STATE OF RHODE ISLAND
ENERGY EFFICIENCY & RESOURCE MANAGEMENT COUNCIL

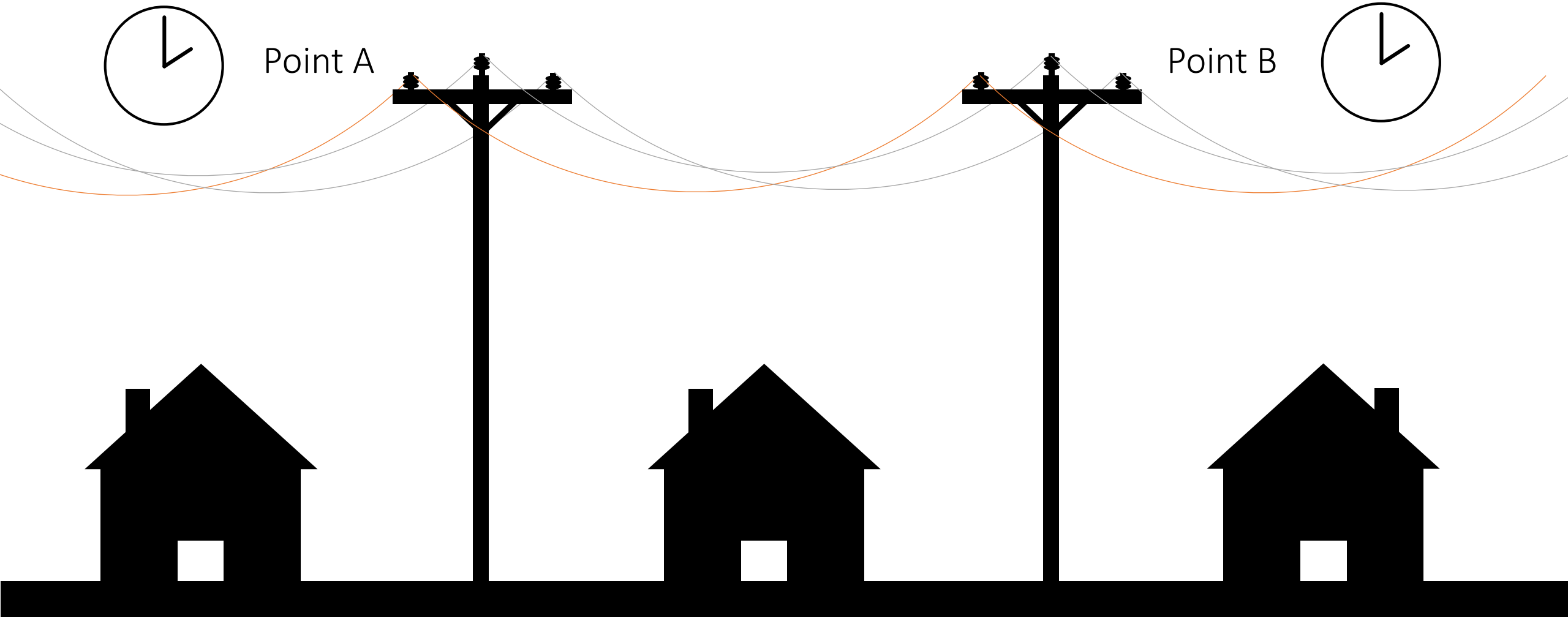
Storage 101:

What is energy storage & how does it benefit Rhode Island?

Carrie A. Gill, Ph.D.
Office of Energy Resources
Carrie.Gill@energy.ri.gov

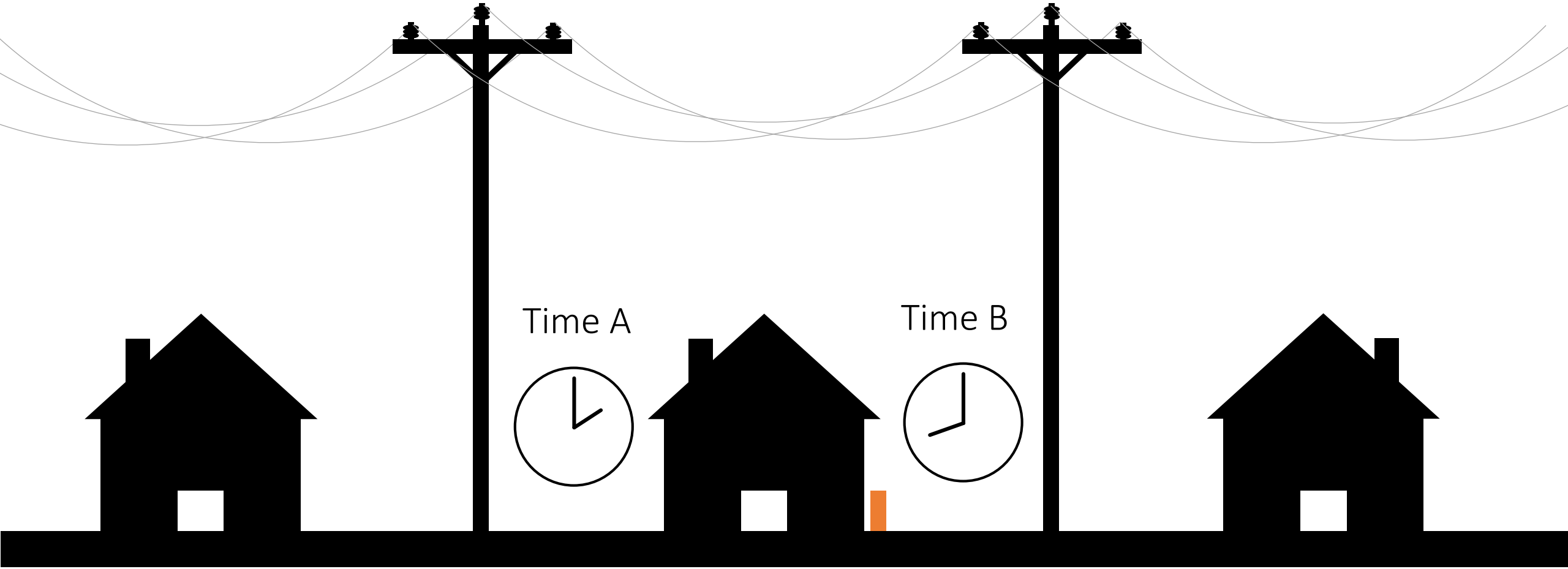
Distribution versus Storage

Distribution systems move electricity
from point A to point B at one moment in time.



