Optimal Storage Operation with Random Renewable Generation and AC/DC Loads

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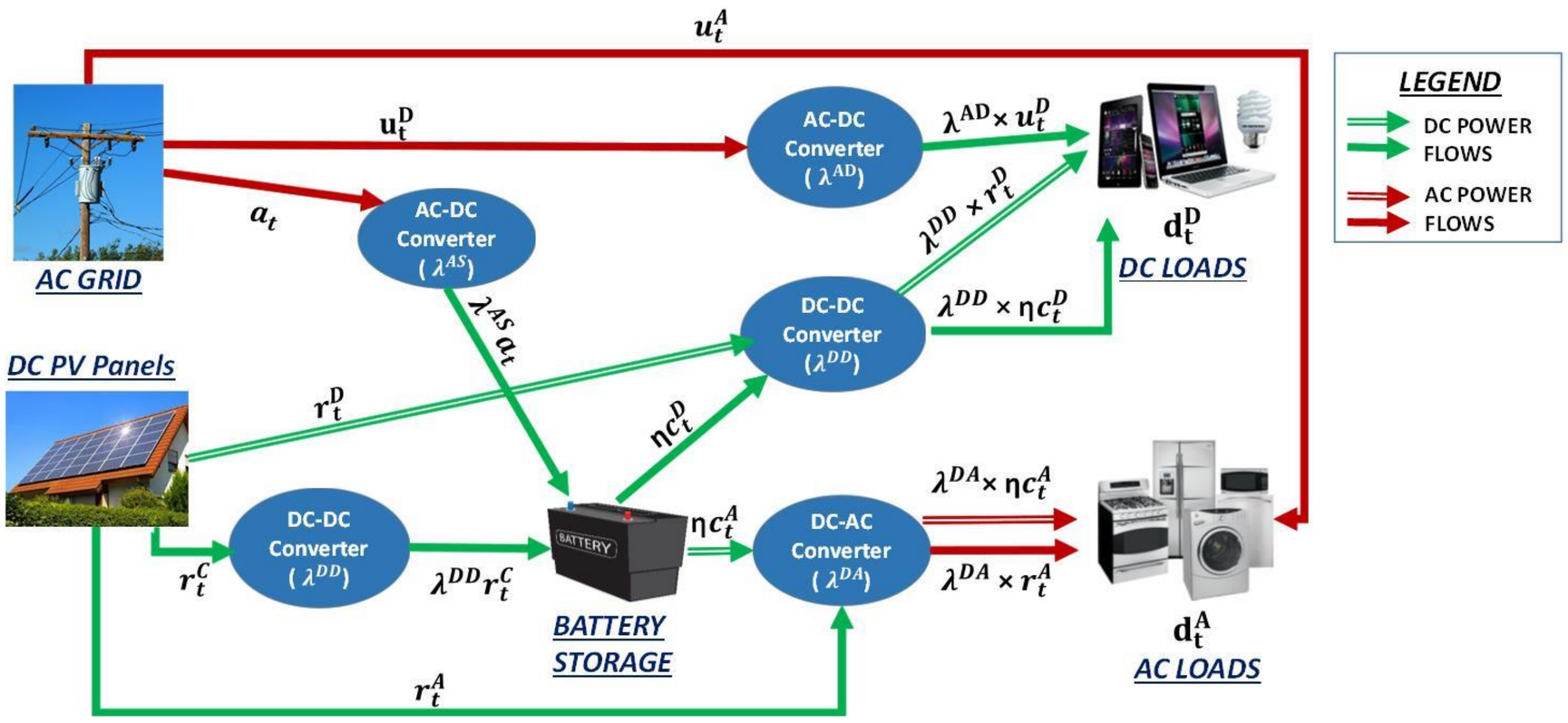
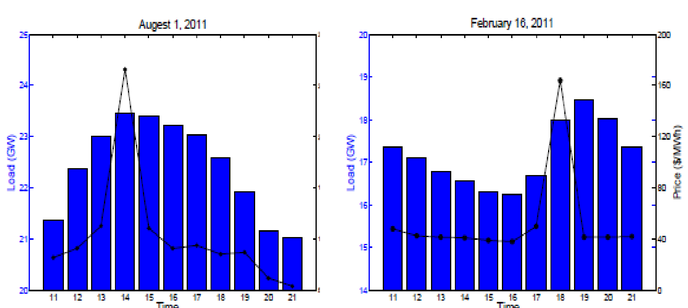
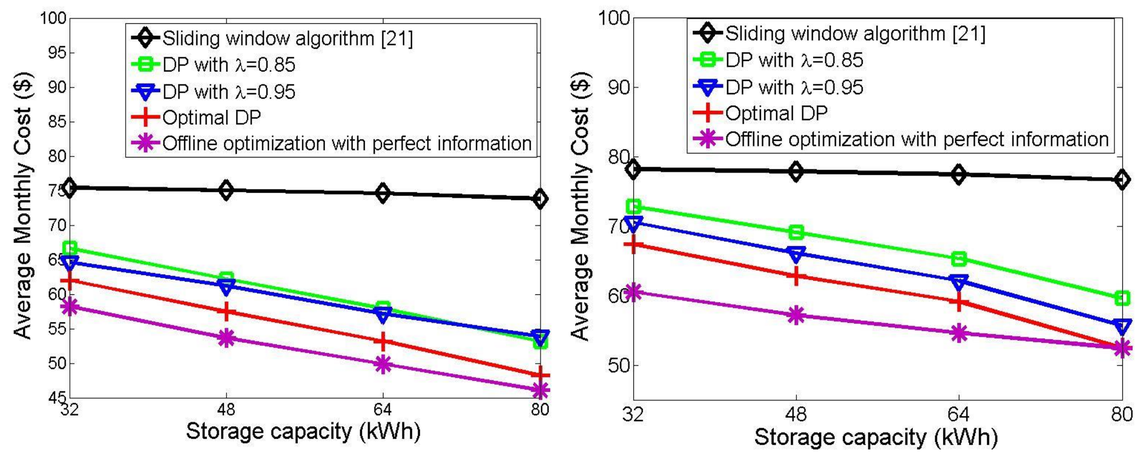
- The operation of a consumer-owned energy storage (e.g., a battery).
- The consumer faces time-varying (and possibly random) electricity prices.
  -- e.g., under time-of-use pricing or dynamic pricing.
- The consumer has different types of AC/DC loads.
  -- AC: dish washer, television, refrigerator
  -- DC: computers, LED lights, electric vehicles
- The consumer may have (intermittent) renewable generation.
- The consumer seeks to minimize its expected energy cost.





- The framework incorporates: (i) different conversion efficiencies (ii) the **randomness** in renewable generation and electricity prices.
- We characterize and compute the **optimal operation policy**:
  -- given the current renewable generation and electricity price
  -- use renewable generation for DC/AC load or charging storage?
  -- procure how much energy for consumption and storage charging?
  -- Withdraw how much energy from the storage for consumption?
- We compute the optimal policy in a realistic setting with random electricity prices and renewable generation.
- Based on real data on hourly prices and solar generation from MISO.



- ***Cost reduction***: 10% of optimal control that ignores the difference in conversion efficiency, 25% of many on-line algorithms.

- Reference*:* J. Jin, Y. Xu*, Y. Khalid, and N. Khan, "Optimal Operation of Energy Storage with Random Renewable Generation and AC/DC Loads"*, IEEE Trans. on Smart Grid.*

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