ESIC DER-VET Task Force

August 5, 2021

Miles Evans | EPRI
Andrew Etringer | EPRI
Halley Nathwani | EPRI
Suma Jothibasu | EPRI
Giovanni Damato | EPRI

Antitrust Guidelines

Antitrust laws apply to EPRI, its members, funders, advisors, licensees, contractors, and vendors. Violations can lead to civil and criminal liability.
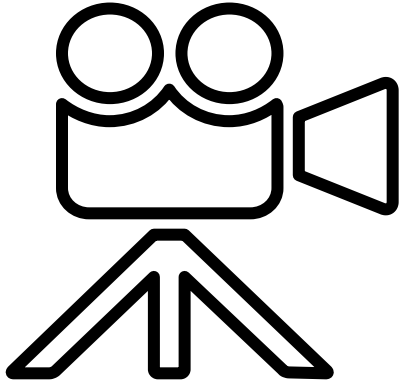
DO NOT DISCUSS…

- Pricing, production capacity, or cost information which is not publicly available;
- Sales territories, market shares, future product offerings;
- Confidential market strategies or business plans;
- Other competitively sensitive information;
- Advise or try to influence others on their business decisions (except to the extent that they are already public);
- Complaints or disparaging remarks concerning customers/suppliers/competitors.
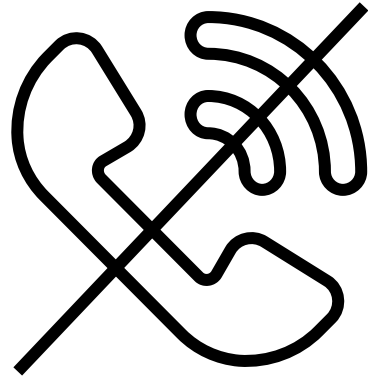
DO NOT AGREE…

- To discriminate against or refuse to deal with a supplier (boycott);
- To only do business on certain terms and conditions;
- To set (or fix) prices;
- To divide markets or technologies;
- To allocate customers/suppliers/territories;
- To suppress a technology;
- To the use, promotion or endorsement of particular vendors, contractors, consultants or products.
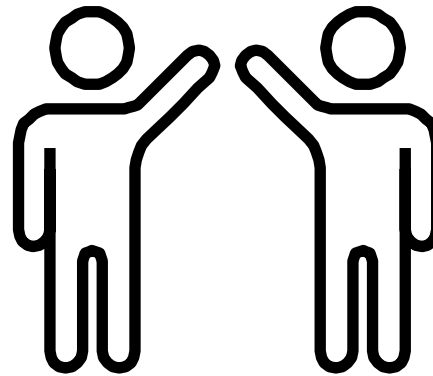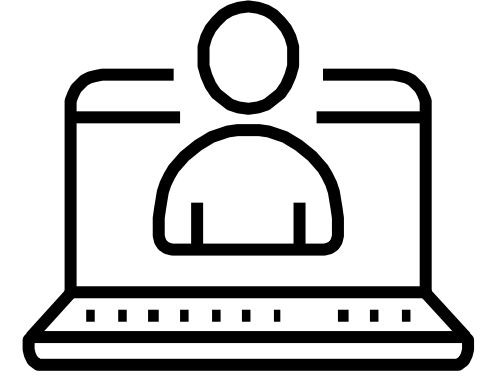
WebEx Tips & Tricks

We are recording this webcast

If your phone is muted to un-mute, press *6 on your phone or push the un-mute icon in WebEx

