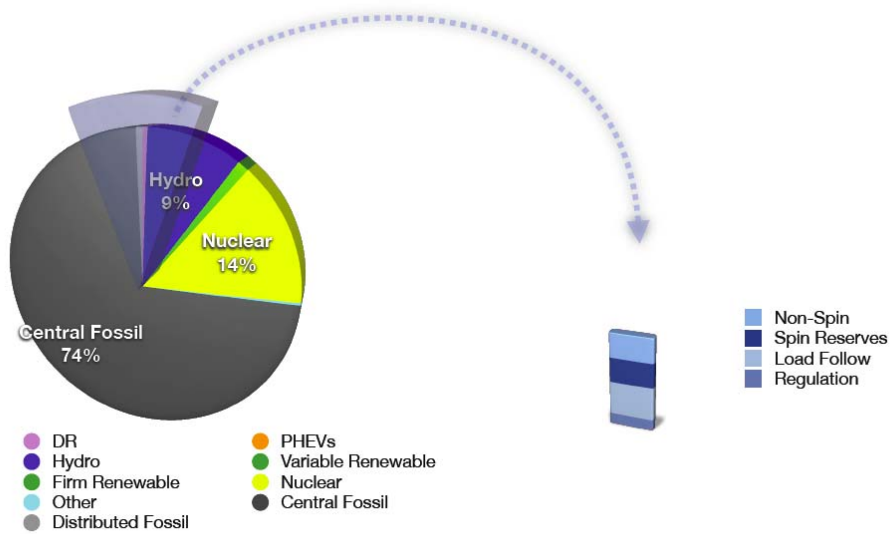




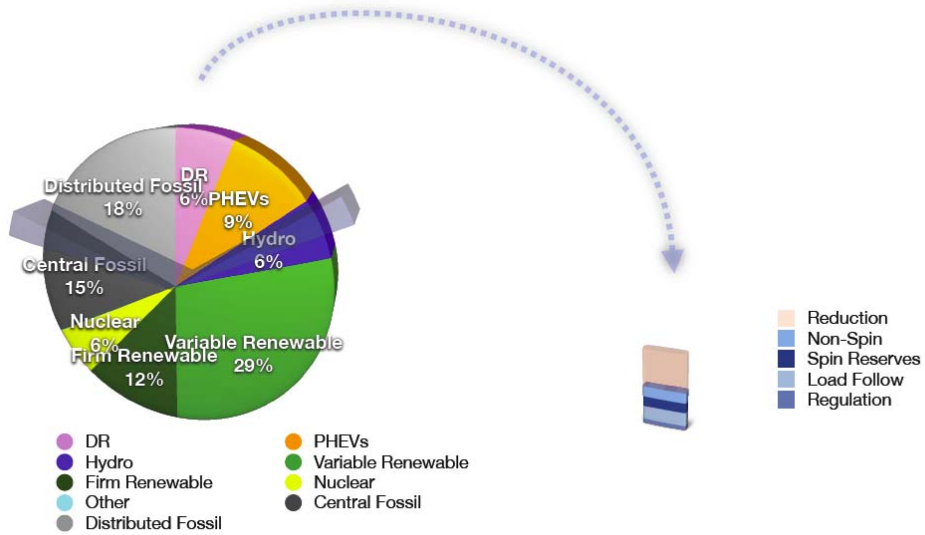
More variable renewables and DG on the grid will demand additional grid services beyond ancillary services



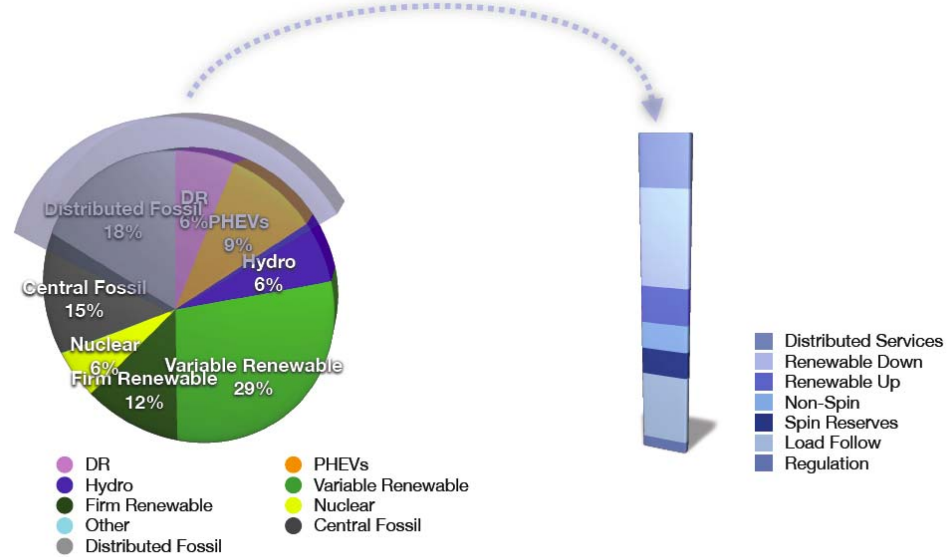
Today's ancillary services come primarily from centralized fossil and hydroelectric Generators