Distribution versus Storage

Energy storage systems store electricity
at one point over a period of time



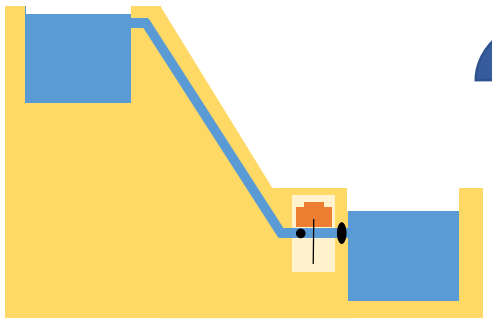
Types of Energy Storage Systems

Energy Storage Systems

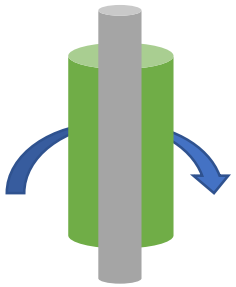
Mechanical Energy Storage

(something spins a generator)

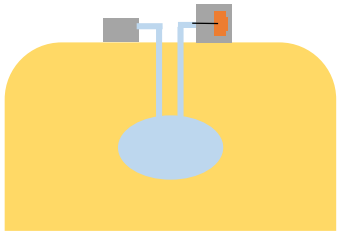
- Pumped Hydro



- Flywheels



- Compressed Air



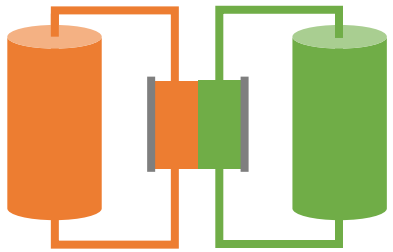
Thermal Energy Storage

(store heat or ice)

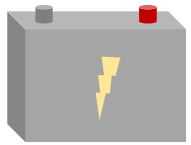
Chemical Energy Storage

(chemical energy turns into electricity)

