Building the Energy Storage Business Case: The Core Toolkit

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IRENA
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The IRENA Electricity Storage Valuation Framework:

Assessing system value and ensuring project viability

Roland Roesch

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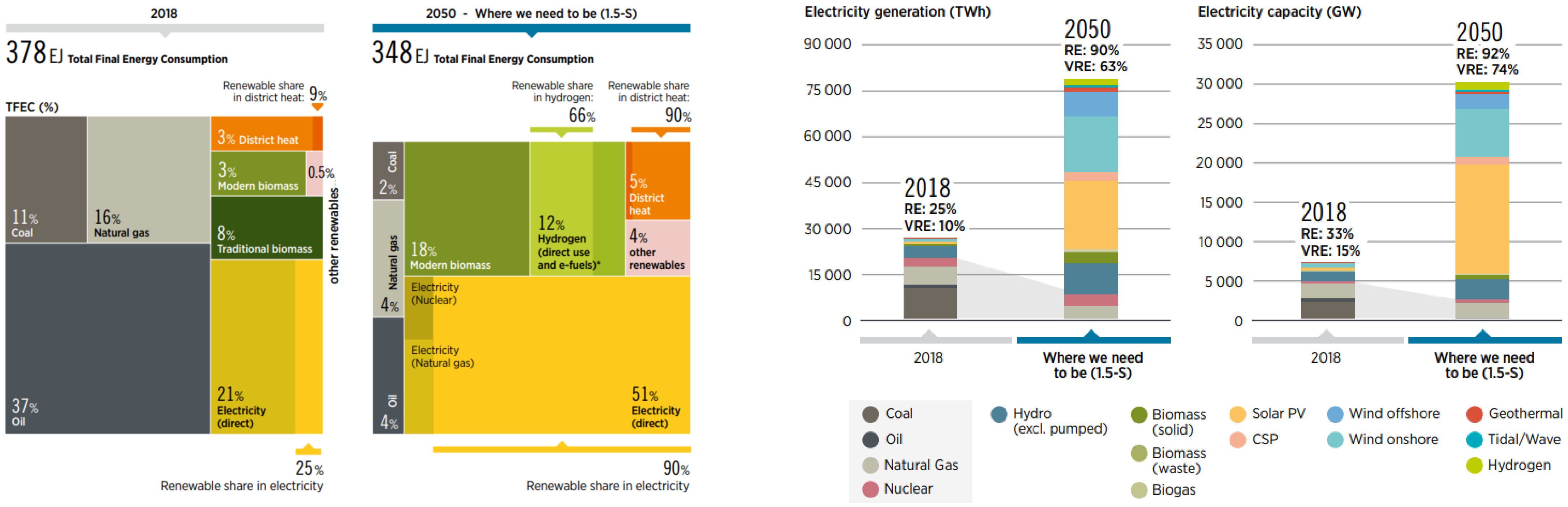
International Renewable Energy Agency (IRENA)

