DER-VET Task Force

ESIC Working Group 1: Grid Services and Analysis

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August 4, 2022

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Agenda

- Long Duration Energy Storage
- Software Update

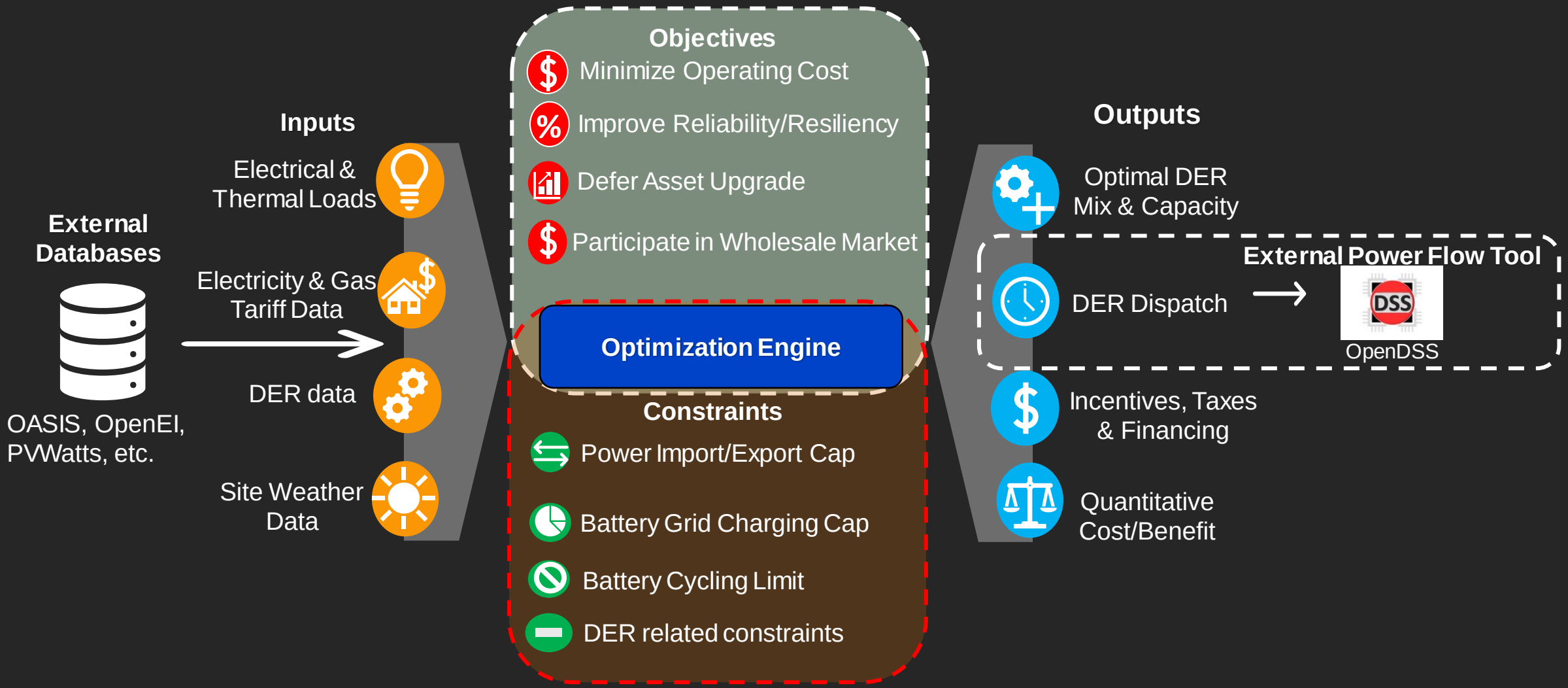
Long Duration Energy Storage

Technology	Acronym
Concrete Thermal Energy Storage	CTES
Electro-Thermal Energy Storage	ETES
Gravitational Energy Storage	GES
Liquid Air Energy Storage	LAES
Lithium-Ion Battery Storage	Li-Ion

Why Model LDES?

- LDES is being driven on an aggressive timeline
  - A sense that LDES is the key to a carbon-free grid may drive implementation quickly relative to our understanding of needs, technologies, etc.
- Emerging technologies compound already high planning uncertainty
- Alternatives to LDES include new transmission, overbuilt renewable generation, demand response or electric vehicles, and short-duration storage.

DER-VET Optimization Framework



Why Model LDES with DER-VET?

- Alternatives include capacity planning models, production cost models, etc.
  - More sensitive to technical detail due to computational intensity

- RFP evaluations for LDES will require differentiating many systems with potentially very different technical abilities
- Established future scenarios can drive speedy analysis
- “Regional microgrid” approach for first-pass technology selection and power/energy capacity sizing

Gaps to LDES Modeling in DER-VET

- Emerging Technology Modeling
  - Compressed air energy storage already has an explicit DER-VET model
  - Others, such as thermal, gravity, liquid air, non-lithium batteries, etc. can be modeled using the default battery model.
    - Some would benefit from a separate model to capture technical differences
  - Technical features not currently included that could be important:
    - Turndown efficiency curves
    - Operational modes (standby, off, etc.)
    - Temperature derating
    - Hot vs cold startup cost/time
    - Different self-discharge mechanisms
    - Rest periods in between half cycles
  - Equipment reliability, uptime, and underperformance could be relevant

Gaps to LDES Modeling in DER-VET

- Resource Adequacy Modeling
  - DER-VET has two simple approaches for resource adequacy
    - Must-offer obligation (just the energy time shift service)
    - Hard discharge or stored energy requirements (resource adequacy service)
  - A more sophisticated capacity value estimate that changes over time could help differentiate systems in some cases

Gaps to LDES Modeling in DER-VET

- Multi-year co-optimization
  - The ‘target SOC’ parameter in DER-VET decouples optimization windows
  - For a system that cycles once yearly with a yearly optimization window, this is analogous to a 24hr optimization window for most storage today.
  - The ability to include a rolling optimization window or multiple optimization years at once may be needed
  - Adding LDES in the middle of an analysis could complicate this

Gaps to LDES Modeling in DER-VET

- How efficient will operational decision-making be for LDES?
  - How does perfect foresight compare to real decision-making on time scales of months?
  - Look to hydro and PSH for baseline

Gaps to LDES Modeling in DER-VET

- Inertia or other grid services
  - As grid needs change, grid services may change as well
  - How these will be valued

How to Address Gaps

- Automatic future scenario testing
- More sophisticated resource adequacy module
- Rolling optimization window option
- Multi-year optimization window option
- Explicit technology comparison and reporting
- RFP evaluation module
- New grid services?
- Ability to add more operational constraints
  - Forced cycling within a time frame
  - Average SOC constraints
  - Rest periods between charging and discharging

Software Update

DER-VET Software Update

- Latest Version: v1.2.2 (updated July 11th, 2022)

- Bugs and Features being worked on currently:
  - Reliability Sizing with PV is buggy
    - If the outages with the most critical load are exclusively during solar hours, the algorithm that checks for feasibility in all outages fails.
    - Applies to short reliability targets where storage is being optimally sized with PV and/or generators
  - Optimization errors with multiple batteries
  - Add validation tests on pre-defined use cases
  - RA and DR revenue should grow each year after the optimization year
  - DR service should be compatible with other services
  - Disallow negative DA energy prices when sizing any technology
  - Automate the build of the application (Windows and Mac)

- *We expect to release an update early next month*