Hybrid Resources

The role and value of hybrid resources in the (not so distant) future

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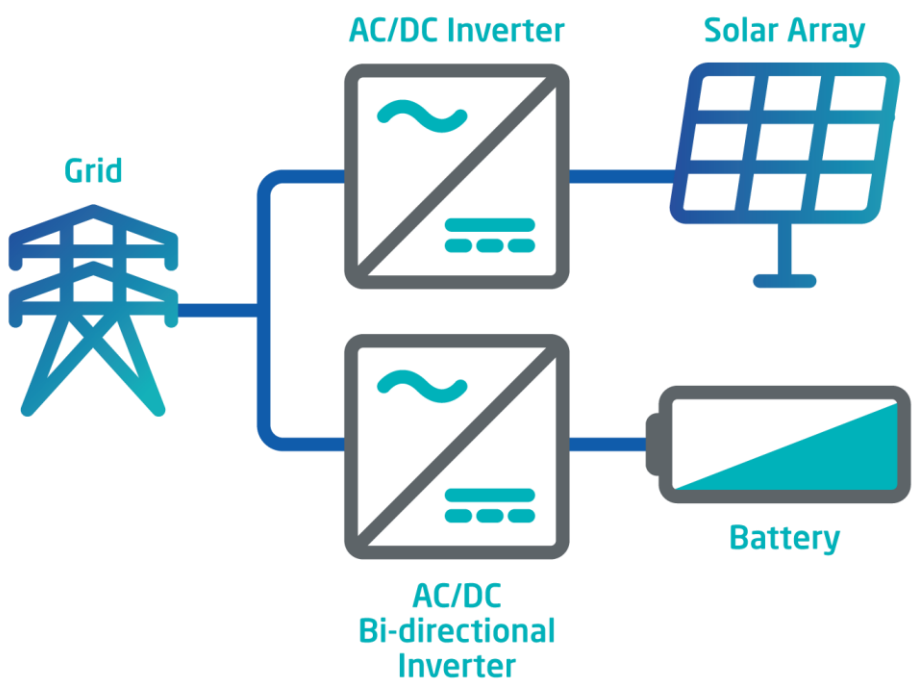
Definition

Hybrid Resource: A combination of multiple technologies that are physically and electronically controlled by the Hybrid Owner/Operator behind the point of interconnection ("POI") and offered to the grid as a *single resource* at that POI

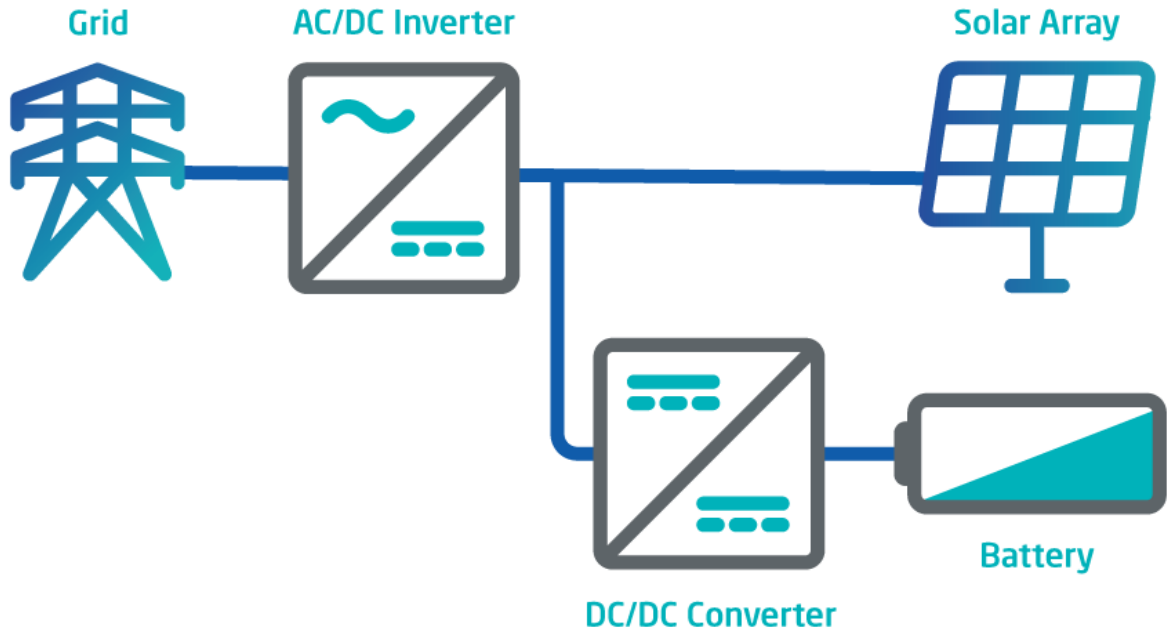
If treated as multiple resources, it is "co-located" rather than "hybrid"