Keeping the power on: The Business Case for Emerging Storage Technologies

14 July 2021

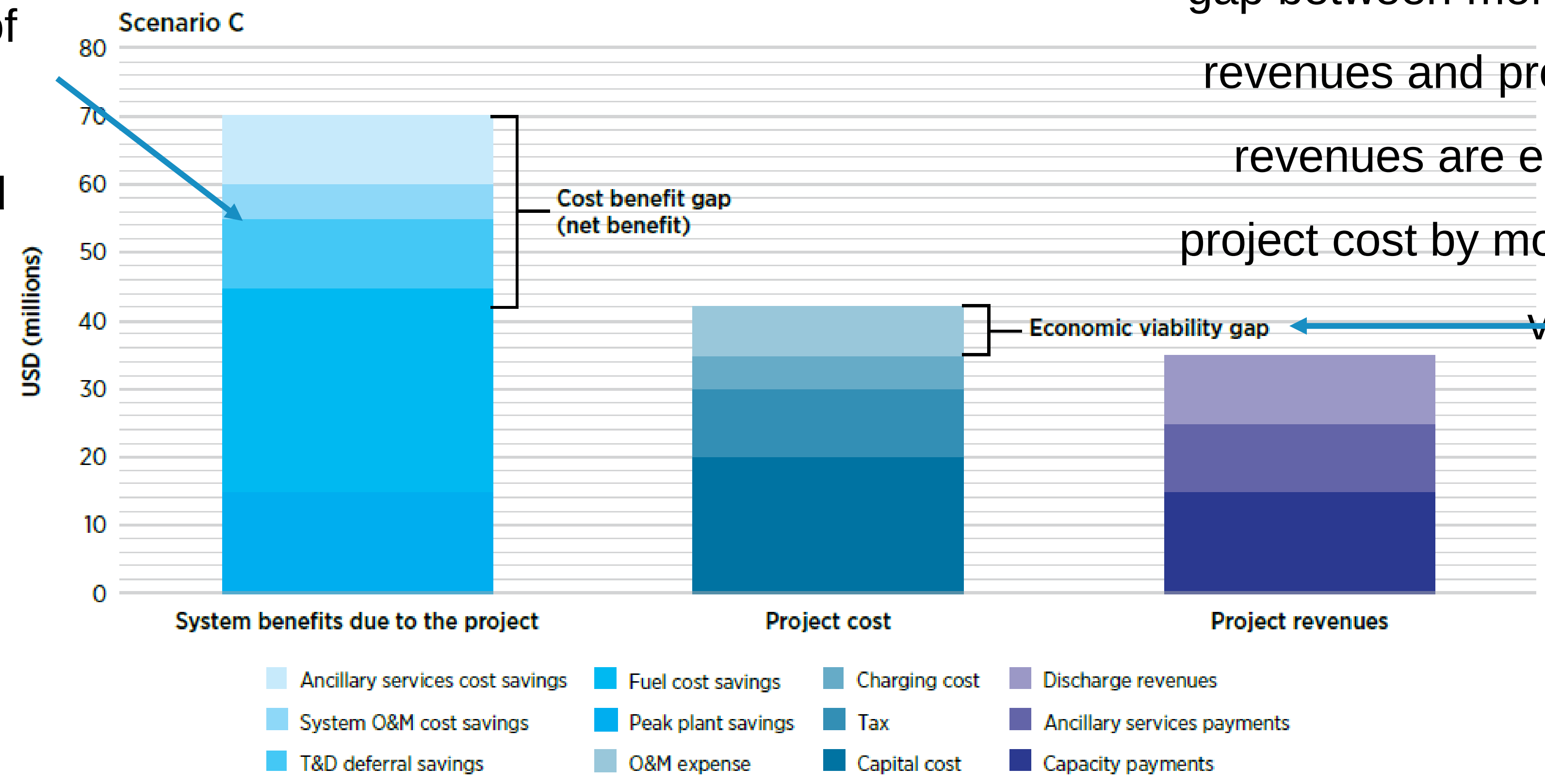
Storage is a key flexibility option to integrate VRE in the 1.5ºC Scenario



- To achieve a 1.5º scenario, 51% of total energy consumption will be electrified and supplied by 90% of renewable energy
- **Solar PV power would be a major electricity generation source**, followed by wind generation. Both together will suppose 63% of the total generation share by 2050 and 74% of the total installed capacity
- Operating a system with this share of VRE could be a **challenge** if the right measures are not in place. **Storage could be a key flexibility option in this scenario**

However, we need to address the "missing money" problem

Reasoning: Some system benefits of ES cannot be monetized based on existing regulations

