ENERGY STORAGE
10:45 AM

TOM MULLOOLY
Moderator
Foley & Lardner

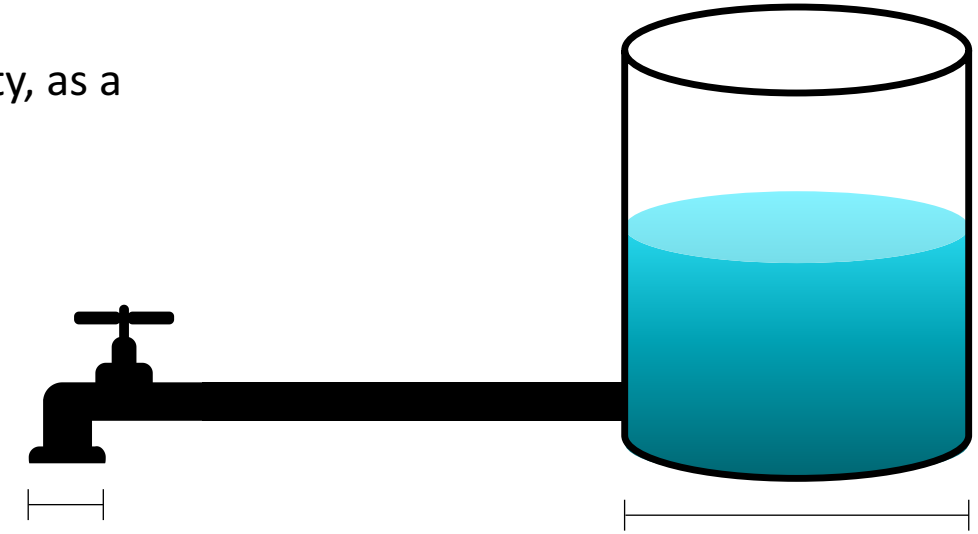
STEVE
DANBECK
Arch Electric

KATE
HOWLING
Invenergy

TIM WILSON
Gundersen
Health

Energy Storage 101 Terminology

A battery stores electricity, as a tank stores water:



Amount of available energy at a given time = **State of Charge** (SOC)

Pipe size = **Power**
Units: Kilowatts (kW)
Megawatts (MW)

Power is limited by the size and number of inverters

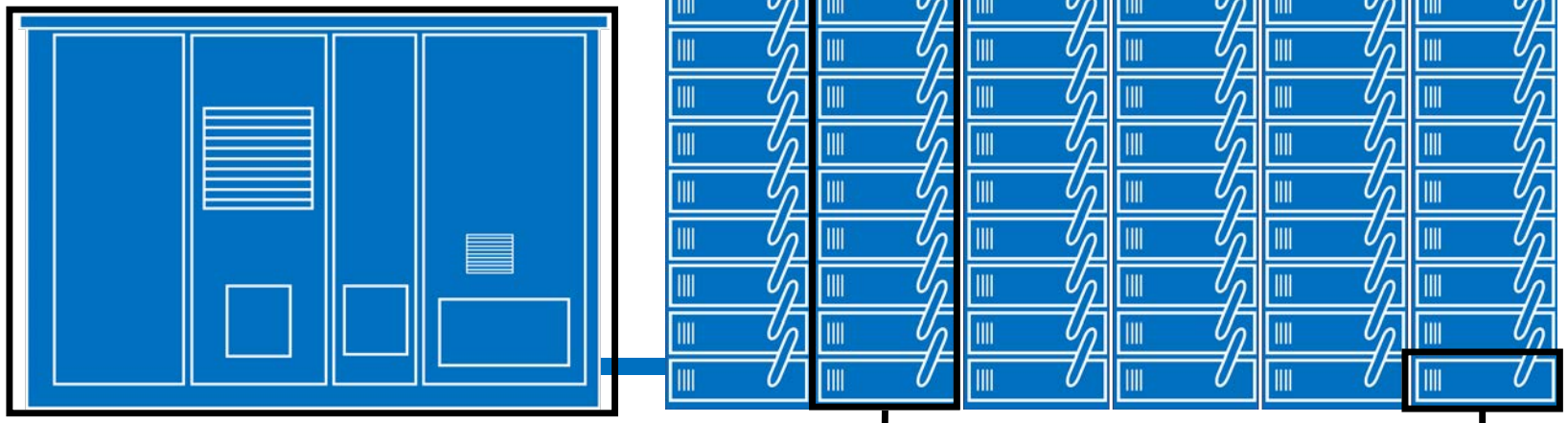
Size of tank = **Energy**
Units: Kilowatt-hours (kWh)
Megawatt-hours (MWh)

