



# Energy Storage Valuation Methodology and Supporting Tool

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**Electricity Advisory Committee: Storage Valuation Panel**

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# Electric Power Research Institute (EPRI)

- **Independent, non-profit, collaborative** research institute, with full spectrum electric industry coverage
- EPRI members represent ~90% of energy delivered in the U.S.
- Energy Storage Research Program has over 30 funding utility members



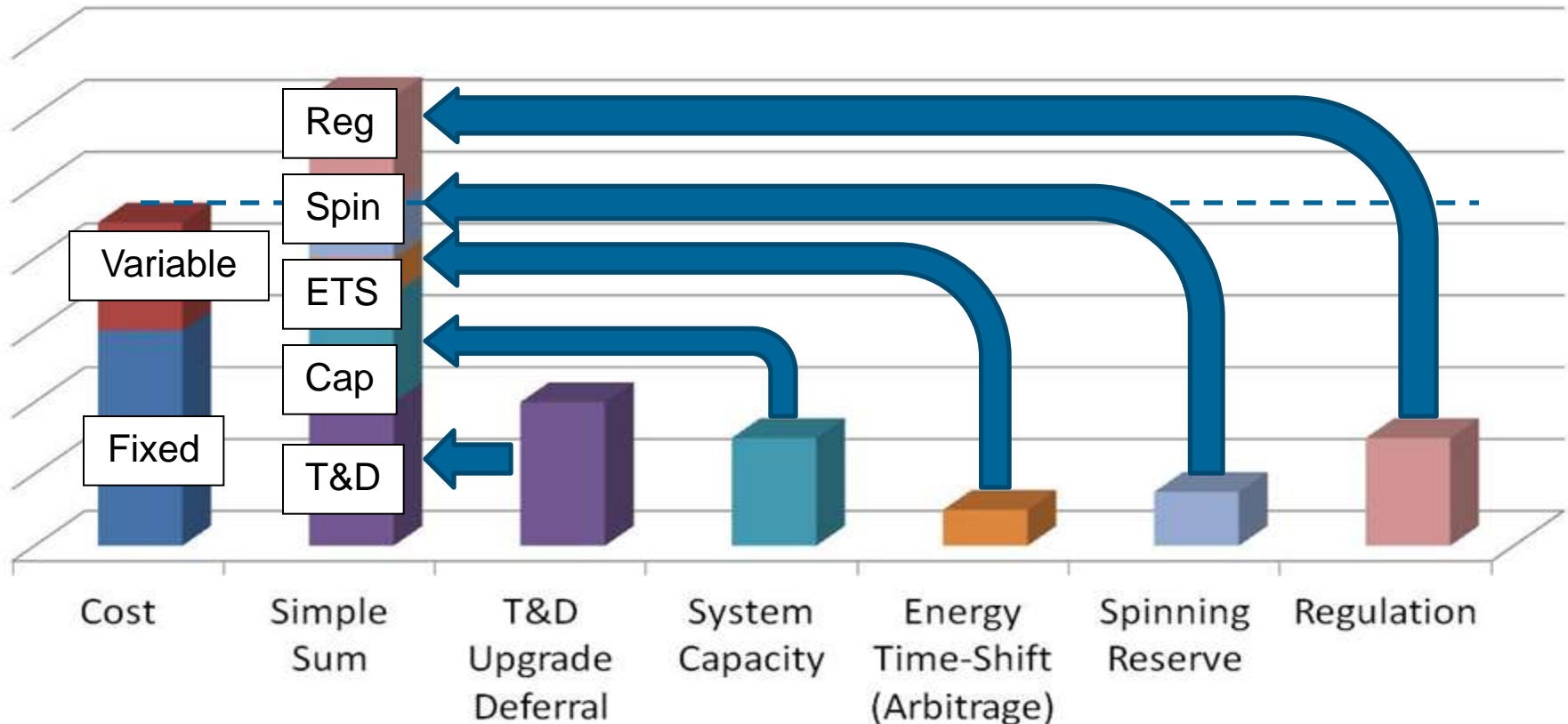
# Storage Valuation Can be Confusing!