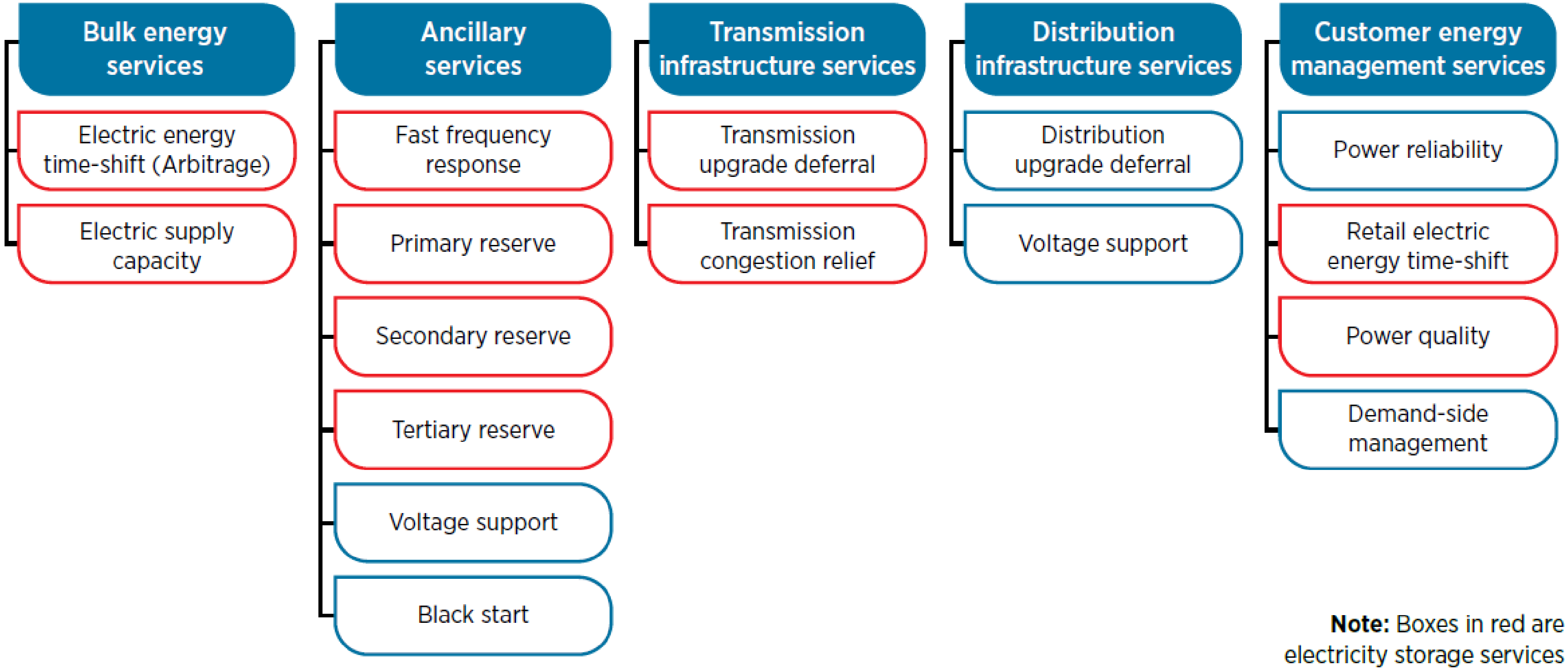


Goal: identify the "economic viability" gap between monetizable project level revenues and project costs, ensuring revenues are equal or higher than project cost by monetizing system level value

A project will only be expected to materialize if monetizable revenues are more than project costs

The key is to stack revenue by providing different services in parallel

- Electricity Storage (ES) is capable of providing a variety of services to the grid in parallel
- Understanding the landscape of value opportunities is the first step to develop assessment methodologies
- Markets should be redesigned in order for electricity storage to be able to monetize system benefits from providing different services



Note: Boxes in red are electricity storage services that are quantifiable within this framework.

The Electricity Storage Valuation Framework as a methodology to ensure project viability

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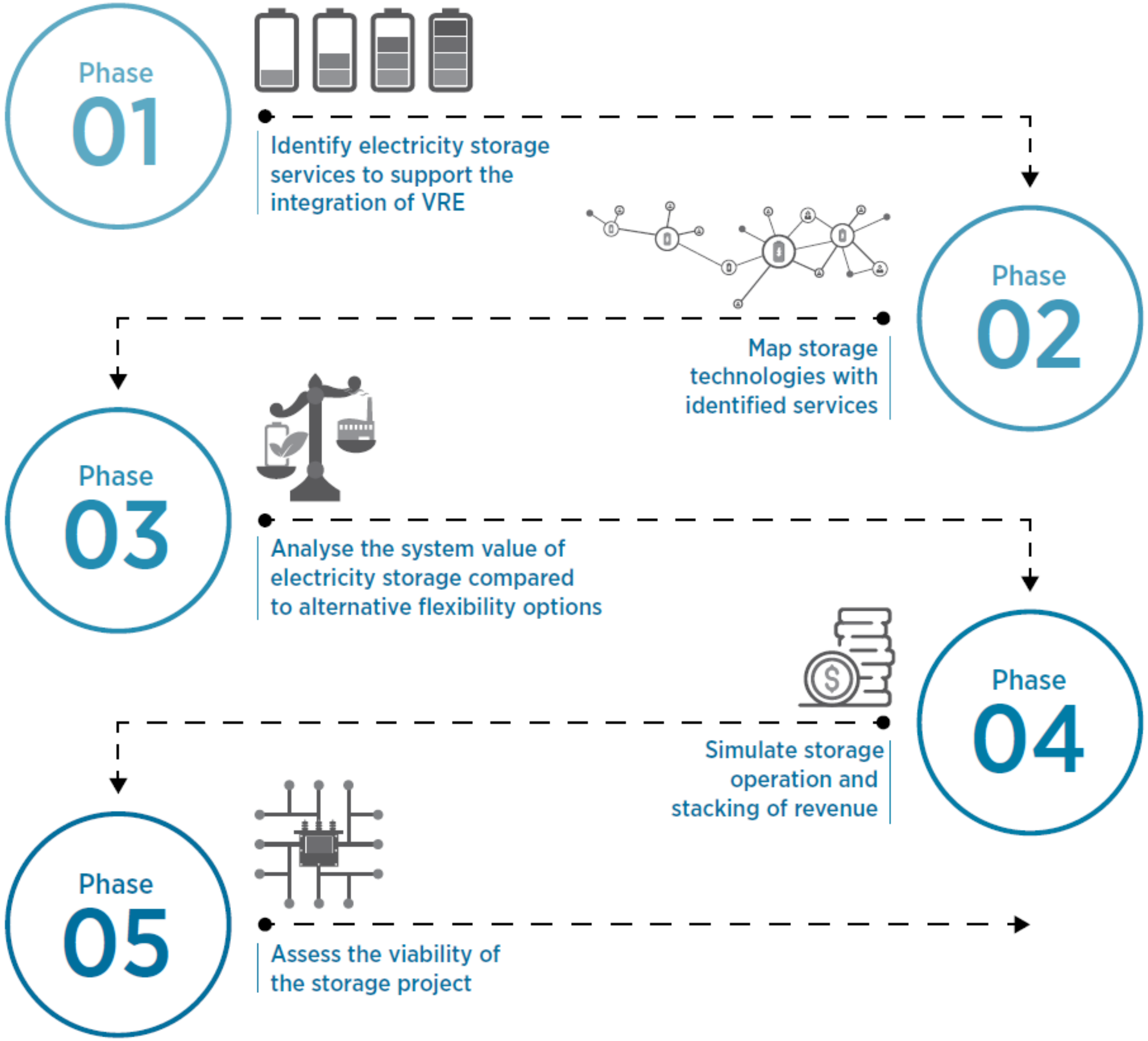
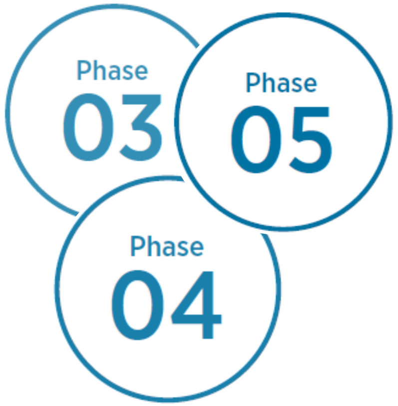