Please ask any questions at any time

We will post the presentation materials on der-vet.com

Your participation provides consent to the recording

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

ESIC DER-VET Task Force

August 5, 2021

Miles Evans | EPRI
Andrew Etringer | EPRI
Halley Nathwani | EPRI
Suma Jothibasu | EPRI
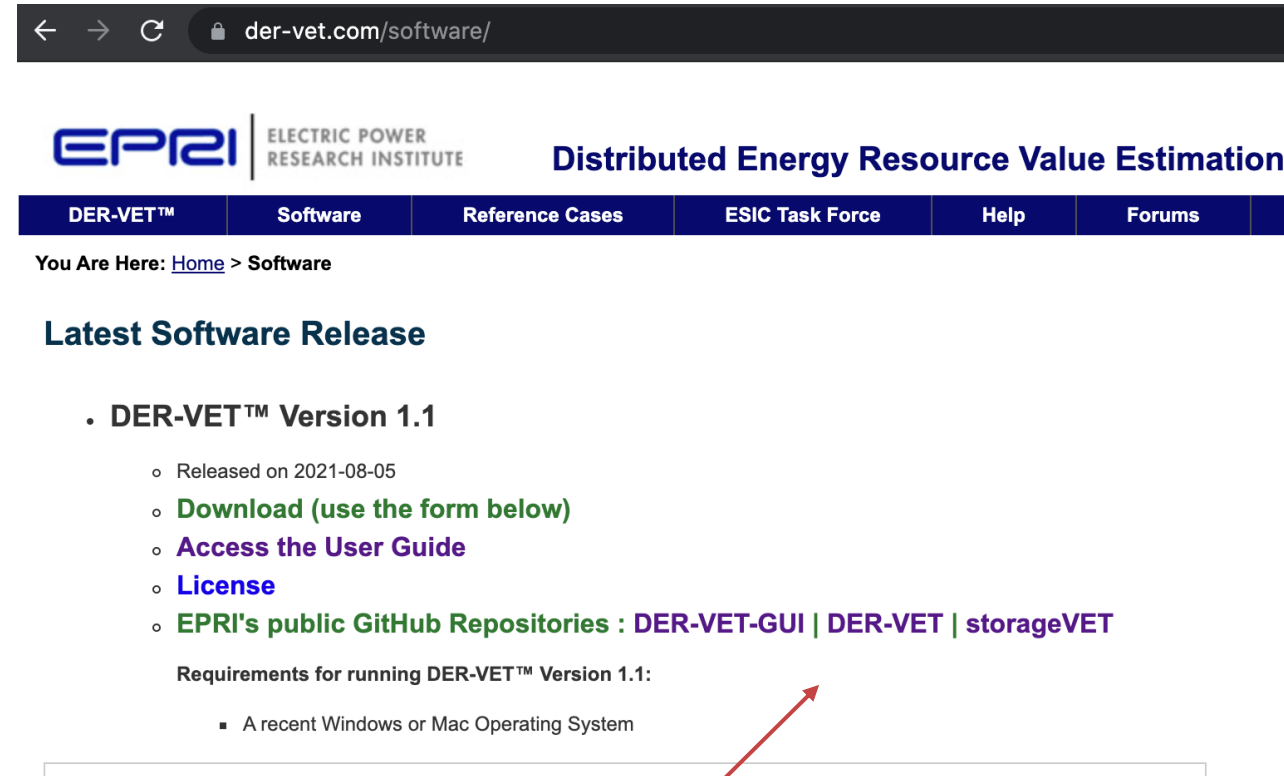**Giovanni Damato | EPRI**

Agenda

- DER-VET v1.1 Release
- Reference Case Updates

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

DER-VET V1.1

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Version 1.1 Released Today (August 5ᵗʰ, 2021)

- Highlights of Bug Fixes:
  - Downloading Sample CSV files from the GUI
  - Upload support for timeseries CSV file saved in Excel on a Mac
  - Demand Response input parameter fixes
  - Tariff file import errors fixed
  - Deferral proforma fix (should have a value beyond analysis year)

- **NOTE**: for further details on changes, please find the CHANGELOG.md files (continuously updated) in each of the 3 EPRI DER-VET GitHub repos.

der-vet.com/software/

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Distributed Energy Resource Value Estimation

| DER-VET™ | Software | Reference Cases | ESIC Task Force | Help | Forums |

You Are Here: Home > Software

Latest Software Release

- **DER-VET™ Version 1.1**
  - Released on 2021-08-05
  - **Download (use the form below)**
  - **Access the User Guide**
  - **License**
  - **EPRI's public GitHub Repositories : DER-VET-GUI | DER-VET | storageVET**

  Requirements for running DER-VET™ Version 1.1:

  - A recent Windows or Mac Operating System

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Version 1.1 Released Today (August 5th, 2021)

- Highlights of New GUI Features
  - Nicer process to import an existing project
  - Easy to now add a new pre-defined case
  - ~~Validation on timeseries data received from project import .json file~~
  - We now have 4 pre-defined use cases in the GUI, with webpage support
  - GUI support for negative growth rates
  - Save a deactivated Technology in a project