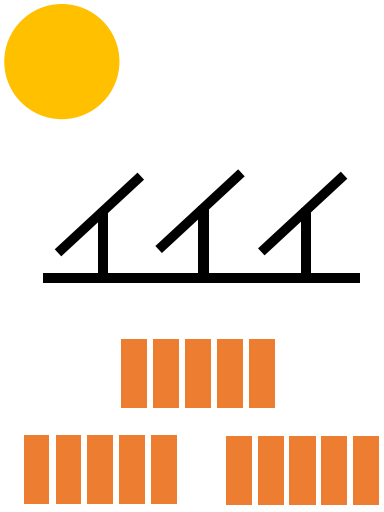
- Batteries
  - Flow



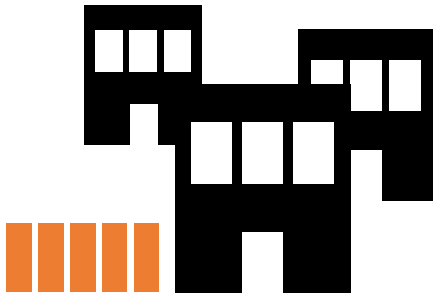
  - Solid State



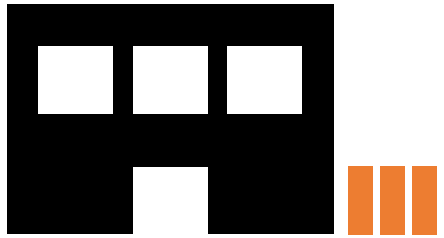
Scales of Energy Storage Systems



Utility Scale



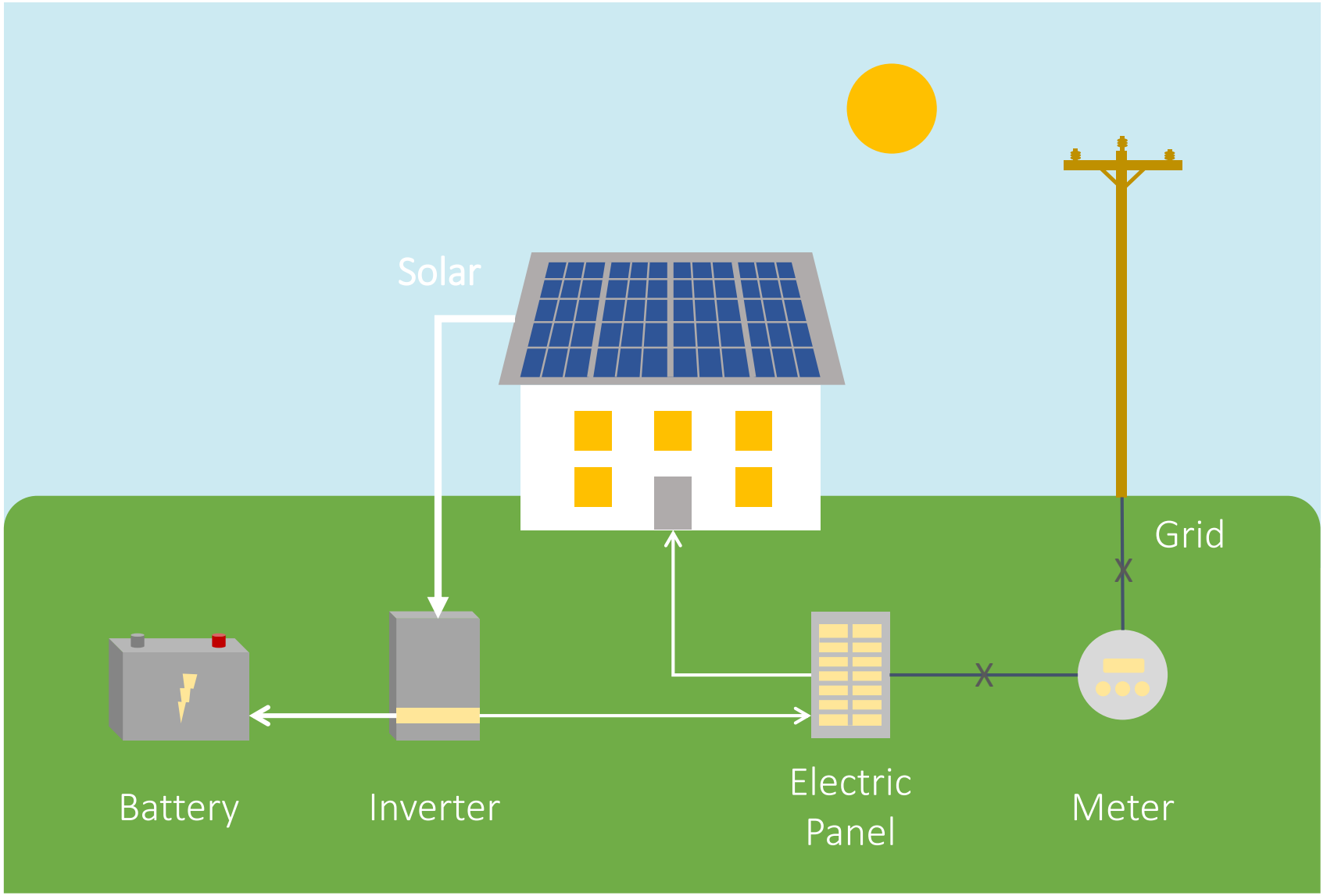
Microgrid Campus



Commercial Scale

Residential Scale

Example: Residential Battery Storage



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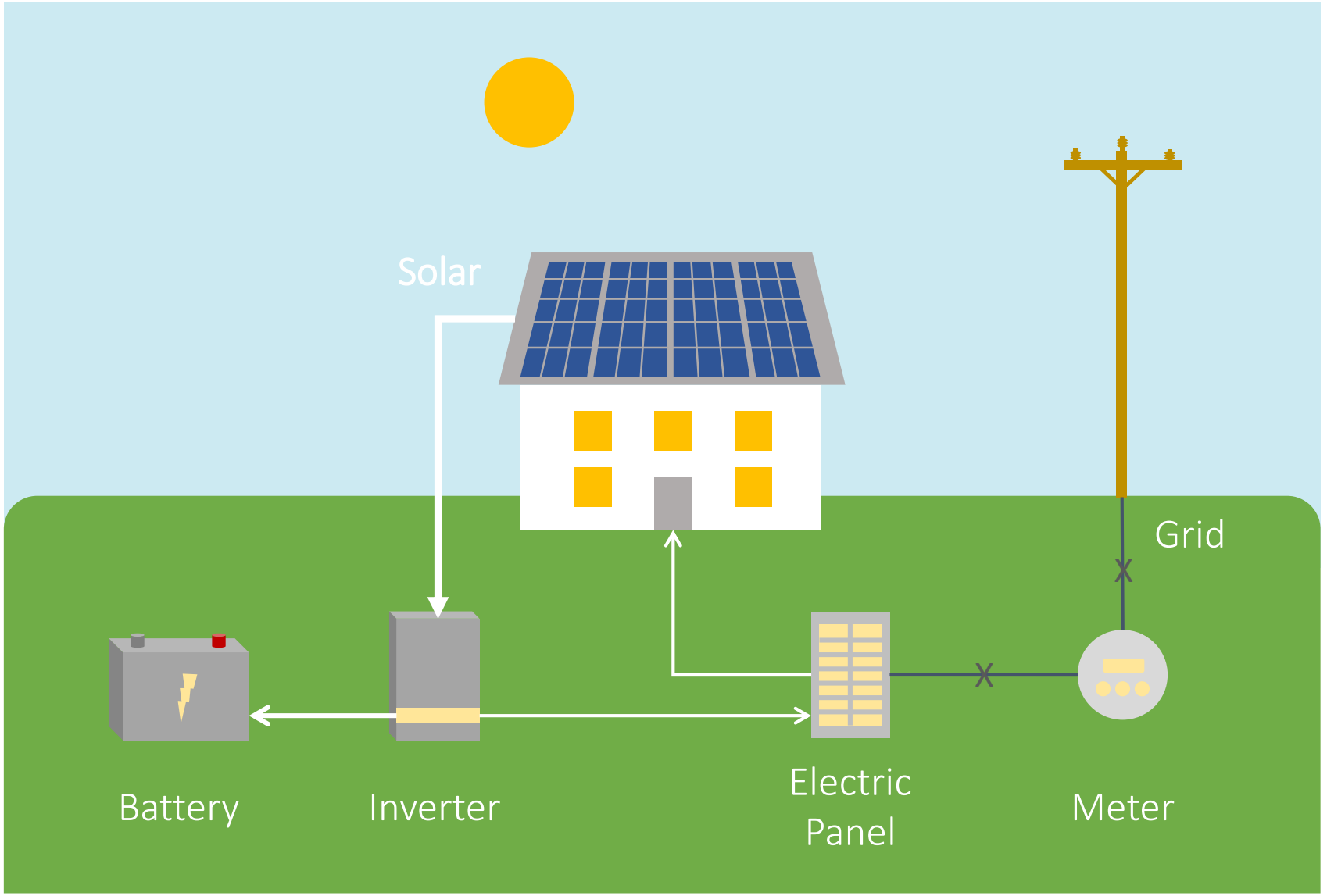

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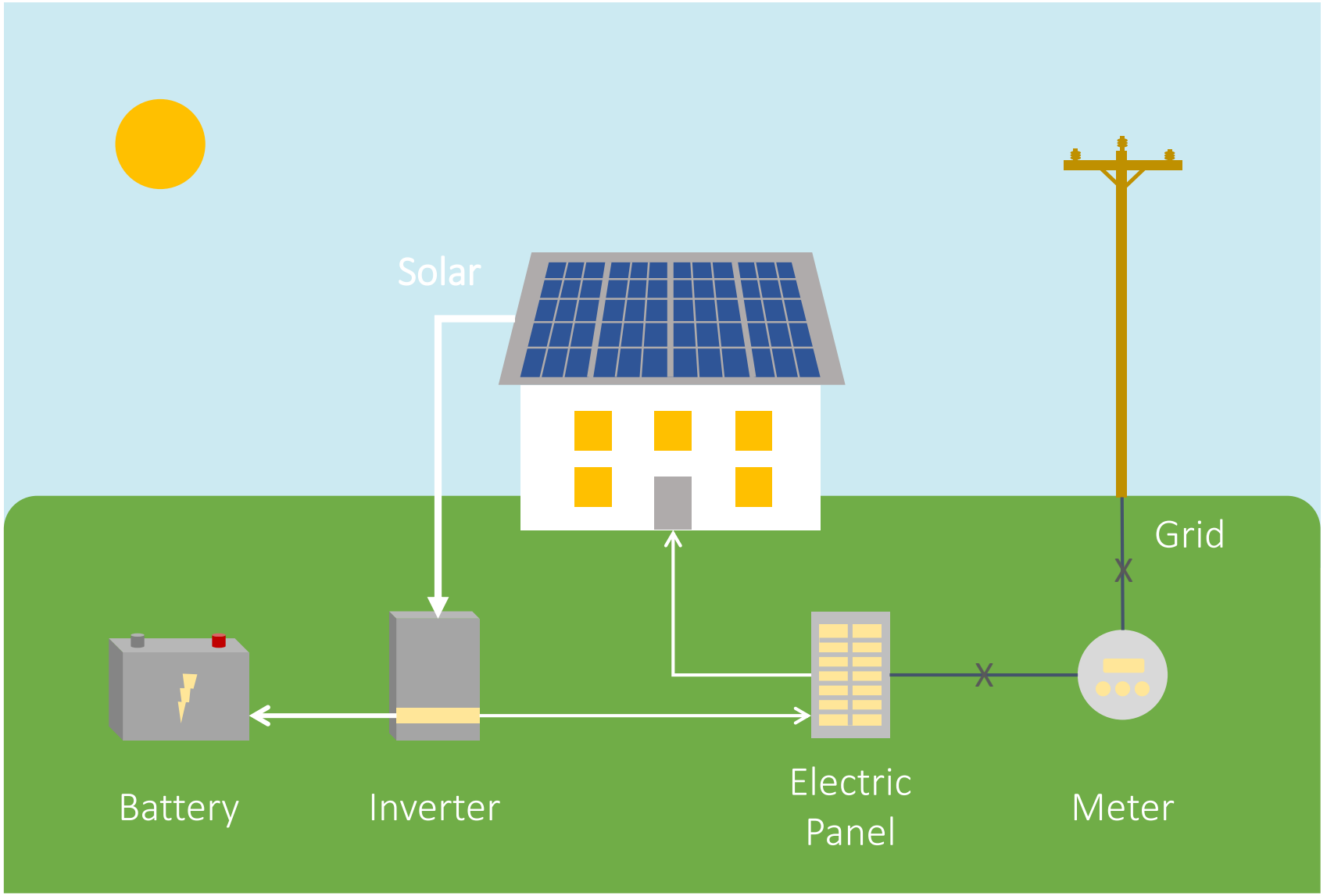