In the future less generation will come from sources that currently provide ancillary services



xEVs, responsive loads and distributed fossil generators will allow expanded grid services



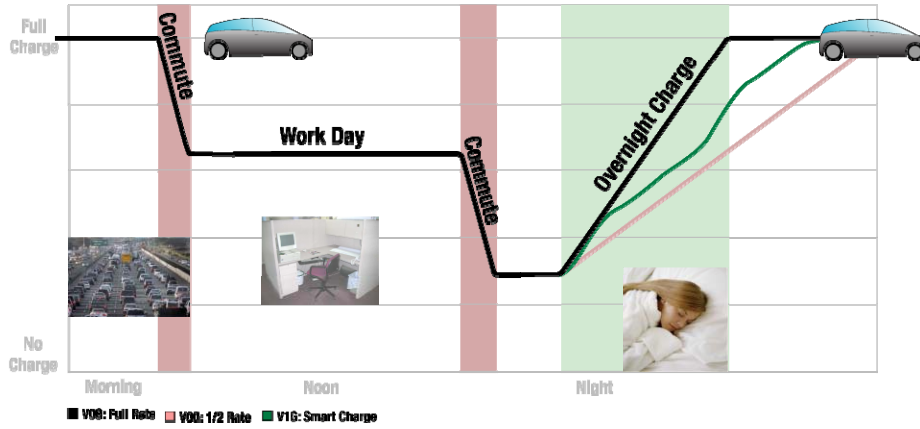


# Electric Drive Vehicles As Generating Loads

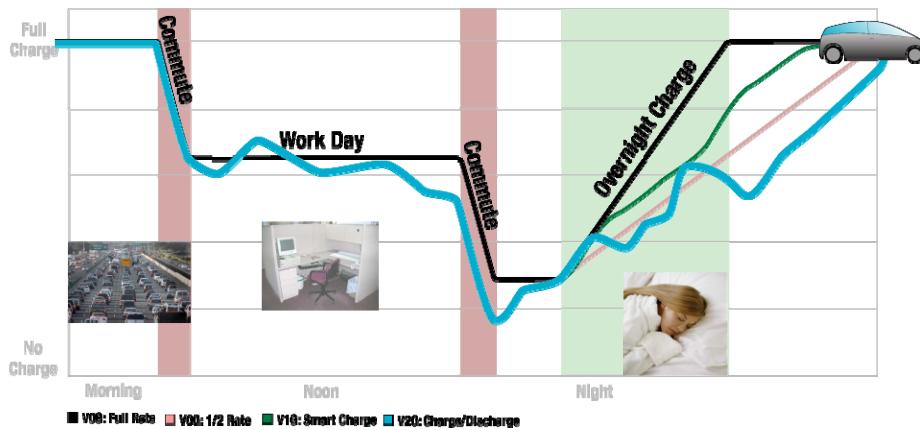
Generating loads such as xEVs can provide bi-directional power flow



