

A vertical photograph of a white wind turbine against a blue sky with light clouds. The turbine is the central focus, with its blades extending outwards. In the background, several other wind turbines are visible, receding into the distance.

The Promise and Potential of Energy Parks

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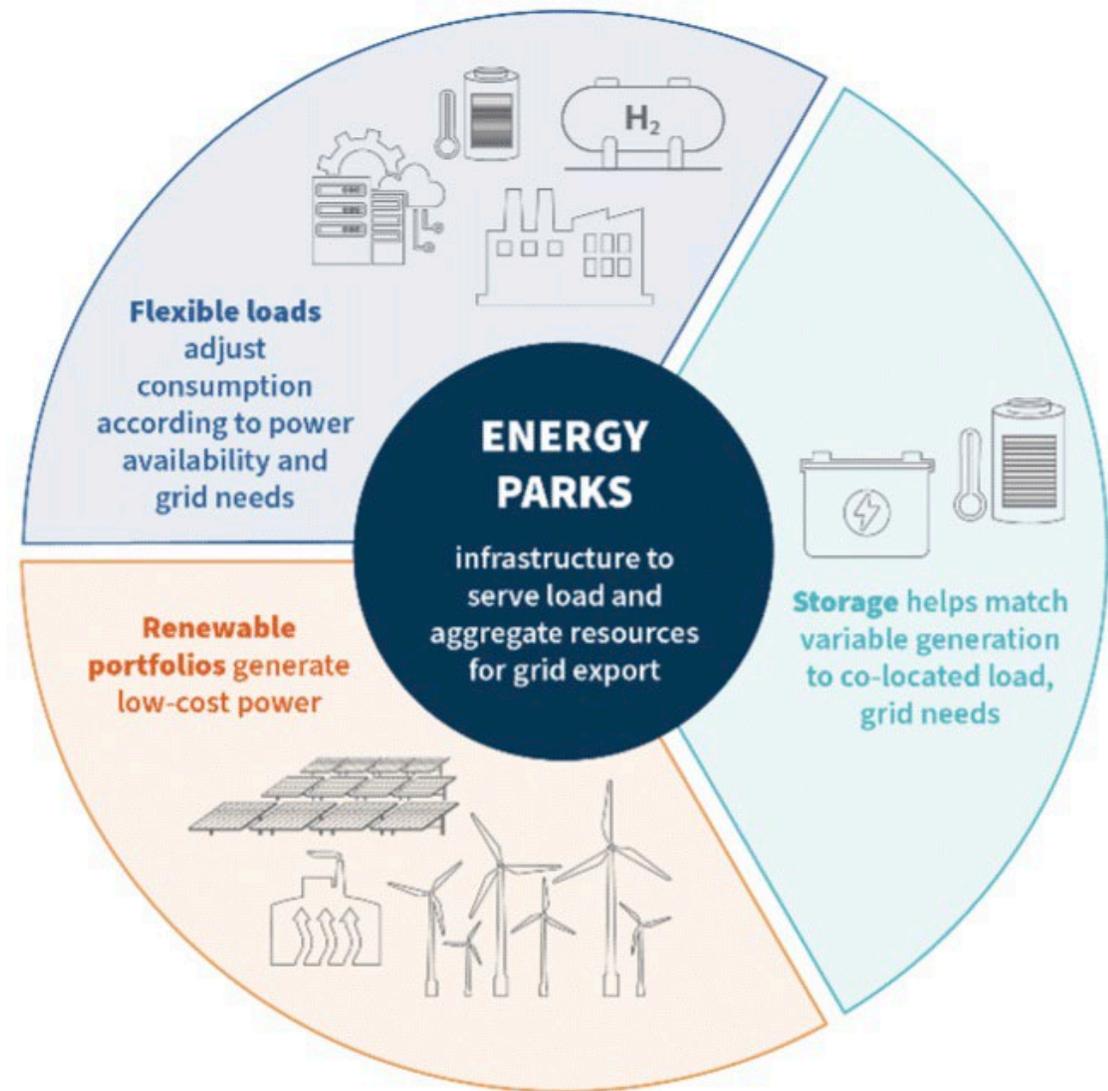


What is an Energy Park?