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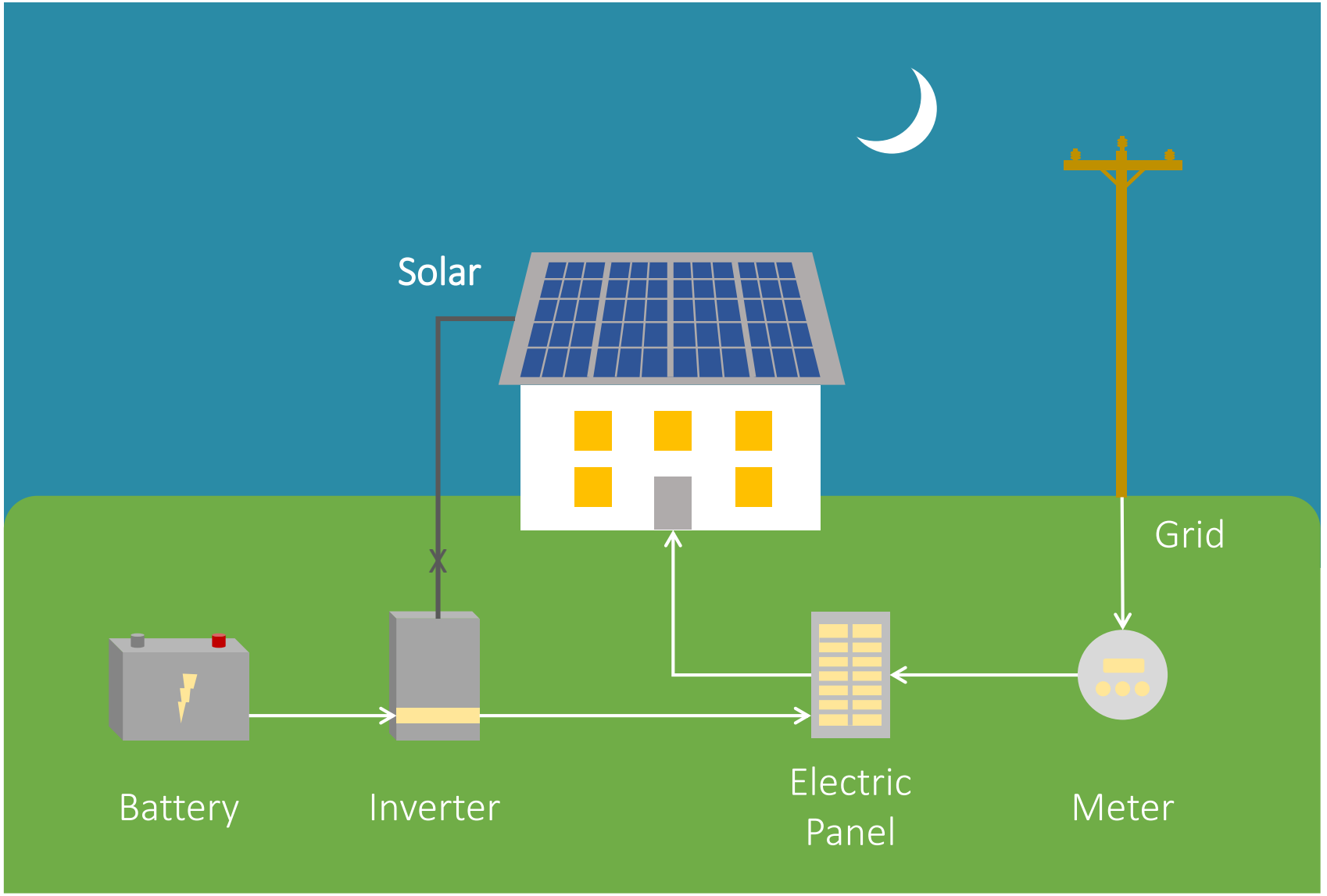

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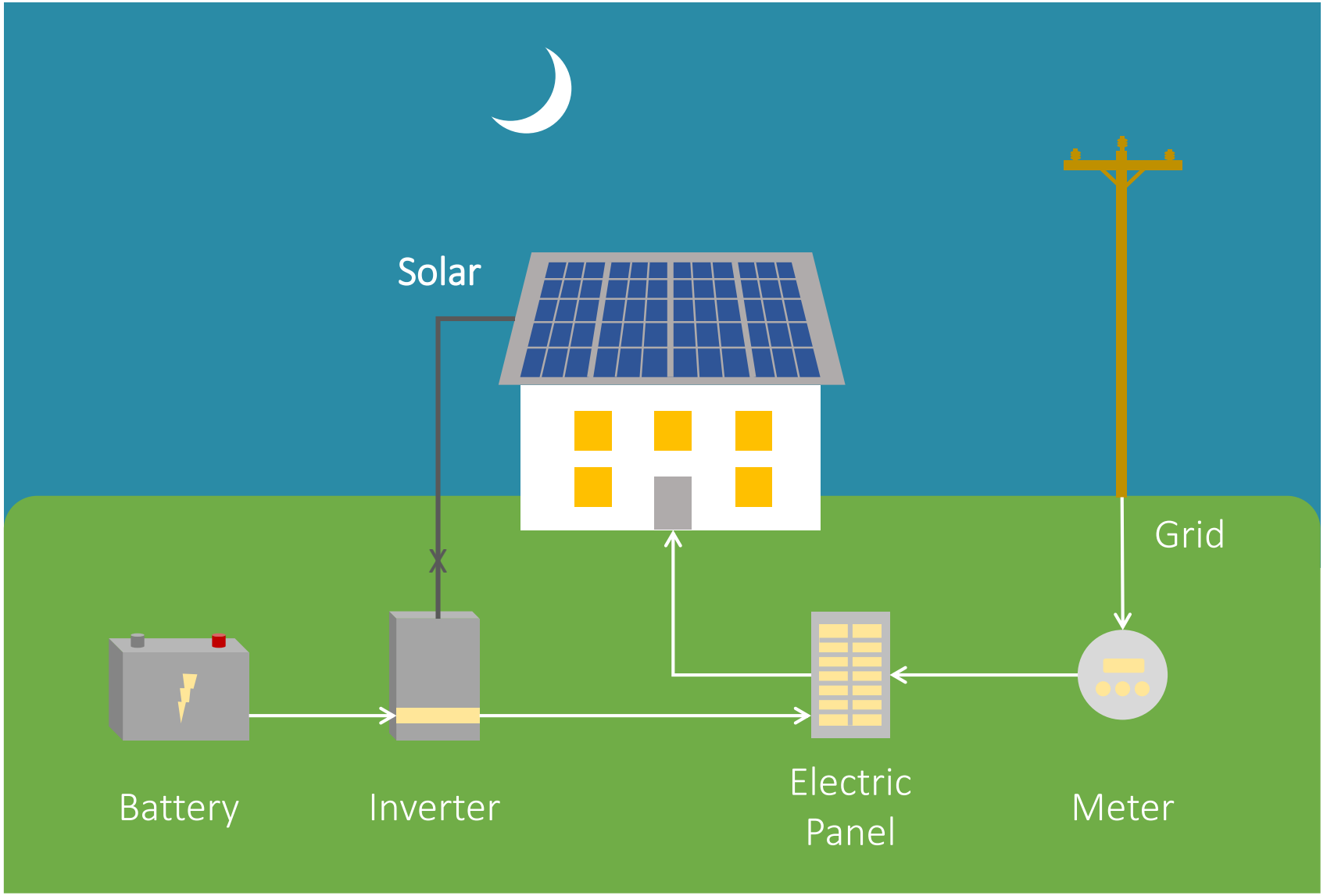