## V1G is essentially a responsive load



## V2G can provide expanded grid services by its ability to return power to the grid

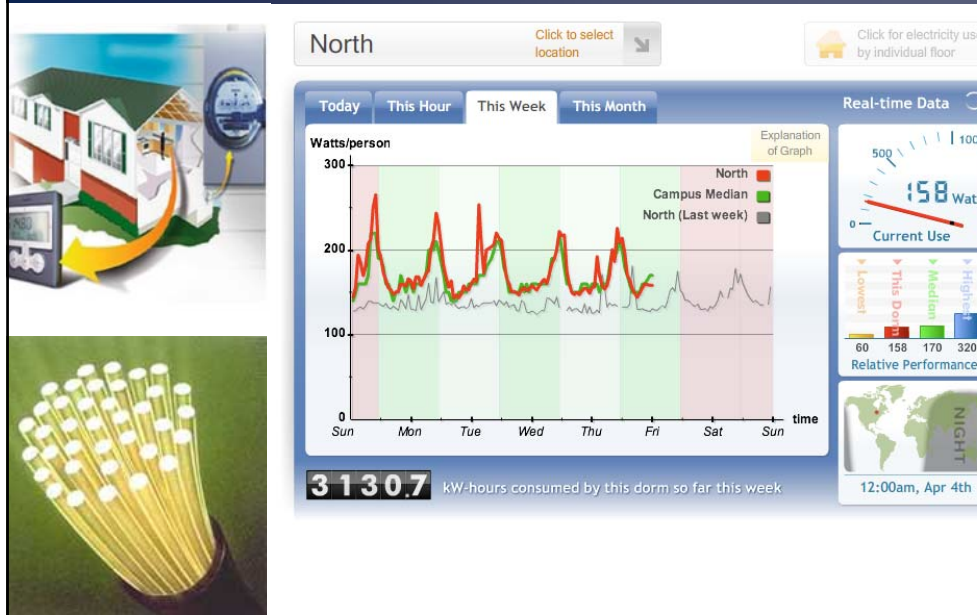


# Responsive Loads

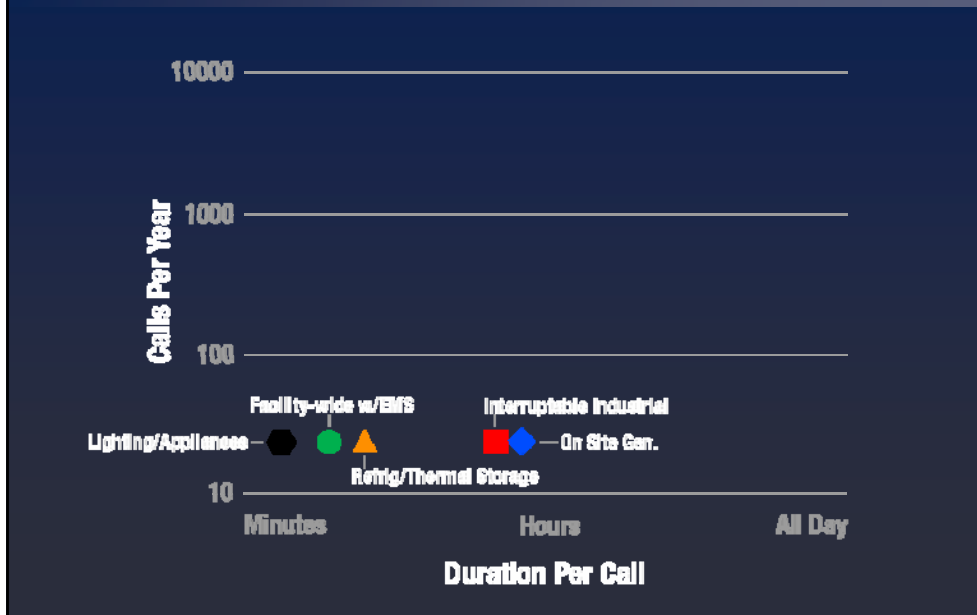
Responsive loads can effectively provide grid services



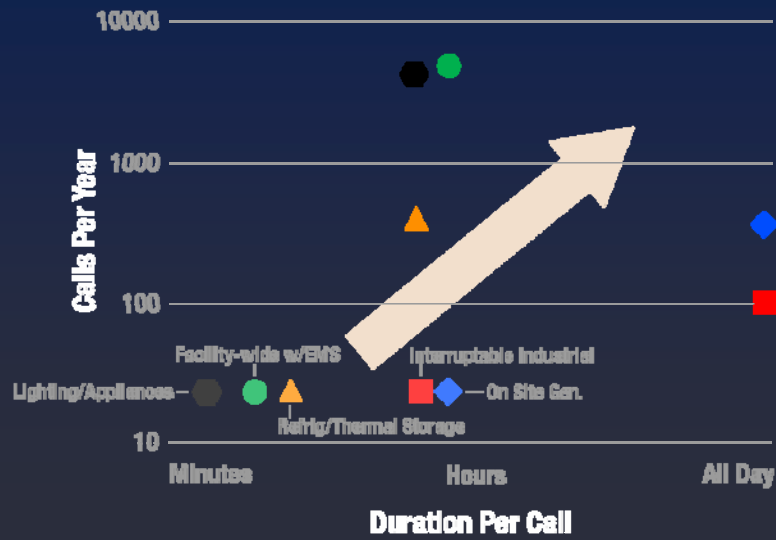
## Responsive loads will be much more intelligent



## How long and how often can responsive loads be operated?



How long and how often can responsive loads be operated?



Summary



Grid services will need to play a bigger role in the NGU



Responsive and generating loads are two key resources for grid services



They enable a low carbon, efficient, and renewable electric utility



We invite *you* to join us in testing these concepts and implementing change

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