An energy park is the **co-optimization** of a set of grid participants (**load, storage, generation**) in a **local region** that can present a **simpler**, lower-cost **hybrid profile** to the bulk power system

Original Idea for Energy Parks

- Combine loads, storage and generation so that they are more than the sum of their parts.
- Utility scale behind-the-meter.
- Export or self-supply focused.
- Clean energy park powered by renewables



What Problems are energy parks trying to solve

- **Large load growth:** Data centers today consume hundreds of TWh annually, alongside electrification of transport, buildings, industrial process heat, and green molecules—together totaling thousands of TWh.
- **Speed:** Co-location is one way to meet these needs faster. Can also deploy renewables faster.
- **Value of electricity:** Value depends on time and location. Some generation is more valuable to export; other generation is better stored or used flexibly on-site.
- **Affordability:** Maximizing use of grid infrastructure spreads fixed costs over more kWh. Industrial electrification is a huge opportunity if it can access the cheapest electricity.
- **Resilience:** Ability to island—or at least guarantee supply—when the broader grid is stressed or failing.
- **Local economic benefits:** Communities hosting generation and infrastructure can see direct benefits.



Needs a larger conception of energy parks

- **Energy parks can be clean or dirty:** They can include **fossil fuel burning** resources like backup generators, gas turbines, co-generation, fuel cells. Combined heat and power is an early form of energy park (could be converted to **clean** energy park with a **thermal battery**). Early examples give useful templates
- **System boundary:** Can be just behind-the-meter assets or span a local region. Maybe be a hybrid of just load and storage (deep flexible) with generation from elsewhere.
- **Break from traditional administrative distinctions:** At the meter or outside the local region, can behave like generation, load and storage.
- **Broad paradigm:** Includes micro-grids and prosumer concepts but mostly thought of as utility-scale phenomenon. Aspiration is **clean** energy parks will drive most benefits.

Benefits of Energy Parks

For the grid:

- Alleviate strain from rapid load growth and enable faster connection of new generation.
- Improve affordability through flexibility, capacity value, and better T&D utilization.
- Potentially reduce operator complexity and improve power-market stability.

Benefits of Energy Parks

For co-located loads:

- Faster access to generation.
- Arbitrage between on-site and grid power.
- Easier access to the full value of flexibility.
- Efficiency, reserves, and resilience.
- Clean energy parks can also provide reputational benefits.

Benefits of Energy Parks

For co-located loads:

- Local economic development and shared benefits.
- Reduce pollution with **clean** version.

Real World Examples

- **Worldwide:** Traditional cogeneration (efficiency and option value of electricity).
- **USA:** Rondo thermal batteries in off-grid parks (Holmes Western Oil, CA) and grid-connected parks (Heineken brewery with EDP in Portugal).
- **Australia:** Fortescue regional energy park with 220-kV internal lines, combining solar, storage, and gas to decarbonize mining operations.
- **Netherlands:** Port of Rotterdam energy and hydrogen hub (offshore wind landing points, electrolyzers, hydrogen pipelines, industrial loads, and storage).



Bonus Material

Why Clean Energy Parks?

- Lower Impacts: Reduced GHG and local criteria pollution, less noise, less water use. (although needs more land if renewables are part of park).