Energy is limited by the size and number of battery modules

Energy Storage 101 Terminology continued

DC Block

Inverter (a.k.a. PCS)



Each string has a **Battery Management System** (BMS) that monitors voltage, current, temperature, SOC, et.

The inverter rating dictates how much power can be charged or discharged to the battery (typically max charge power = max discharge power)

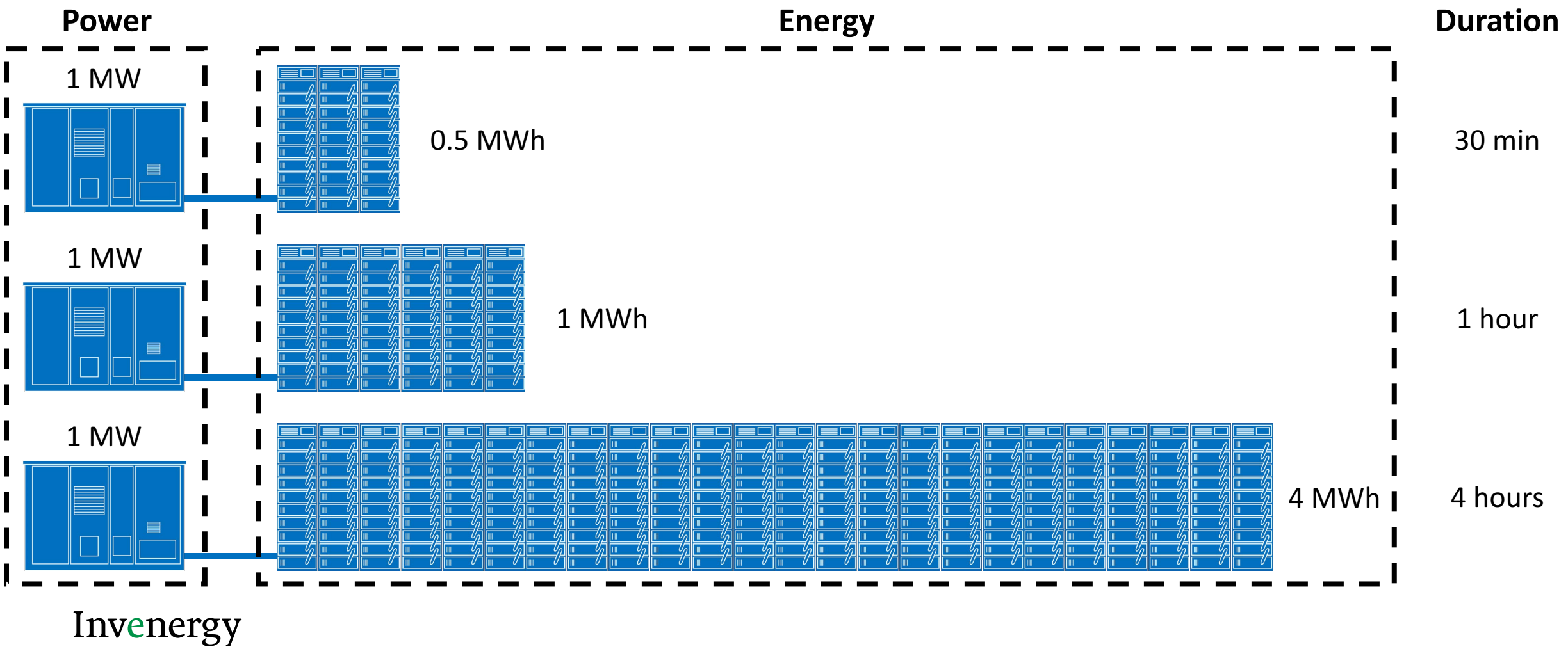
Multiple trays are wired in series to form a **Battery String**. Strings can be configured vertically in a single rack, across multiple racks, or horizontally.