Based on data gathering and application of a straightforward methodology



Based on different types of optimization models to carry out the analysis

Recommendations for different stakeholders

For electricity storage developers

Get familiar with existing business models and collaborate closer with regulators and utilities to highlight system benefits of ES.

For vertically integrated utilities

Update planning tools to include ES and update procurement processes for services required, rather than picking technologies.

For regulators

Eliminate barriers for ES participation in different markets, create new markets able to capture the value of ES, make incorporation of least cost planning for ES mandatory for TSOs and DSOs. .

For the research community

Support further development of tools and methodologies to perform ES valuation, develop scenarios to study benefits of ES.

Check the IRENA Website for more info

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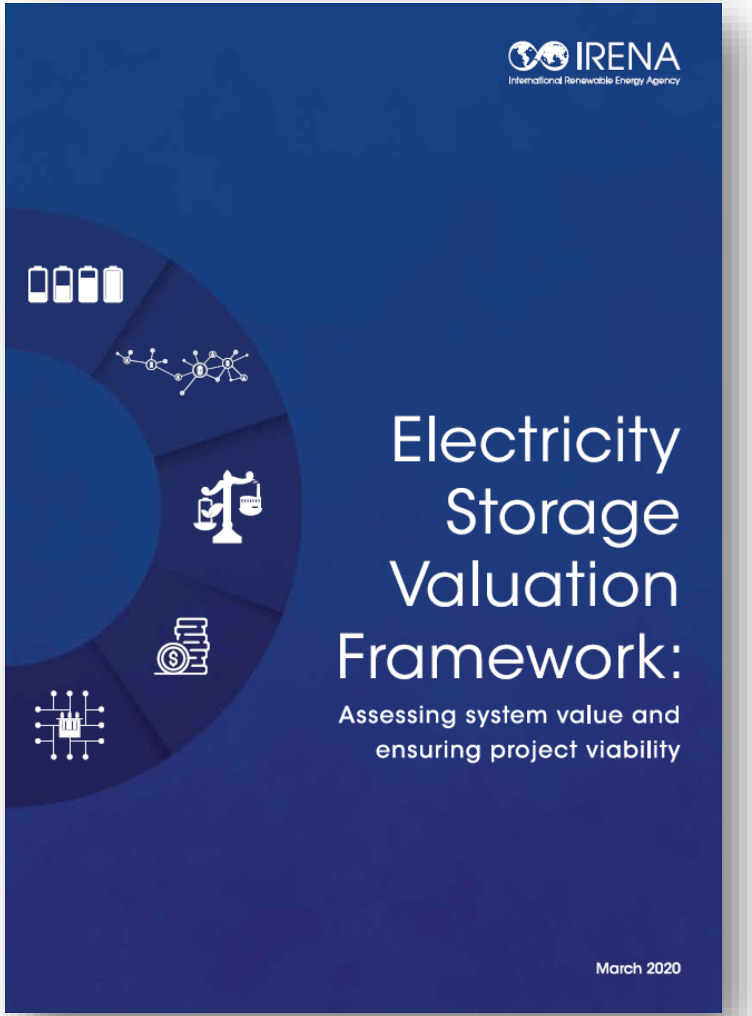
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Electricity Storage Valuation Framework:

Assessing system value and ensuring project viability

March 2020

Full report here

IRENA FlexTool

Try our main modelling tool that performs capacity expansion and dispatch with a focus on power system flexibility, here

Download IRENA FlexTool

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Background for a Model Selection Platform (MSP)

Energy Storage Grand Challenge (ESGC) Strategy Roadmap:

Need more information to "effectively plan for and operate storage both within the power system alone and in conjunction with transportation, buildings and other industrial end-uses; and how the different services storage provides can be fairly valued and compensated in a way that incentivizes technologies and projects that provide greatest value to the energy system and its end users"

Facilitating Grid Decarbonization
Ensure grid flexibility and the continued reliability, resilience, and security in a decarbonized electric power system.