- IMPROVEMENTS
  - How-To video for installation on a Mac
  - Better instructions (README) for building DER-VET from source code
  - Dispatch plot sign convention update (GUI)
  - O&M cost calculation escalates rates before energy is considered (StorageVET)

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Reference Cases

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Distributed Energy Resource Value Estimation Tool (DER-VET™)

DER-VET™	Software	Reference Cases	ESIC Task Force	Help	Forums

You Are Here: Home > Reference Cases

Pre-Defined GUI Cases

- **User Guide: Quick Start Cases**
- **Video: Pre-Defined Case Tutorial**

- ### DER for Bill Reduction

  Have DER-VET size a battery energy storage system paired with a fixed-size solar PV system to maximize customer bill savings relative to the system's cost over its life. Use the "post-facto" option in DER-VET's reliability service to estimate how much critical load this economically-optimally sized and operated battery can cover and for how long.

  - **Presentation Materials | GUI Import Files**

- ### DER for Reliability

  In a similar case to "DER for Bill Reduction", use DER-VET's reliability service (with the post-facto option turned off) to optimally size and operate a battery energy storage system paired with a fixed-size solar PV system to guarantee critical load coverage during grid outages that last up to 4 hours.

  - **Presentation Materials | GUI Import Files**

- ### CAISO Market Case

  Calculate the maximal value of a fixed-size battery energy storage system as it participates in the CAISO day-ahead energy and frequency regulation markets during a historical year.

  - **Presentation Materials | GUI Import Files**

- ### EV Battery Sizing

  Optimally size a stationary battery energy storage system to mitigate the electricity costs of a fleet of electric vehicles whose charging can be partially curtailed, also to mitigate electricity costs.

  - **Presentation Materials | GUI Import Files**

Command-Line Cases

- ### Energy Shifting Value Across US ISO_RTOs 2020

  This command-line only case implements a broad scenario analysis of the energy time shifting value of Lithium ion-like energy storage in all US ISO/RTO regions at durations ranging from 2 to 96 hours.

  - **Presentation Materials | Project Data Files**

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

CAISO Market Case

- Replaces ERCOT case
- Energy time shift + regulation for a fixed-size battery
- Uses 2020 historical data and a simple battery energy storage system model

Dispatch Summary

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Distributed Energy Resource Value Estimation Tool (DER-VET™)

DER-VET™	Software	Reference Cases	ESIC Task Force	Help	Forums

You Are Here: Home > Reference Cases

Pre-Defined GUI Cases

- **User Guide: Quick Start Cases**

- **Video: Pre-Defined Case Tutorial**

- **DER for Bill Reduction**

  Have DER-VET size a battery energy storage system paired with a fixed-size solar PV system to maximize customer bill savings relative to the system's cost over its life. Use the "post-facto" option in DER-VET's reliability service to estimate how much critical load this economically-optimally sized and operated battery can cover and for how long.

  - **Presentation Materials | GUI Import Files**

- **DER for Reliability**

  In a similar case to "DER for Bill Reduction", use DER-VET's reliability service (with the post-facto option turned off) to optimally size and operate a battery energy storage system paired with a fixed-size solar PV system to guarantee critical load coverage during grid outages that last up to 4 hours.

  - **Presentation Materials | GUI Import Files**

- **CAISO Market Case**

  Calculate the maximal value of a fixed-size battery energy storage system as it participates in the CAISO day-ahead energy and frequency regulation markets during a historical year.

  - **Presentation Materials | GUI Import Files**

- **EV Battery Sizing**

  Optimally size a stationary battery energy storage system to mitigate the electricity costs of a fleet of electric vehicles whose charging can be partially curtailed, also to mitigate electricity costs.