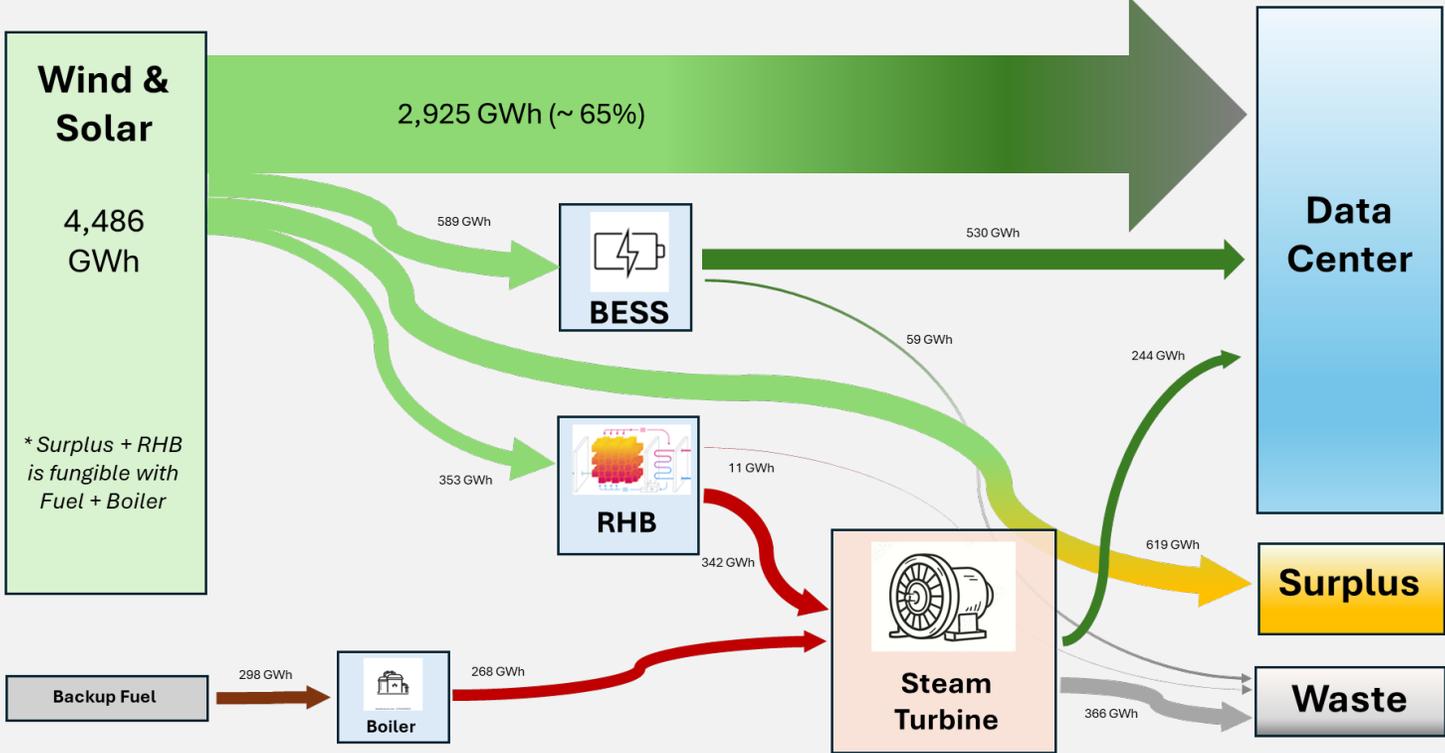
- Versatility: Inclusion of flexibility from storage and loads needed for viable energy parks allows lowest value production from variable renewables to be used on site while highest value is traded with bulk grid via transmission.



- Grid Friendly: Hybrid resources can play nice with bulk power grid.

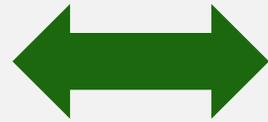
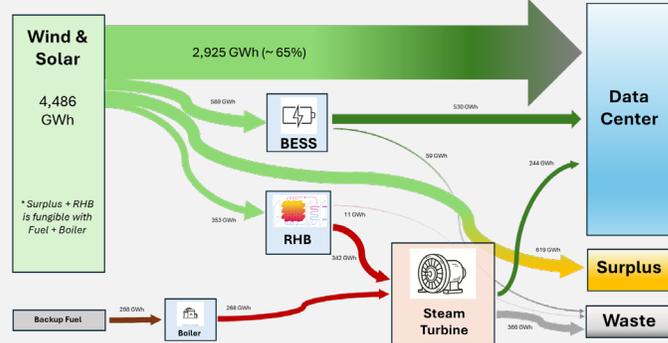
Clean energy park for off-grid data center supply

Sankey Diagram for Data Center Energy Park (off-grid)



What happens when you connect to grid?

Sankey Diagram for Data Center Energy Park (off-grid)



Clean energy park acts as virtual storage for the grid. It can avoid consuming at bad times, absorb excess during surplus, and provide some extra peak resource.

Extra IT capacity could be easily accommodated without extra grid investments.