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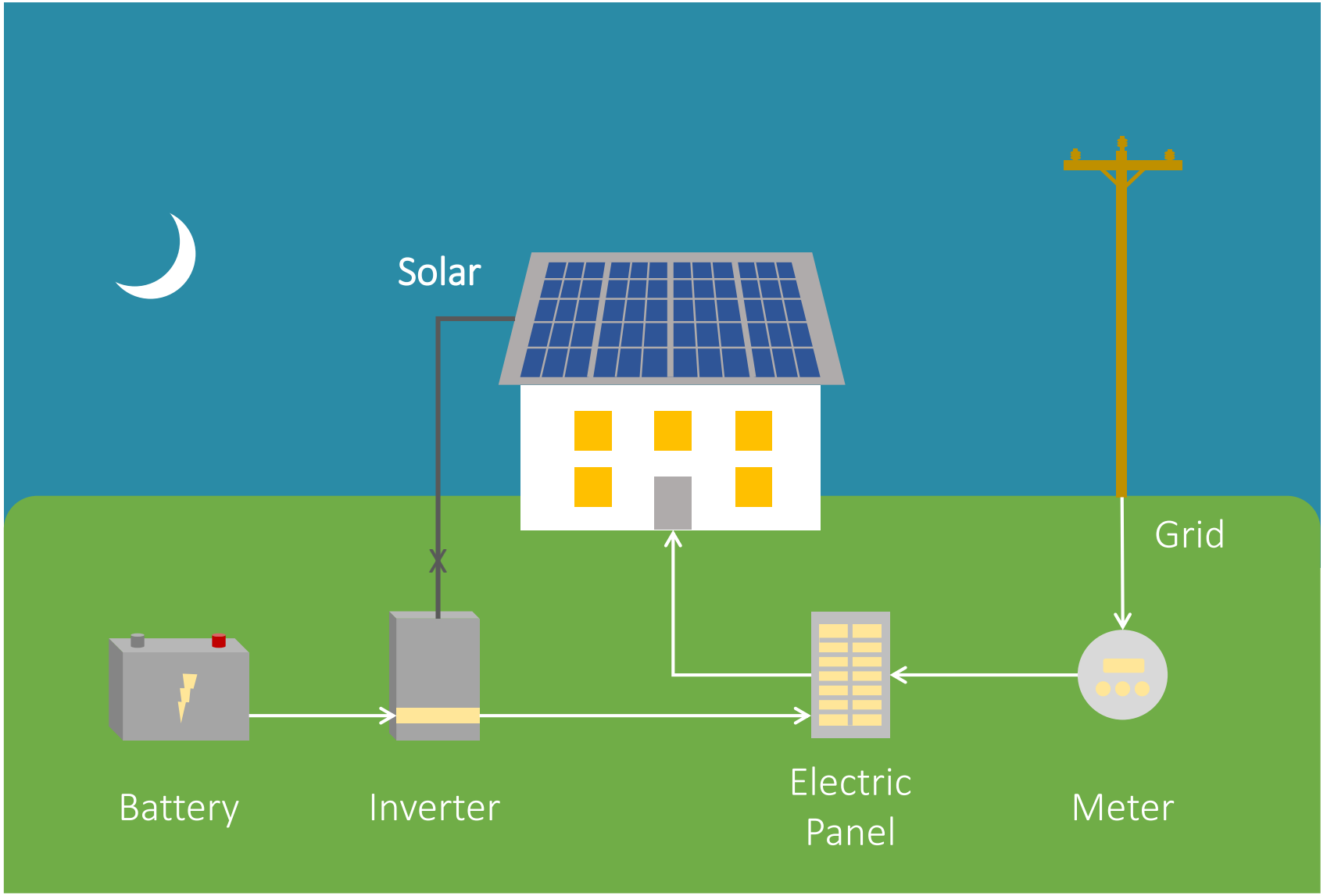

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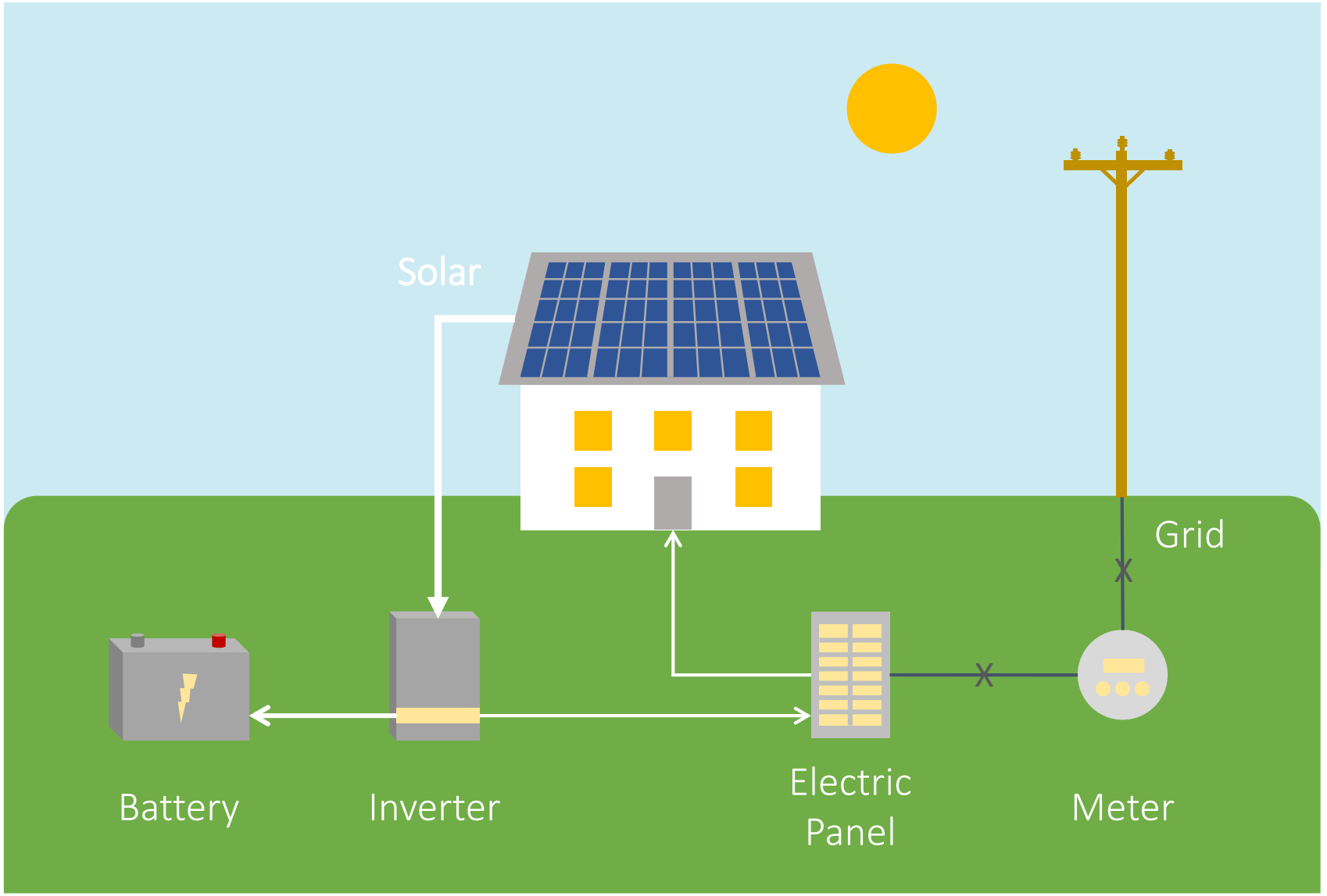