Interdependent Network Infrastructure
Infrastructure that is interdependent with the electric grid and requires reliable electricity delivery to maintain effective operations.

Serving Remote Communities
Support communities not connected to the bulk power and may be subject to high energy costs, supply disruption, and disaster events.

Critical Services
Maintain operations in facilities critical to public health/safety during major outage events

Electrified Mobility
Support electrification of the transportation sector by minimizing charging impacts to the grid and promoting low-cost, high performance EVs.

Facility Flexibility, Efficiency, and Value Enhancement
Optimize energy production and/or usage to optimize value and enable flexible, efficient operations for the facility owner

Analyzing Value for Energy Storage

- Given the distinct use case or combination of use cases that Energy Storage can provide benefits for, it is important to analyze all directly and indirectly captured value streams available

Examples of Directly Captured/Market Based Value Streams	Examples of Indirectly Captured Value Streams
Ancillary Service, Energy, and Capacity markets, in ISO/RTOs	Value of deferred investment on transmission/distribution infrastructure
Electric Bill Savings, TOU and Demand Charge	Power Reliability, Value of Lost Load (VOLL) during outages

- **Energy Storage Valuation Models/Tools** are software programs that can capture the operational characteristics of an ESS and use forecasts, data, and other inputs related to information about available value streams to determine the optimal dispatch and estimate the value provided by a system

DOE Supported Value Analyses

BESS on Nantucket Island, MA

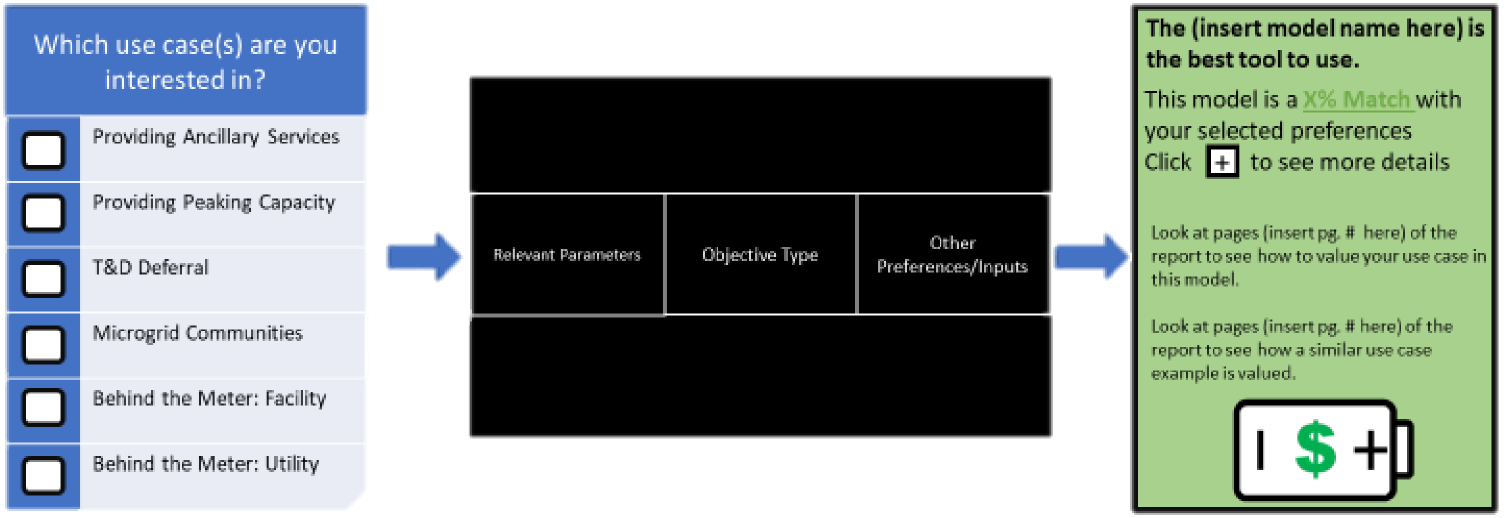
- Beacon Power Hazle Township Flywheel – Study that looked at maximum revenue potential of a 20 MW/5 MWh Flywheel plant participating in PJM's frequency regulation and energy arbitrage markets
- Sterling Municipal Light Department – Study to determine potential revenue from multiple value streams for a public power utility if they installed a 1 MW/1 MWh system, included analysis of value from multiple ISO-NE markets as well value coming from outage resiliency
- Nantucket Island – Assessment of the value of a 6 MW/48 MWh battery system to an island community considering the value of value of deferred investment in transmission infrastructure, ISO-NE market streams, and others
- HECO Behind-the-Meter (BTM) Storage – Developed tool to help users understand the customer-side value storage and PV, analyzed value streams included utility bill savings, Demand Response (DR) program incentives, avoided outage time

Modeling Tools and Goals for MSP

Modeling Tools Examined:

- QuEST
- REopt
- DER-CAM
- System Advisor Model (SAM)
- Energy Storage Evaluation Tool (ESET)
- Production Cost Modeling Tool(s) - TBD