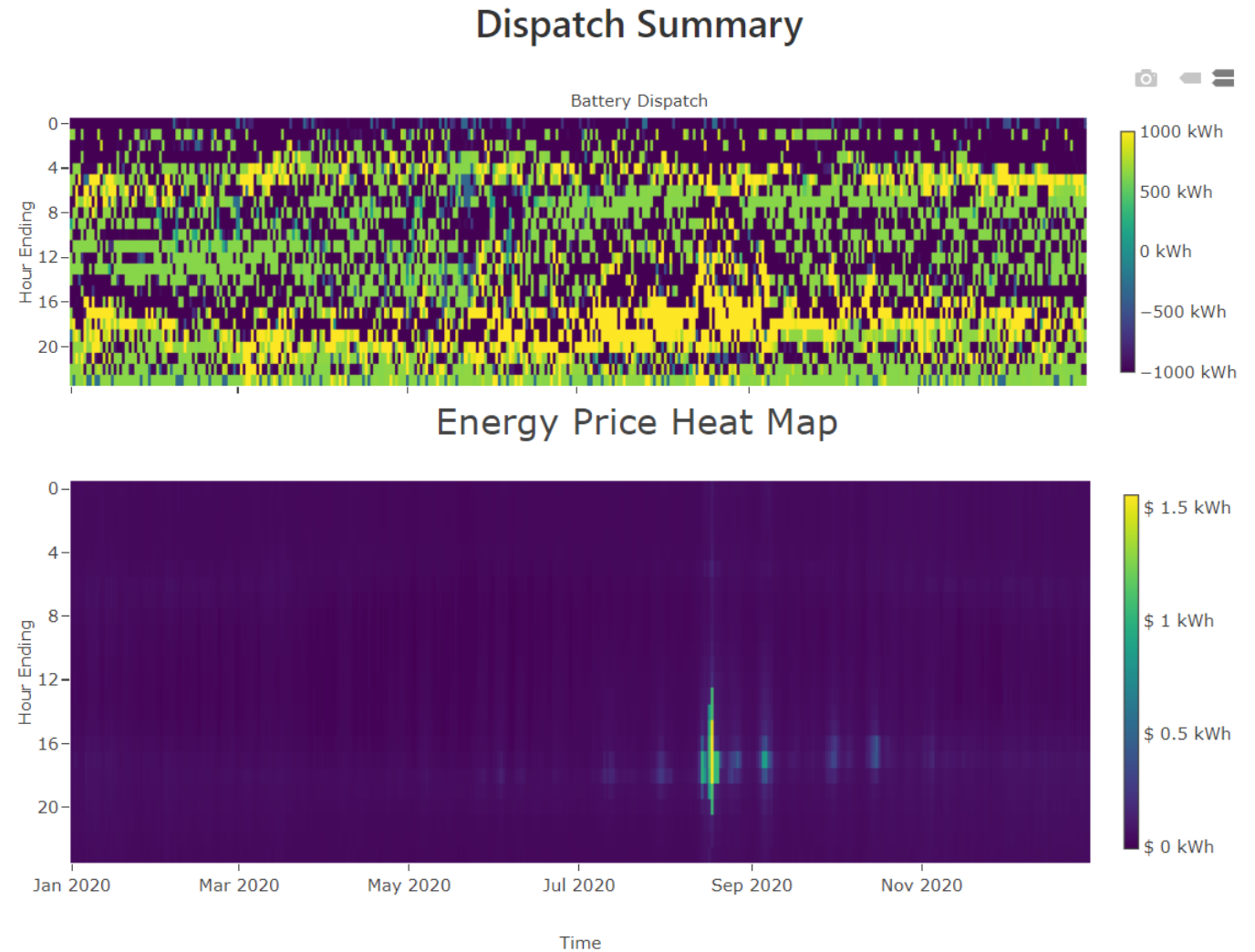 - **Presentation Materials | GUI Import Files**

Command-Line Cases

- **Energy Shifting Value Across US ISO_RTOs 2020**

  This command-line only case implements a broad scenario analysis of the energy time shifting value of Lithium ion-like energy storage in all US ISO/RTO regions at durations ranging from 2 to 96 hours.

  - **Presentation Materials | Project Data Files**

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

EV Battery Sizing

- Curtailable EV fleet charging load
  - Instantaneously, up to 50% of charging load can be curtailed
  - Cost of lost load input suppresses this
- Optimally-sized battery
  - Sized and operated to work with the curtailable EV charging load
- EV load based on real data, but repeats every day

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Distributed Energy Resource Value Estimation Tool (DER-VET™)

DER-VET™	Software	Reference Cases	ESIC Task Force	Help	Forums

You Are Here: Home > Reference Cases

Pre-Defined GUI Cases

- **User Guide: Quick Start Cases**

- **Video: Pre-Defined Case Tutorial**

- **DER for Bill Reduction**

  Have DER-VET size a battery energy storage system paired with a fixed-size solar PV system to maximize customer bill savings relative to the system's cost over its life. Use the "post-facto" option in DER-VET's reliability service to estimate how much critical load this economically-optimally sized and operated battery can cover and for how long.