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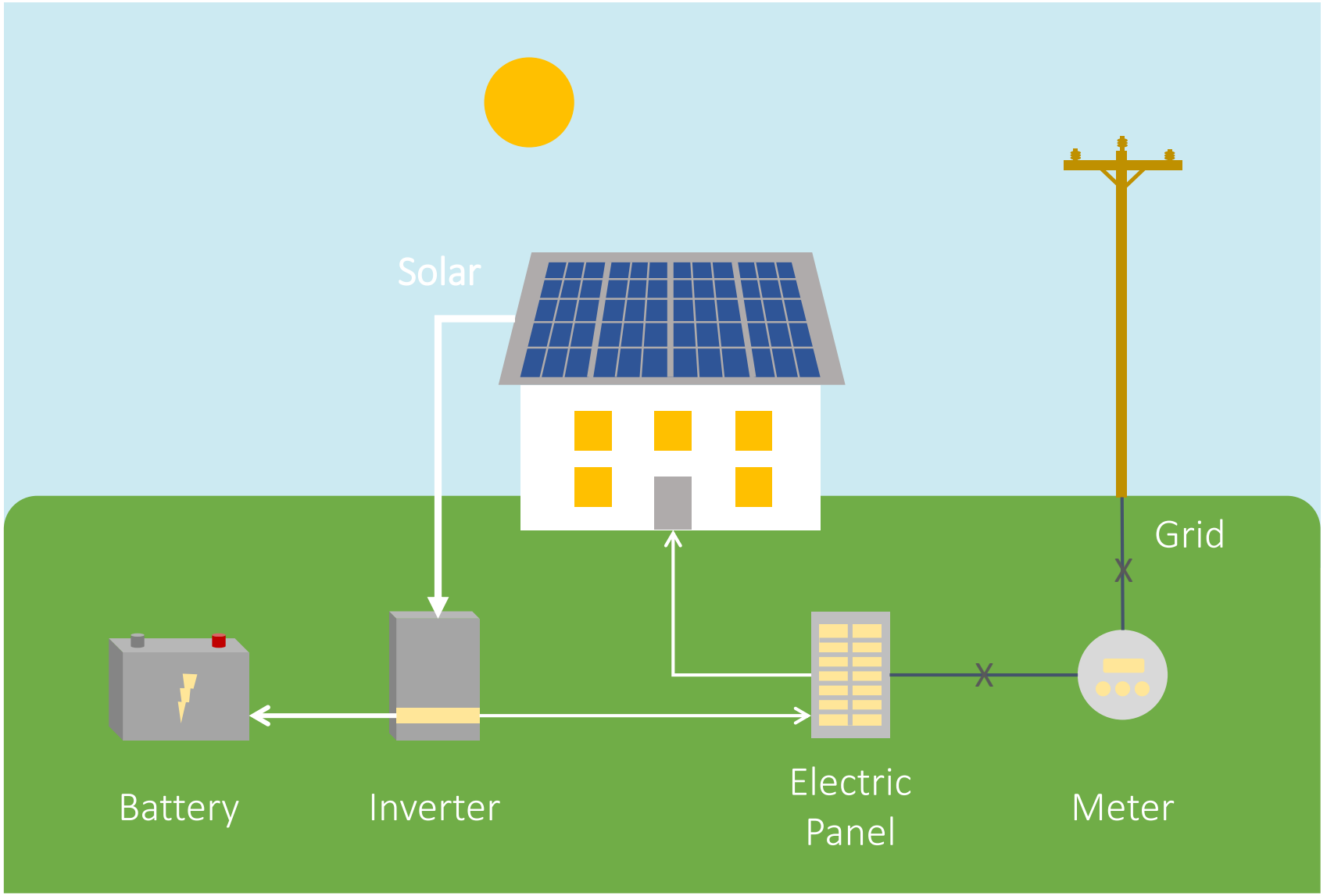

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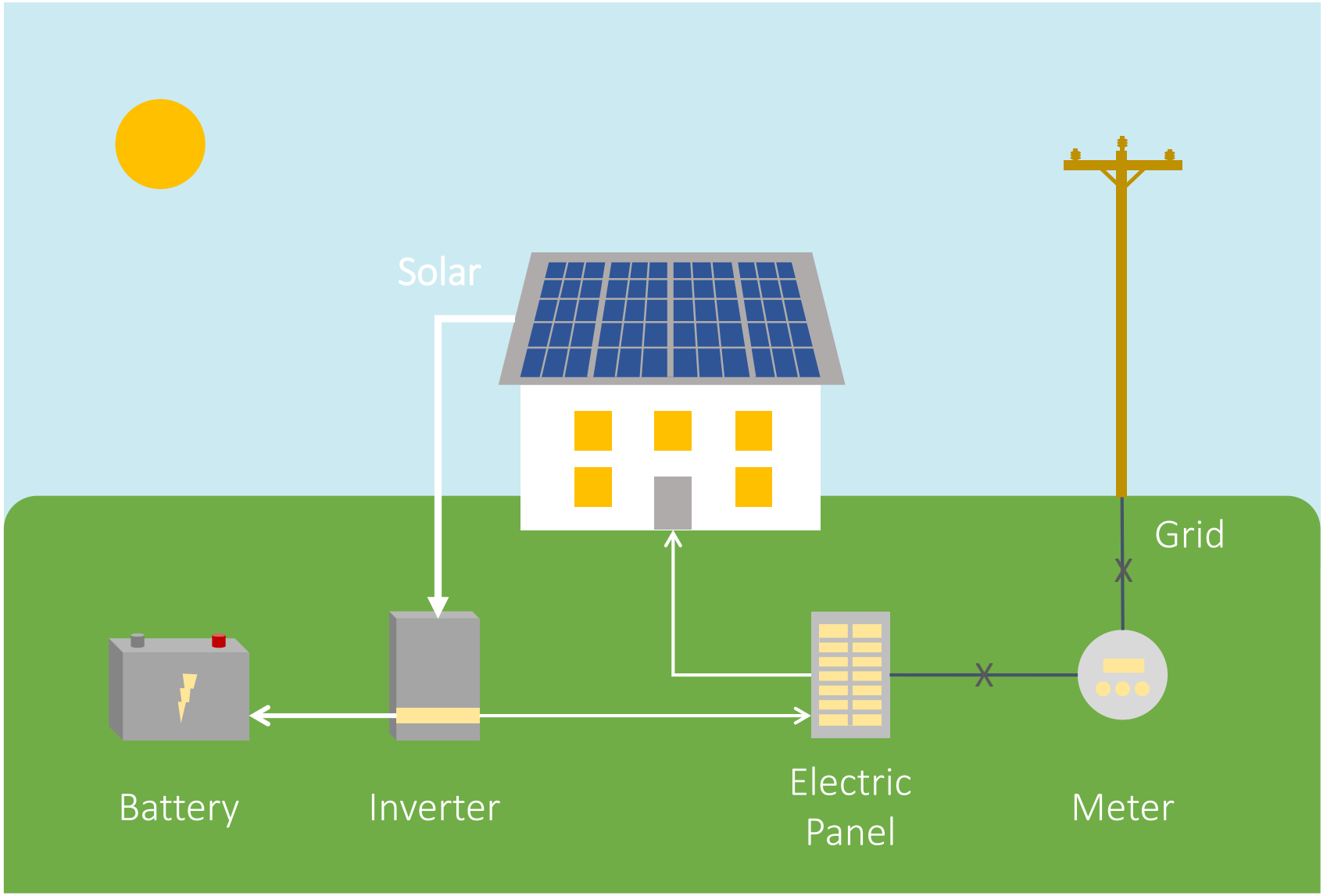