AC Coupled, DC Coupled

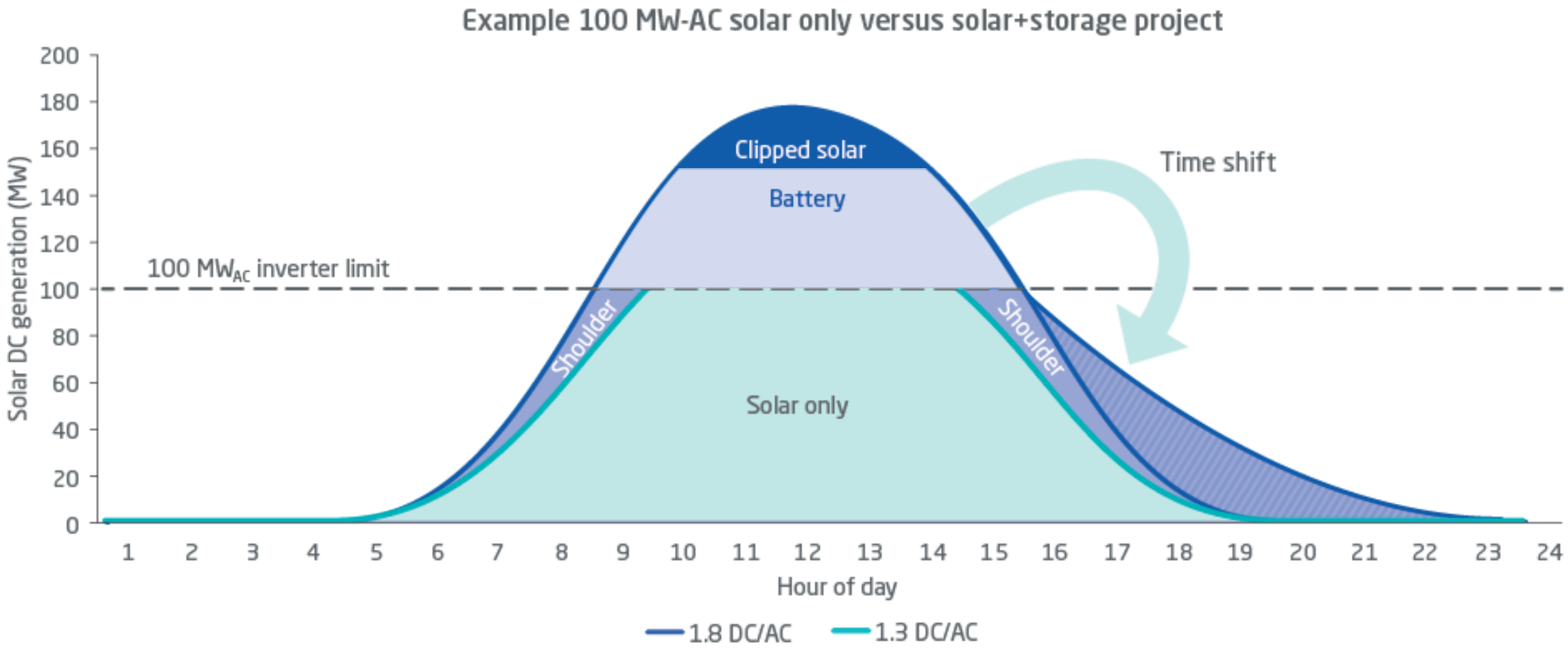
AC Coupled



DC Coupled



Maximizing capabilities with DC-coupled energy storage



Benefits to the RTO and Market Participants

- Participate in all market products using an "existing" market participation model (changing a master data file, not creating a new participation model)
- Treat hybrid like conventional resources, not renewable or storage resources
- Hybrid Owner/Operator manages state-of-charge (through their offers)
- Doesn't curtail renewable for headroom – services from battery rate-of-charge
- Allows the storage component of the Hybrid Resource to be charged from the renewable component of the Hybrid Resource (and from grid—and that's an economic choice, not a requirement of the solar investment tax credit)
- Provides fully convex, one-part offers* without advance commitment requirements, startup costs, minimum generation levels or other constraints

* Monotonically increasing energy offers without startup or no-load fees. For a good explanation of convexity and offers, see: https://www.iso-ne.com/static-assets/documents/2015/06/price_information_technical_session11.pdf

Key Points – Common Discussion Points

- Reliability is maintaining supply/demand balance in real time
  - Hybrids are great source of reliability, flexibility and energy services (and their evolution)
- But what about the "interdependencies" within the hybrid resource?
  - If the hybrid resource owner/operator is willing to internalize them, provide conventional offers and manage their own risk, they should be allowed to do so
  - Let's simplify ISO/RTO software… We're not asking for your optimization help in our plants
- But what about resource adequacy (capacity value)?
  - Is resource adequacy about reliability, or about daily energy for rare events?
  - We conflate the two concepts, but increasingly, they are becoming different issues
    - Real time balancing capability is for reliability (and a very large part of today's perceived RA value)
    - Is longer duration storage and less flexible capacity for "large energy/slow contingency" events?

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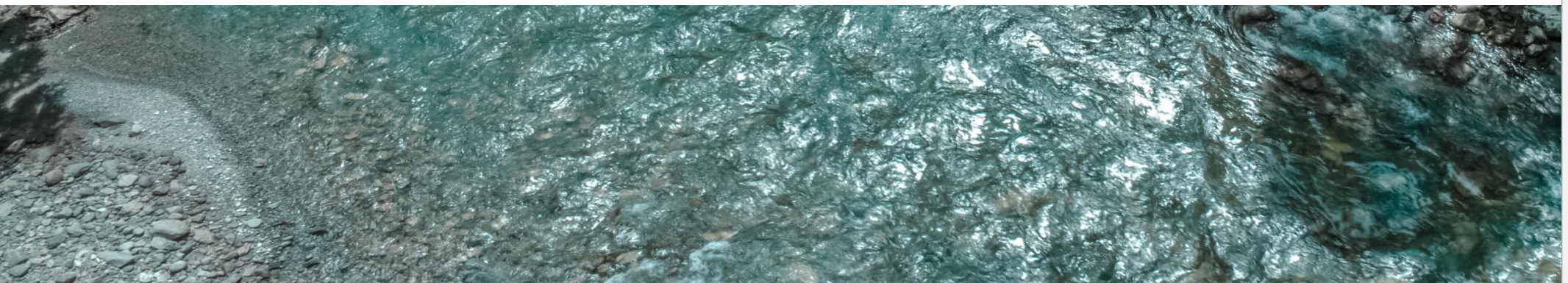

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