  - **Presentation Materials | GUI Import Files**

- **DER for Reliability**

  In a similar case to "DER for Bill Reduction", use DER-VET's reliability service (with the post-facto option turned off) to optimally size and operate a battery energy storage system paired with a fixed-size solar PV system to guarantee critical load coverage during grid outages that last up to 4 hours.

  - **Presentation Materials | GUI Import Files**

- **CAISO Market Case**

  Calculate the maximal value of a fixed-size battery energy storage system as it participates in the CAISO day-ahead energy and frequency regulation markets during a historical year.

  - **Presentation Materials | GUI Import Files**

- **EV Battery Sizing**

  Optimally size a stationary battery energy storage system to mitigate the electricity costs of a fleet of electric vehicles whose charging can be partially curtailed, also to mitigate electricity costs.

  - **Presentation Materials | GUI Import Files**

Command-Line Cases

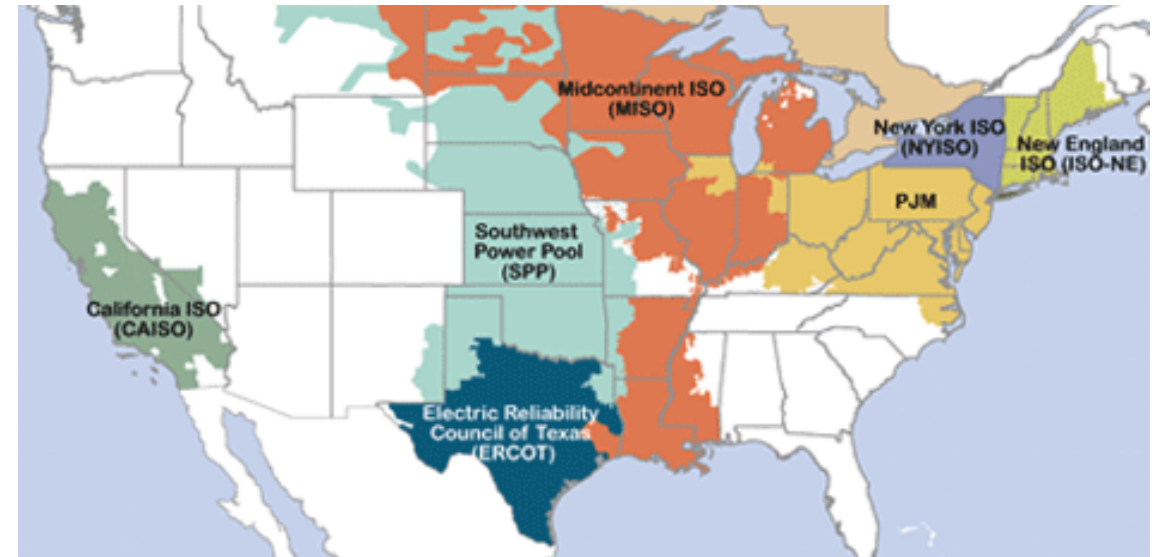- **Energy Shifting Value Across US ISO_RTOs 2020**

  This command-line only case implements a broad scenario analysis of the energy time shifting value of Lithium ion-like energy storage in all US ISO/RTO regions at durations ranging from 2 to 96 hours.