**Voltage Support**      **Load Following**  
**Arbitrage**      **Spinning Reserve**      **Congestion Relief**  
**Renewable Integration**      **Non-spinning Reserve**  
**Frequency Regulation**      **Distribution Deferral**  
**Black Start**      **Backup Power**  
**Asset Utilization**      **Ramping**      **Reduced GHG?**  
**Lower Production Costs**      **Resource Adequacy**  
**Demand Charge Management**      **Transmission Deferral**

**Energy storage defies characterization as a generation, transmission, distribution, or customer asset.**

# Fundamental Question: What Services is Energy Storage Providing to the Grid?

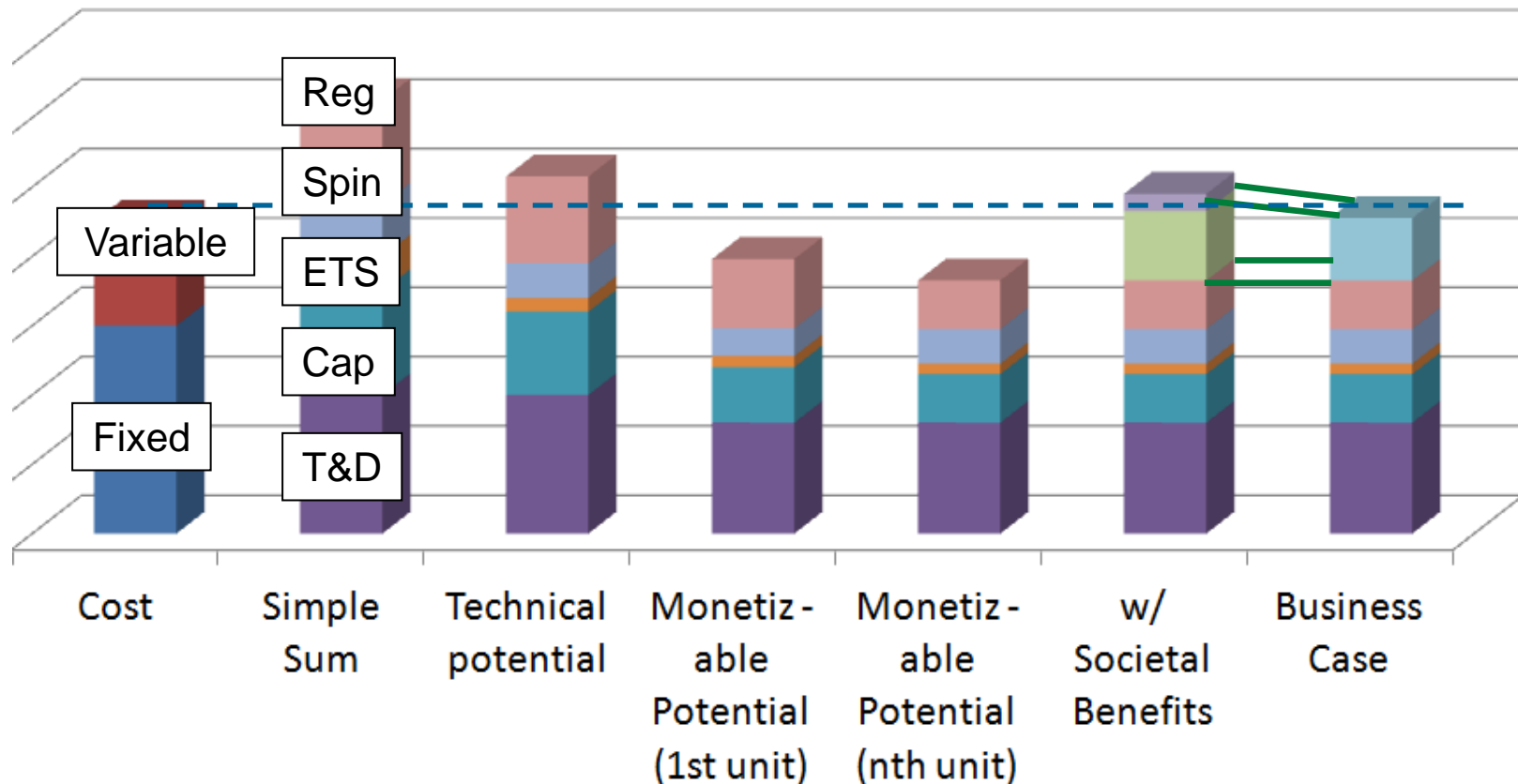
*For Illustration Only*



**Cost of Storage exceeds benefits from single service**

**Focus should be on stacking benefits.**

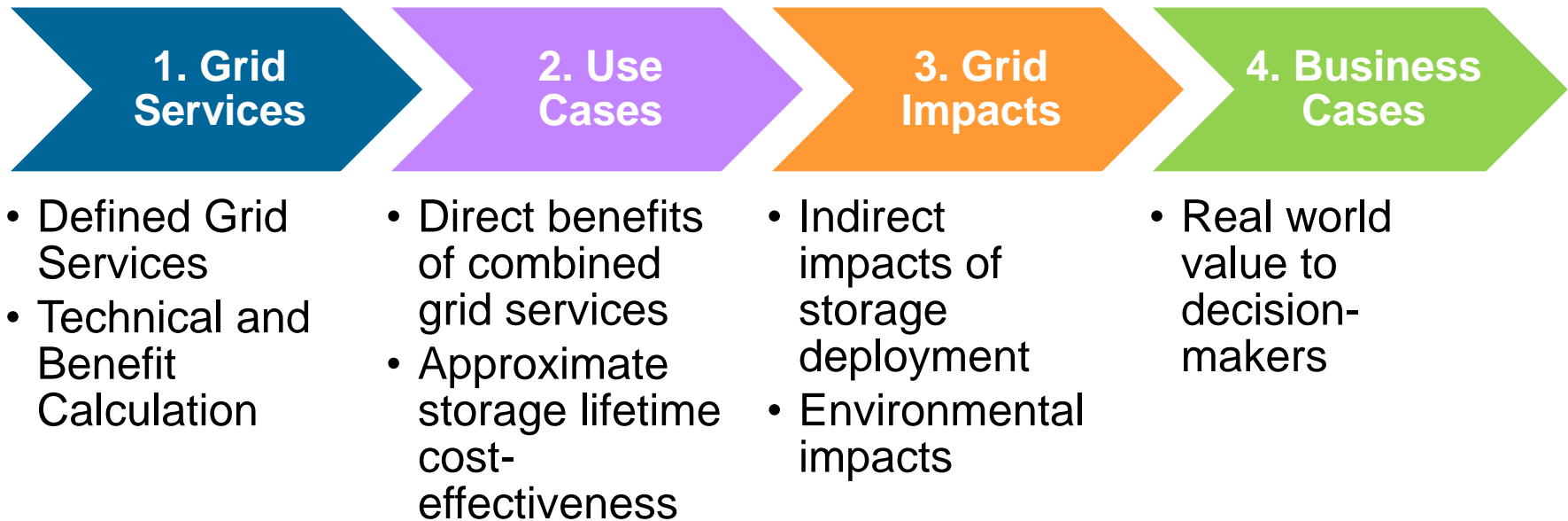
# Stacking Benefits: Understanding Storage Valuation is a Journey of Multiple Phases