The **Battery Tray** or **Module** is the smallest replaceable unit. It is filled with **Battery Cells**.

"Battery" = …almost anything, depending on who is speaking

Invenergy

Energy Storage 101 System Duration



Invenergy

Energy Storage 101 System Example

Grand Ridge IV Exp, 3MW, 1.5MWh

MidAmerican Energy Storage, 1MW, 4MWh

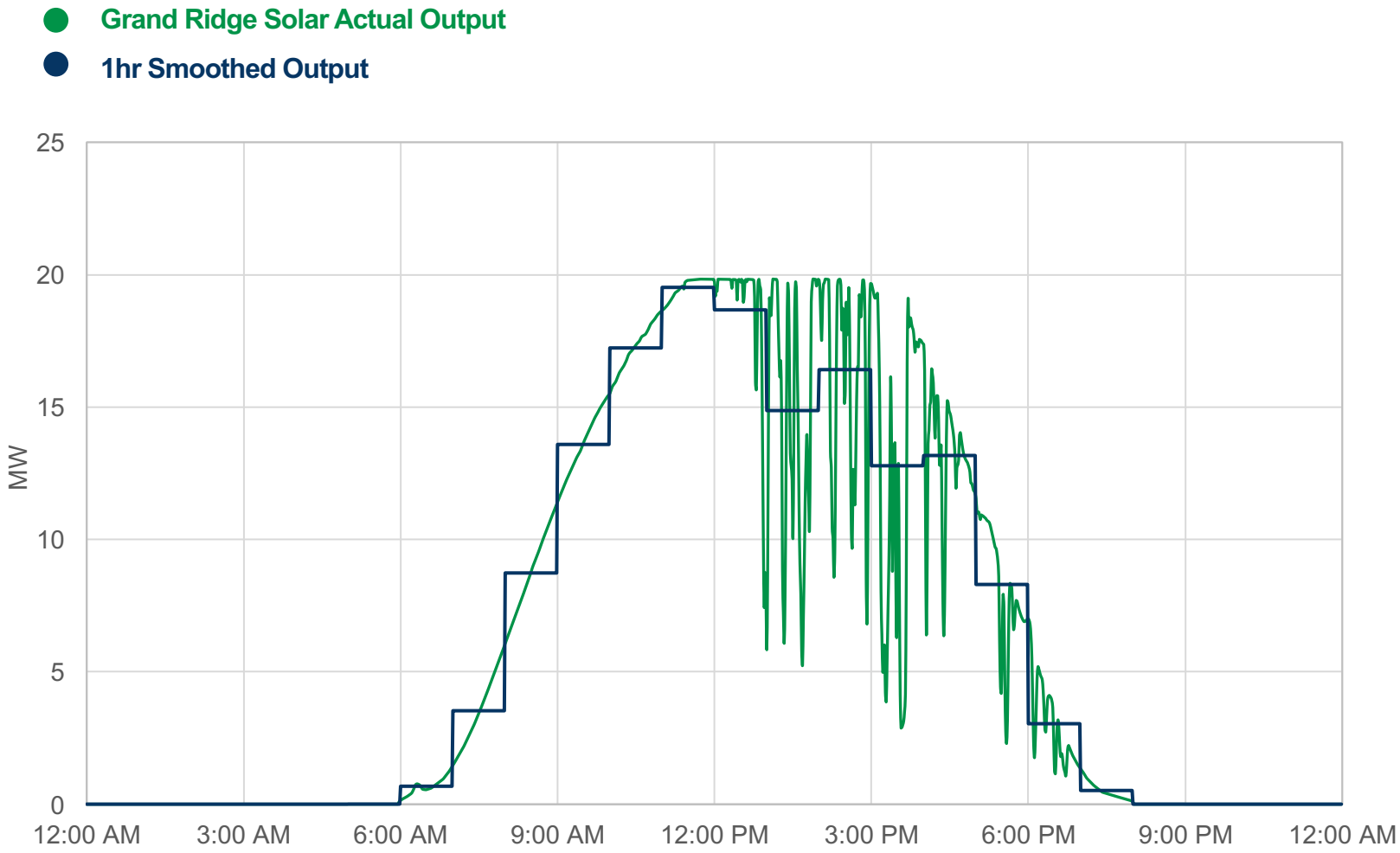
Invenergy