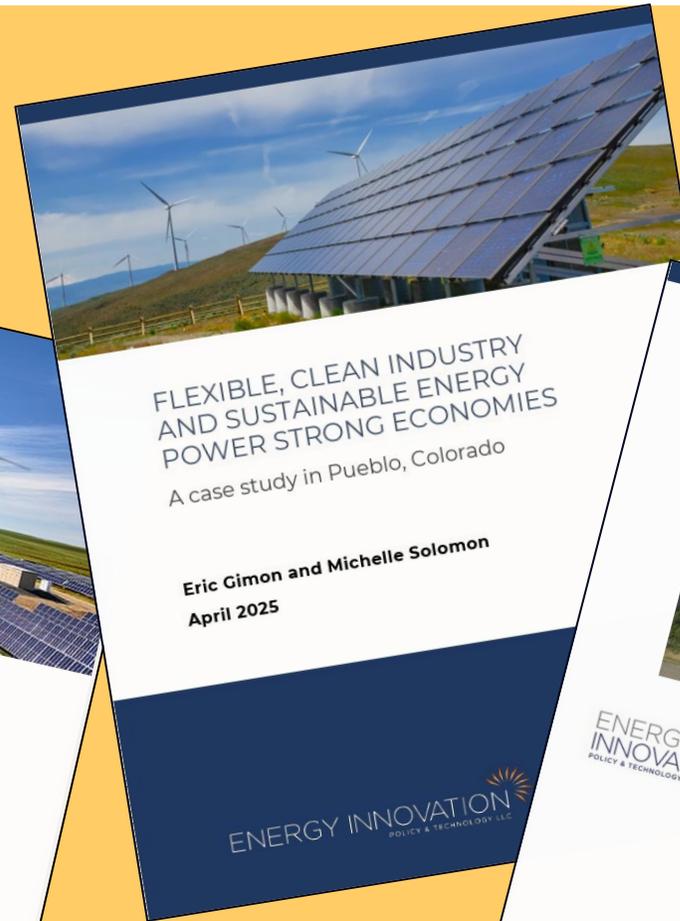
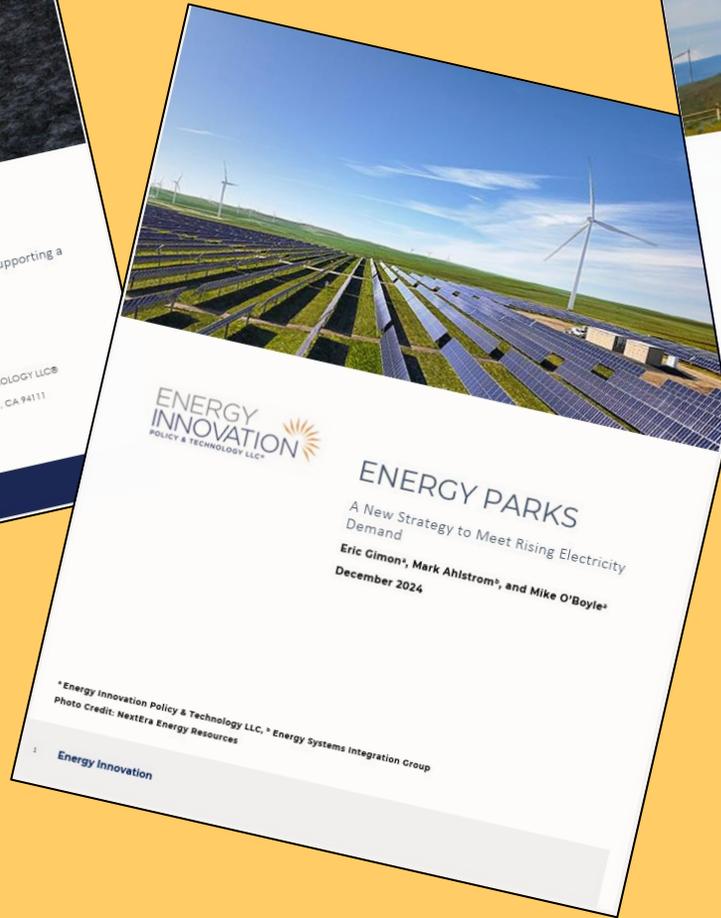
Gas turbines or RICE units as sole suppliers for data center.



Dirty energy park immediately start drawing power the grid to avoid fuel cost. Best you can do is avoid peak periods by burning fuel.

Extra IT capacity not easily accommodated without extra grid investments.

MORE READING





Thank you

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