  - **Presentation Materials | Project Data Files**

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Case Description

Value of Energy Shifting

- Hub-level across United States ISO/RTO regions

- Energy time shifting only

- Very simple storage model
  - 85% roundtrip efficiency
  - Variable duration (2-96 hours)
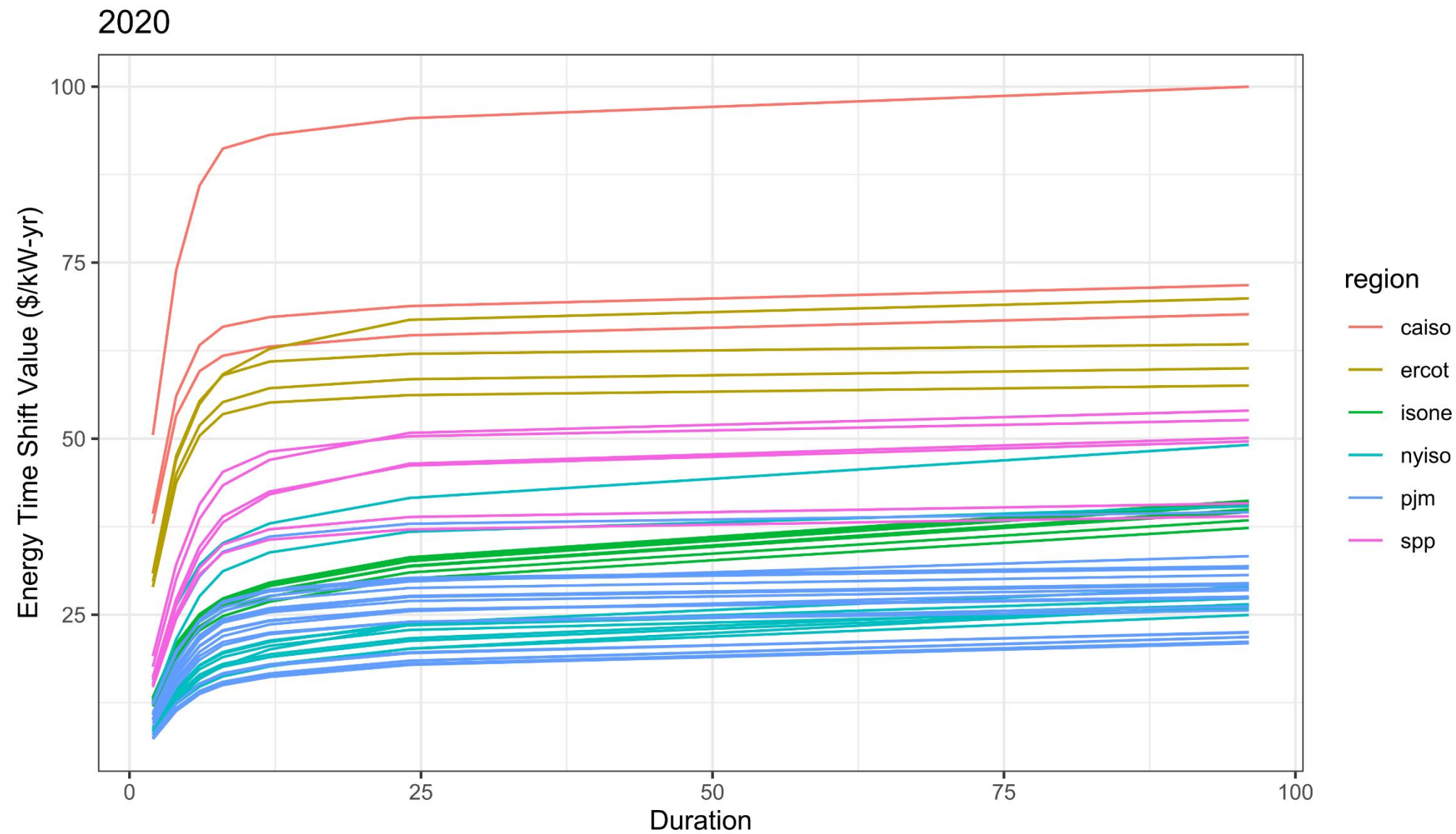 - No auxiliary load, self discharge, minimum power, etc.

*For a full list of assumptions, see the reference case on www.der-vet.com/referencecases