Solar + Storage: Renewable Firming

20 MW solar farm output

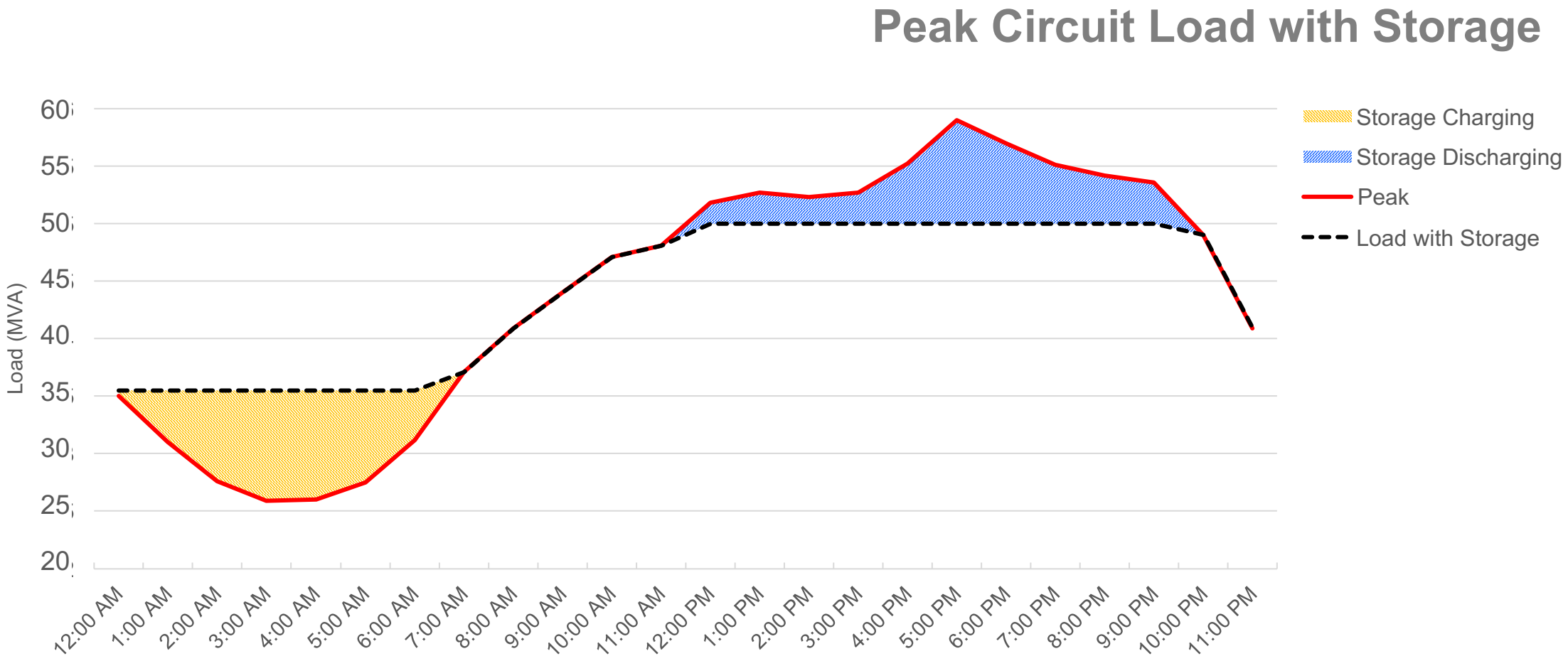
4 MW / 1 Hour duration battery

- Smooths variations into hourly firm blocks
- Reduce energy imbalances



Invenergy

Application: Peak Shaving



Invenergy

ENERGY STORAGE
10:45 AM

TOM MULLOOLY
Moderator
Foley & Lardner

STEVE
DANBECK
Arch Electric

KATE
HOWLING
Invenergy

TIM WILSON
Gundersen
Health