**Later phases involve increasing detail, complexity, resources.**

**Validated tools for storage valuation are needed.**

# EPRI Proposed Methodology for Clarifying the Phases of Storage Valuation



# EPRI Energy Storage Valuation Tool (ESVT) Supports this Methodology

## INPUTS

### Time-Varying Prices/Loads



### Financial Assumptions

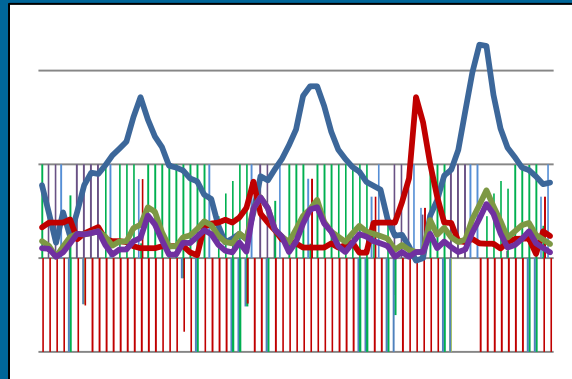


### Storage Cost / Performance



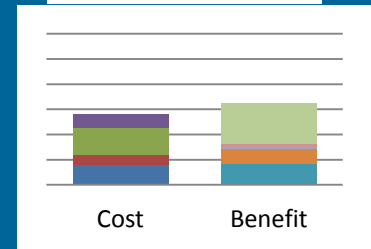
## MODEL

### Optimization of Storage Operation



## OUTPUTS

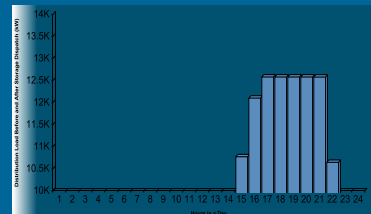
### Cost / Benefit



### Detailed Financials

A screenshot of a detailed financial spreadsheet with multiple columns and rows of data, including headers and numerical values.

### Storage Operation



# ESVT Applied to Inform CPUC Energy Storage Proceeding

## Example Result (Draft): 2020 Bulk Battery Storage Peaker Substitution Base Case

- **Benefit/Cost Ratio = 1.17**
- **Breakeven Storage Capital Cost: \$831/kWh (\$1662/kW)**

### CPUC Input Summary

Year 2020

50MW, 2hr (battery)

CapEx = \$1056/kW, \$528/kWh

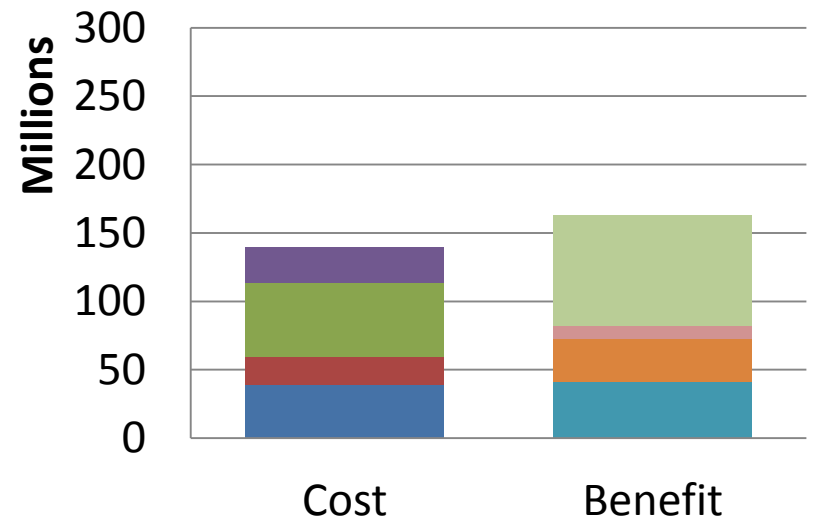
1 Batt Replacement @ \$250/kWh

11.5% discount rate

83% RT Efficiency

Energy & A/S prices escalated 3%/yr from CAISO 2011

### 2020 Base Case



**EPRI is Informing Regulators of Storage Value;**

**>30 Scenarios with Inputs Defined by CPUC stakeholders;**

**Public Report: June 30**



# Together...Shaping the Future of Electricity