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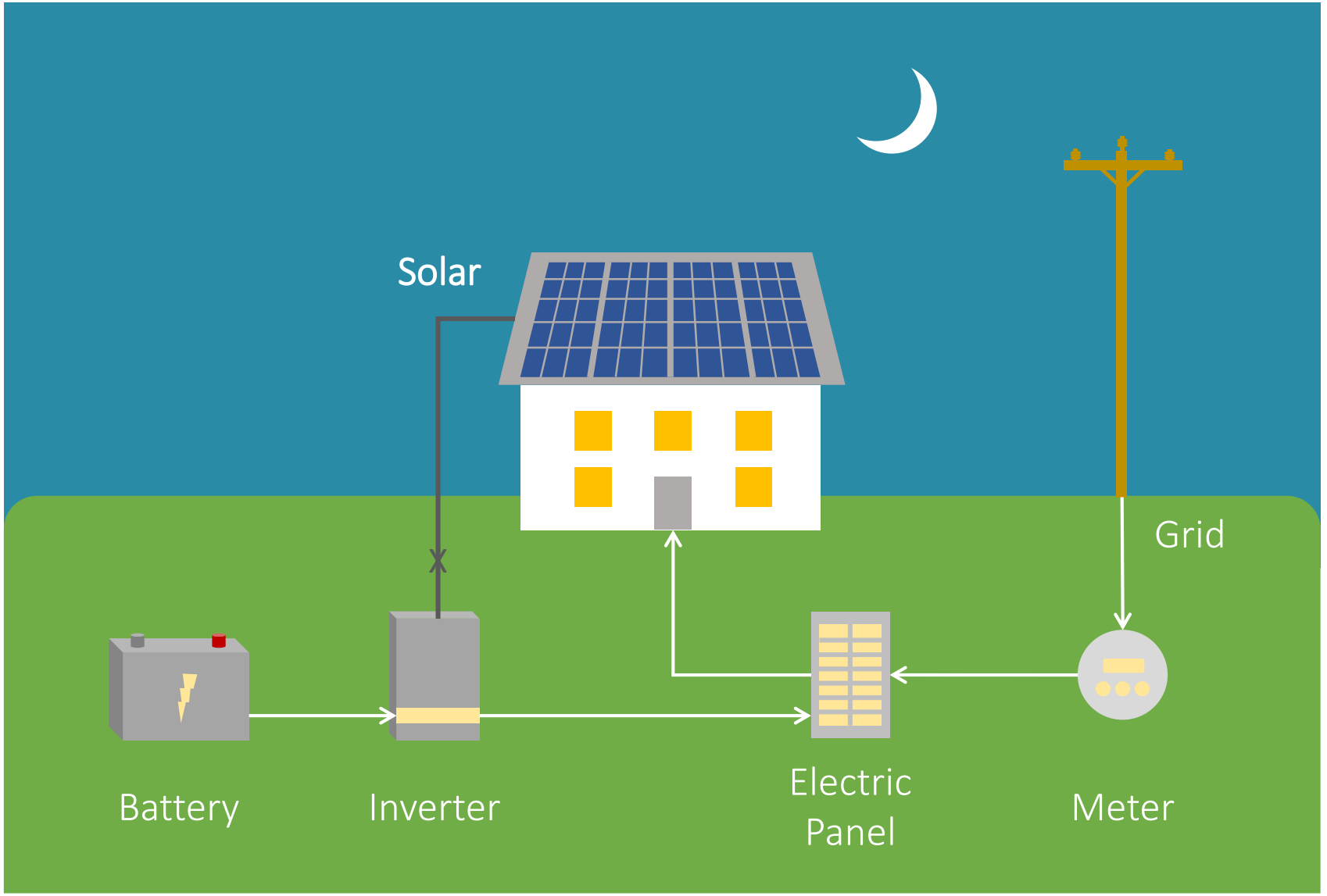

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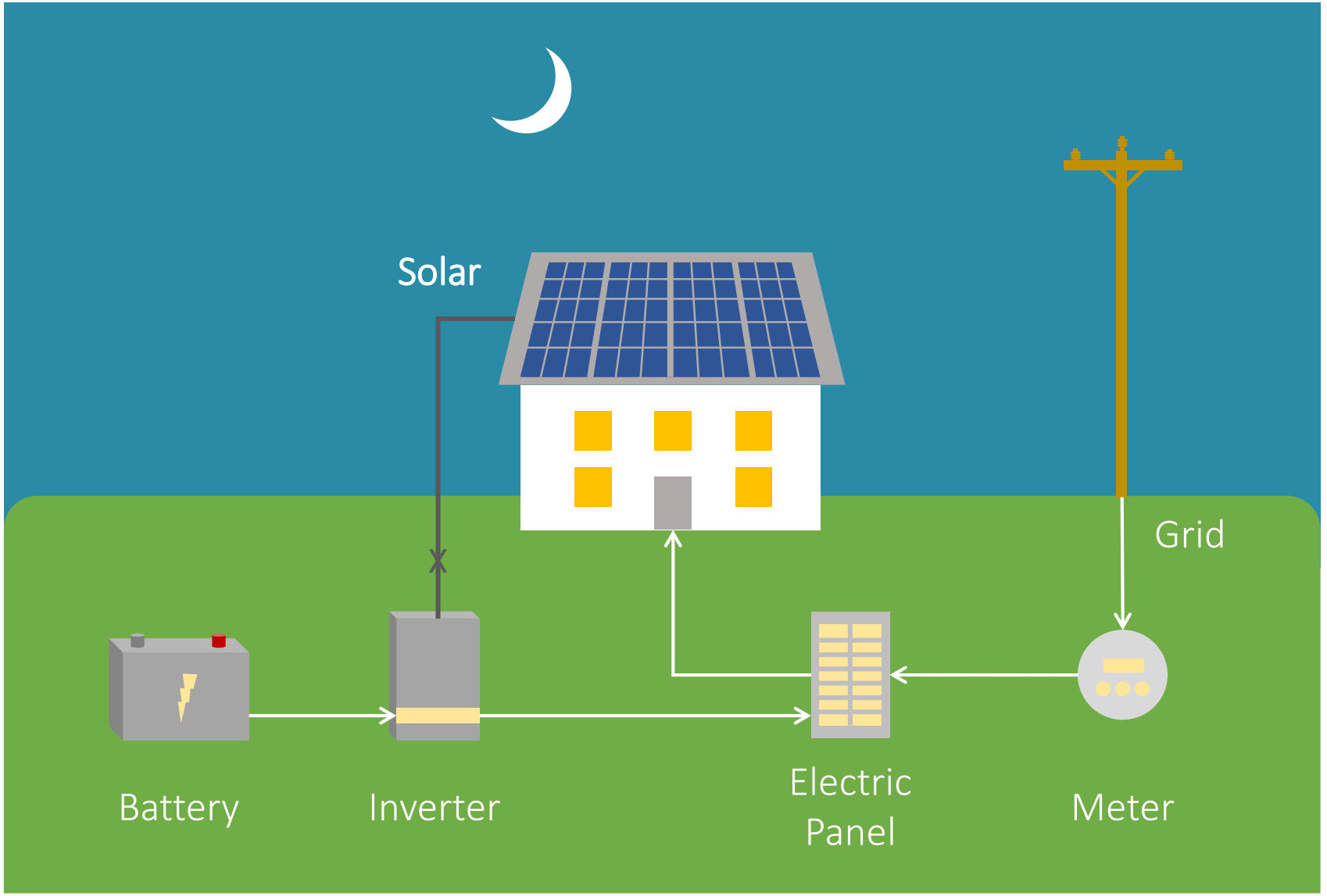