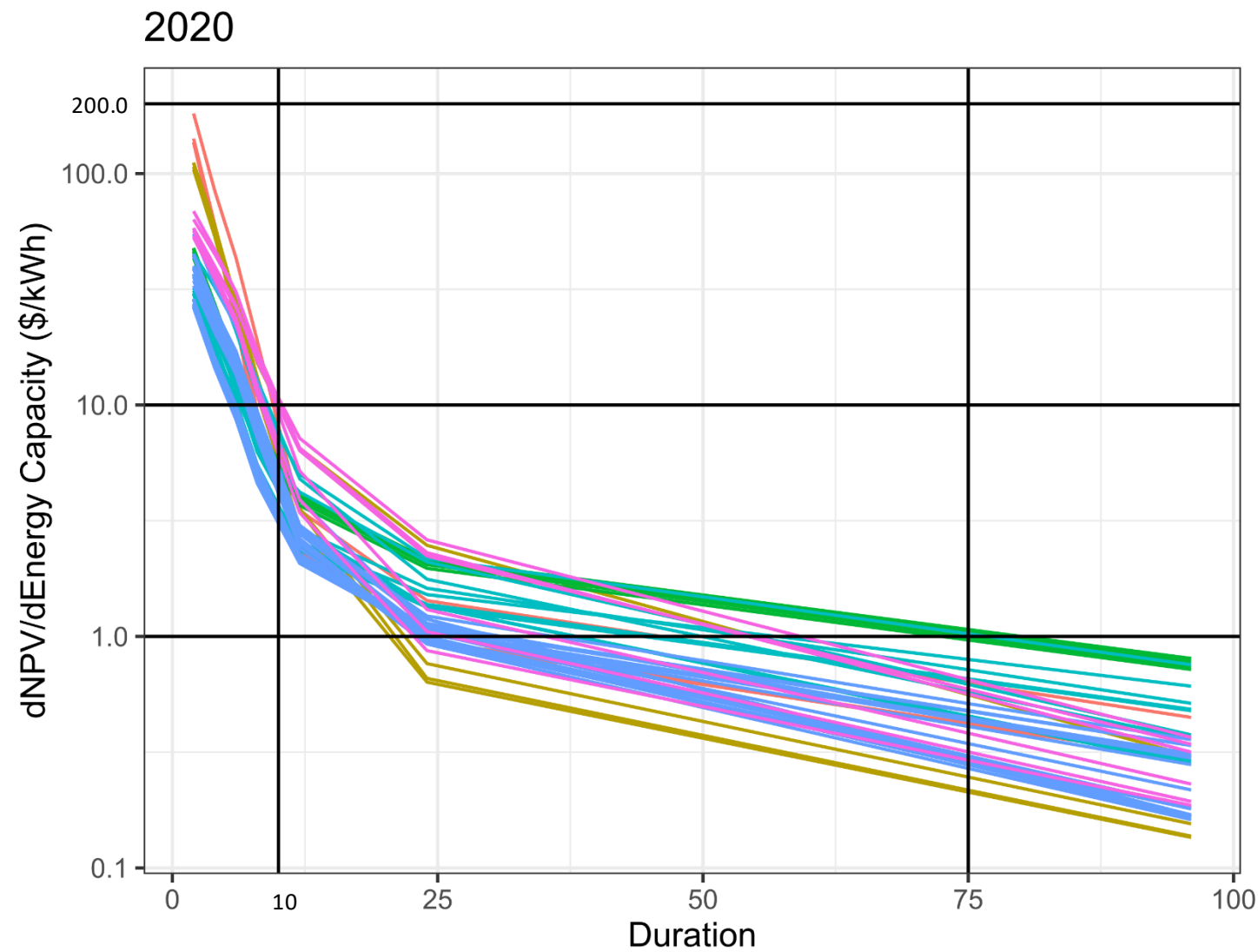EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Setup

- Install command line version of DER-VET and StorageVET as a sub-module
- Download Reference Case .zip file and extract contents
- Move model parameters files to dervet folder
- Move run_all.bat to dervet folder
- Move timeseries data files to dervet\storagevet\data\Timeseries Files
- Move other data files to dervet\storagevet\data
- Run all cases at once with run_all.bat file on Windows
    - Open anaconda prompt
    - cd to dervet directory
    - Activate DER-VET virtual environment
    - Type "run_all.bat" and hit enter

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Results

Results

2020

Assuming 10yr life and 7% discount rate

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Conclusion

- No capacity value or other services (note, ERCOT is included)
  - Future work could add in capacity value, where applicable
- Only looked at one historical year of data (2020)
  - Future work could bring in projections
- Only highly simplified Li-ion reference specs were used
  - Longer lived, lower efficiency technology options would be interesting, especially for the longer durations.
  - More detailed technology specs could improve results

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Next Meeting

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Next Meeting

- September 2, 2021 11:00 AM Pacific Time

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Together...Shaping the Future of Electricity

EPRI | ELECTRIC POWER RESEARCH INSTITUTE