Black Box Framework for MSP:



Belén Gallego

Chief Executive Officer, ATA Insights

BRINGING YOUR ENERGY STORAGE BUSINESS CASE TOGETHER

Climate Investment Fund (CIF) event: Keeping the Power on, the business case for emerging energy storage technologies (July 14, 2021)

Belén Gallego
CEO of ATA Insights

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Planning is the biggest challenge of the energy transition

It is a radical departure in the way that electricity generation is planned, commissioned and operated

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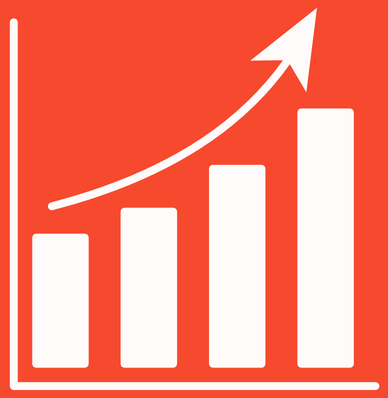
Traditional energy planning

Generation of electricity from burning [often imported] fossil fuels

- To the amount demanded
- When it is demanded
- Volatile costs of fuel

High CO_2 footprint

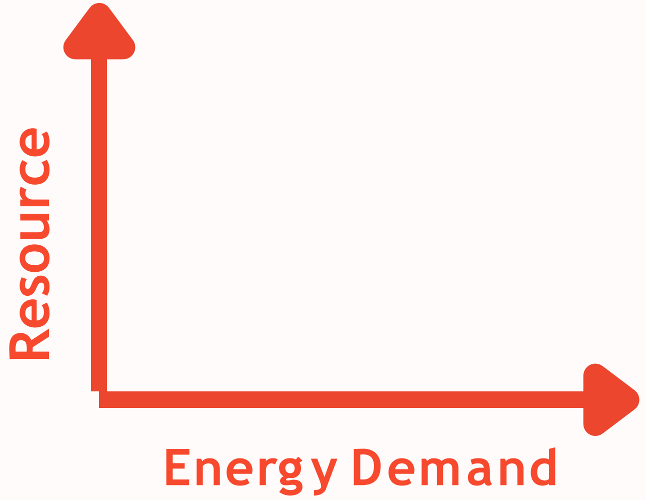


Energy transition planning

Generation of electricity from [mostly local] renewable natural resources

- Use energy when generated as much as possible
- Store for when demand is higher
- No cost of fuel

Low CO_2 footprint



The grid is now at the centre of all energy planning

Grid stability is a precious resource. Each energy asset must be evaluated considering the value they bring to the grid balance, firmness and stability.

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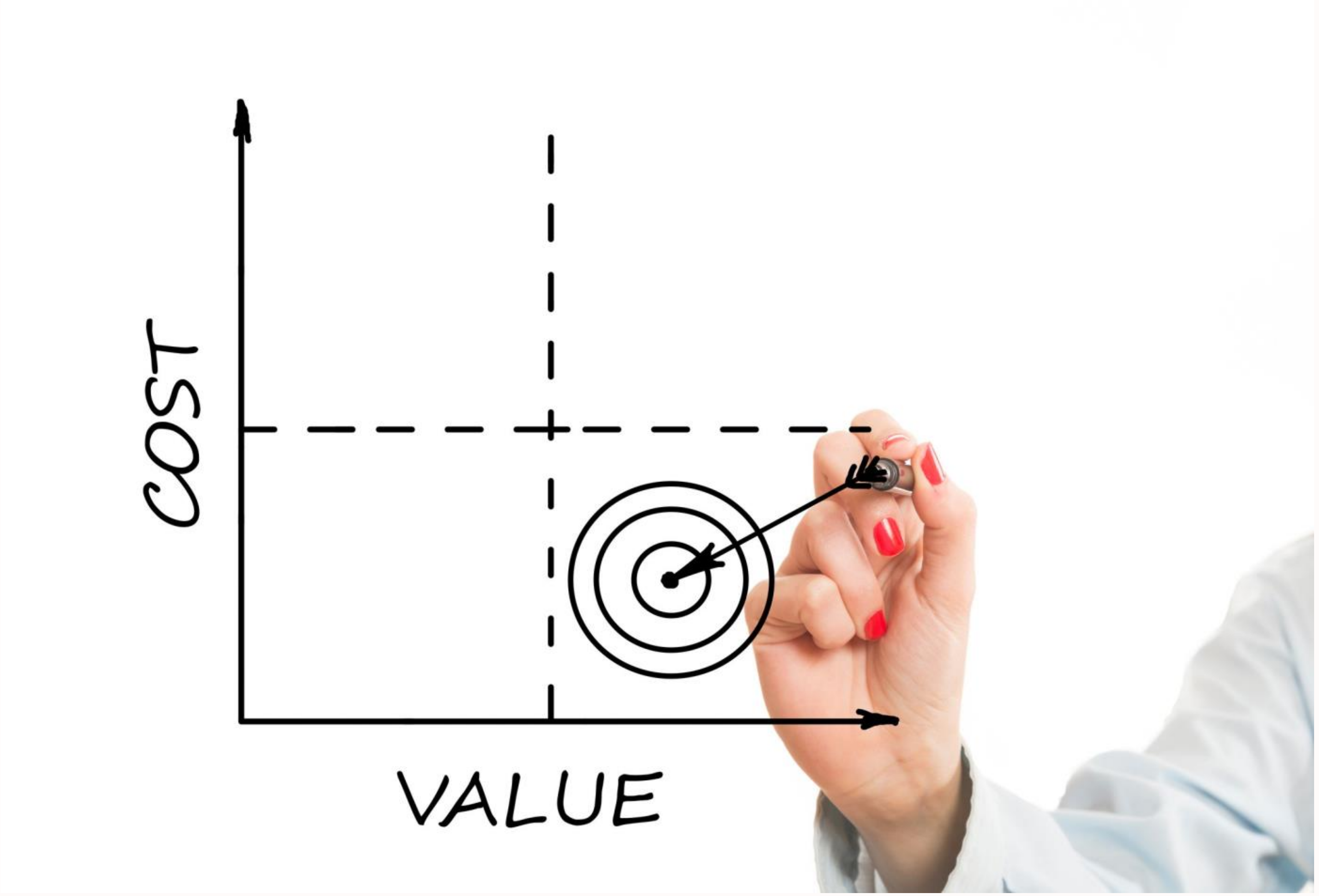

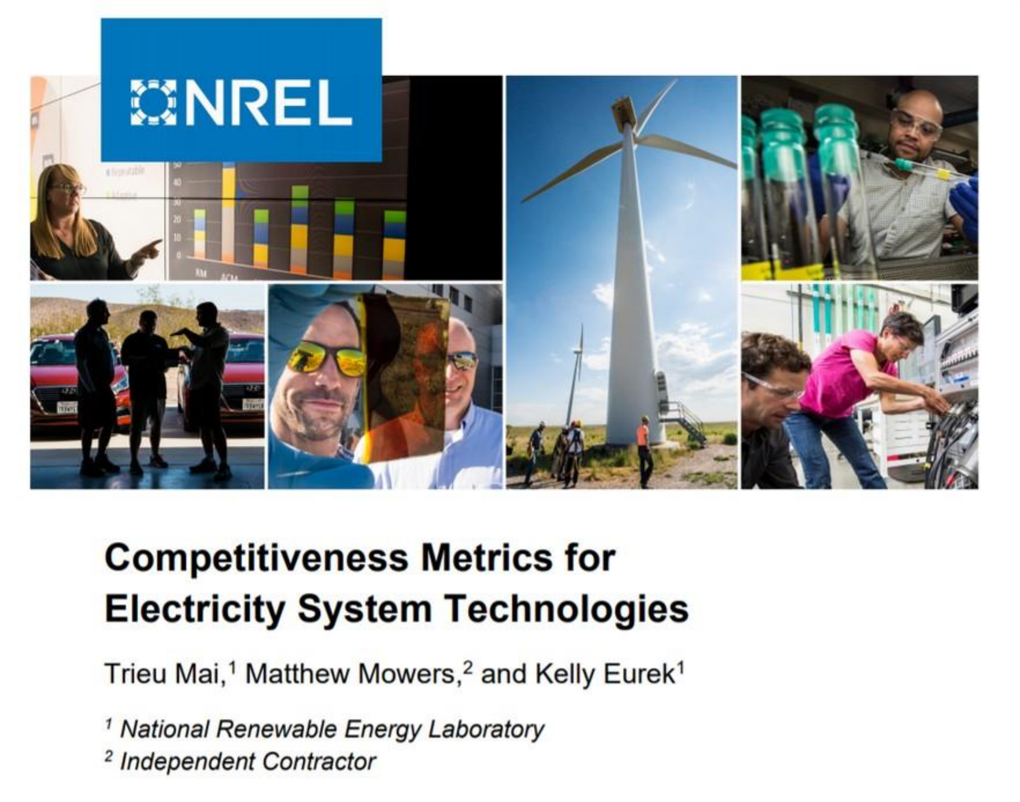
NREL

Competitiveness Metrics for Electricity System Technologies

Trieu Mai,[1] Matthew Mowers,[2] and Kelly Eurek[1]

[1] National Renewable Energy Laboratory
[2] Independent Contractor

https://www.nrel.gov/docs/fy21osti/72549.pdf

The business case energy storage coupled with renewables

- Low to very low CO_2 footprint
- It replaces the use/import of price volatile fossil fuels
- It allows grid integration of more cheap variable renewable energy (VRE)
- It minimizes the building of new infrastructure
- It provides multiple services of energy storare and capacity
- It provides wide technology choice to fit different needs

Stores electricity for when you need it

Adds stability to the grid

↑

Warning alert! Warning alert! Warning alert!

YOU HAVE TO PAY FOR THIS TOO!

↙

Stores Electricity +adds stability to the grid

Figuring out what your grid needs from energy storage

- **Know your grid**, what areas are priorities right now?
- **Model your grid**, what services do you need from now to the next 10+ years?
- **Define your objective**, what problems are you going to tackle?
- **Define your scope**, what is your budget? what are your time constraints?

Creating sustainable business model for energy storage

Stacking of payments is the most common way to make the business model for energy storage bankable whilst optimizing services to the grid. In its simplest version it contains:

- A payment for availability of energy and power
- A payment for the number of cycles per day/year
- A payment of the efficiency of the system (performance, response time, etc)

The grid is technology agnostic. The best solution may not look like you imagined

Let the best technology provide the service(s) the grid needs. Thinking of technology first could do the grid a diservice.

Noor III
Concentrated Solar Power (CSP)

150MW* 8h full turbine thermal storage * Spinning reserves

Hybrid renewables

- storage or stand-alone projects?

It depends…..

Whether the approach is stand alone or hybrid will depend on the needs of the grid. It is important to leave both options open

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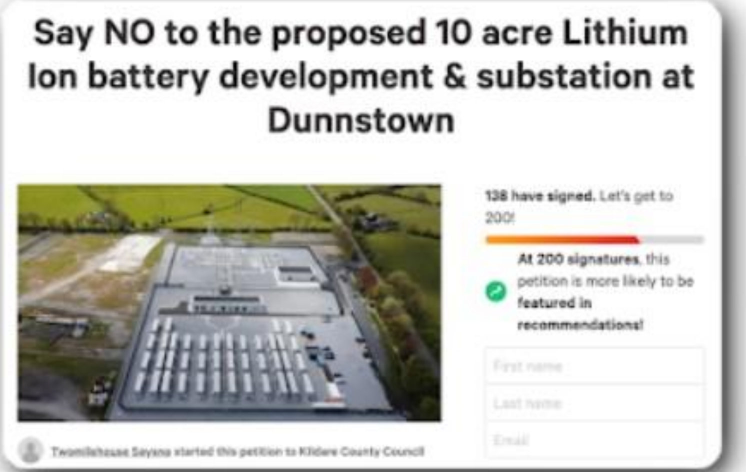
Work in 'just transition' and circularity strategies into your projets

- 'NIMBYism' against these projects is gaining strength. Work with local communities to ensure that locals are included and benefit from the project
- Consider the social and environmental impact of each project
- Plan the circularity strategy for the project; its equipment and materials before it begins
- Reduce, reuse, recycle, repurpose
- Create know-how and jobs locally

Monday, July 05, 2021

Dunnstown BESS project refused by planners



The recent application to build a battery energy storage system at Dunnstown was turned down by Kildare County Council on the grounds of premature development, fire safety issues, and concerns about its effect on the health of the community, *writes* ***Brian Byrne***.

The application was made by Strategic Power Systems for the development of 76 battery storage units on an 4,000 ha site that is currently agricultural land. A strong campaign against the project was mounted by local people and residents of the Two Mile House area.

Related reasons given by the KCC planners report advising the refusal include that it would 'set an undesirable precedent' for similar developments in the area, would interfere with the amenity of residents, and would therefore devalue property in the area.

https://kilcullenbridge.blogspot.com/2021/07/dunnstown-bess-project-refused-by.html

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THANK YOU

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Climate Investment Fund (CIF) event: Keeping the Power on,
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Considering the End of the Storage Asset – Right from the Beginning

Brittany Westlake, Ph.D.
Sr. Technical Leader

Climate Investment Funds
Keeping the Power On – The Business Case for Emerging Energy Storage Technologies
July 13, 2021

Stationary Storage Decommissioning

Overview: Looking ahead as we begin procuring storage

Questions - How to plan for recycling and disposal?

- What's Involved?
- Who's responsible? (Vendor/Utility/Third Party)
- Cost of Disposal?
- Regulations and Guidelines
- Recent news on material shortages (Cobalt, Lithium)

Recycling and Disposal of Battery-Based Grid Energy Storage Systems: A Preliminary Investigation. EPRI, Palo Alto, CA: 2017. 3002006911.

Example Recycling Process

- Collect System Information
- De-energize & Disconnect
- Module Removal & Packaging
- Loading for Transport (Crane/Forklift Rental)
- Transportation and Shipping
- Non-Battery Components Recycling and Reuse
- Scrap Metal and Electronics Recovery
- Specialized Battery Recycling or Sorting Facility
- Stored until ready to process
- Module Disassembly
- Cell Recycling & Material Recovery

What to Consider for Battery End of Life, during…

- **Planning and Procurement**
  - Plan for End of Life and Total Cost of Ownership of Operating the Storage System
- **Contracting**
  - Request End-Of-Life Plan
  - Ask for Cost Estimates
  - Ask for Identified Transportation and Disposal Vendors
- **Operation**
  - Consider Degradation and what Triggers End-of-Life
- **Decommissioning**
  - Source Disposal Experts with demonstrated and verifiable performance

Together…Shaping the Future of Energy™

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