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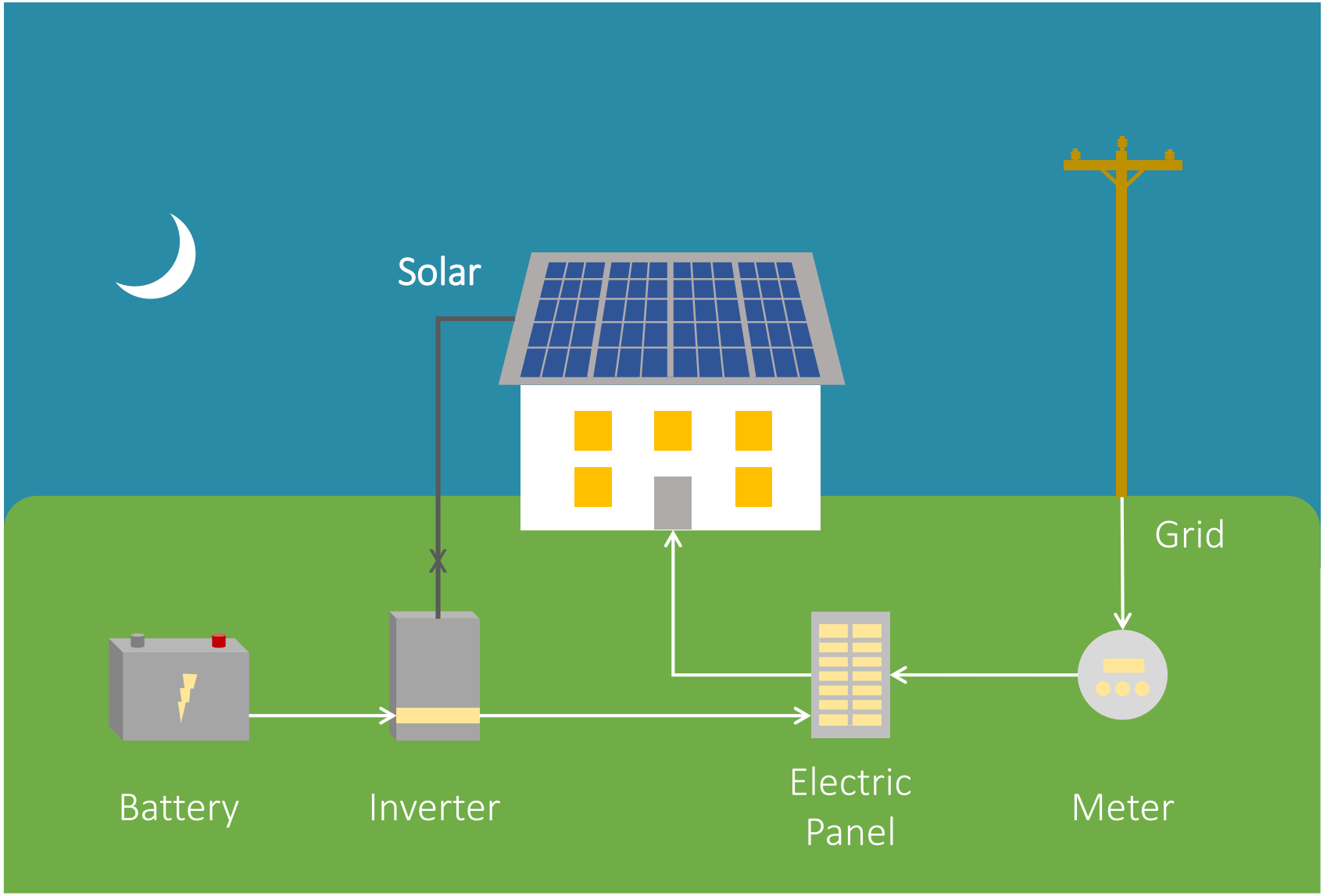
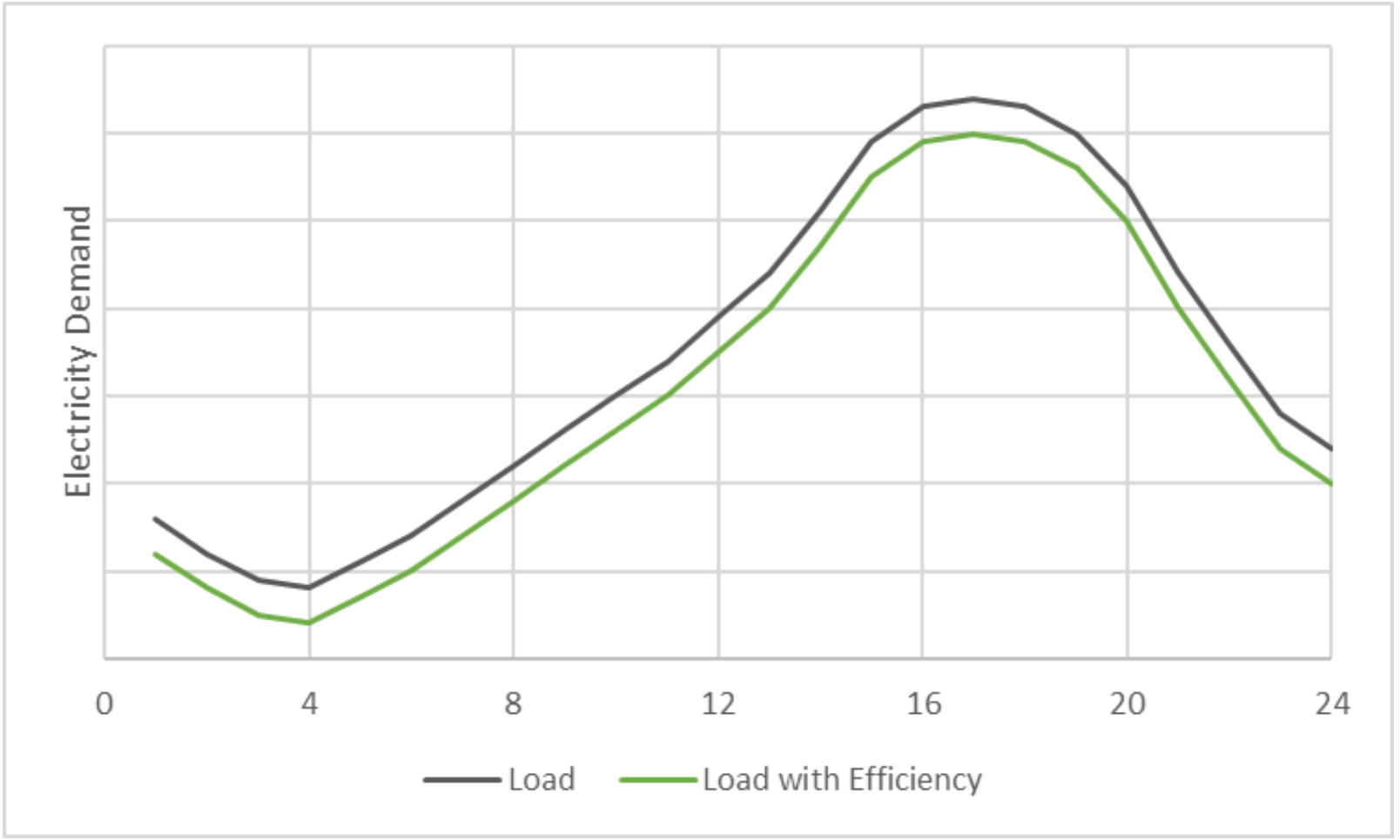


Residential Scale

Energy Efficiency, Renewable Energy, and Energy Storage

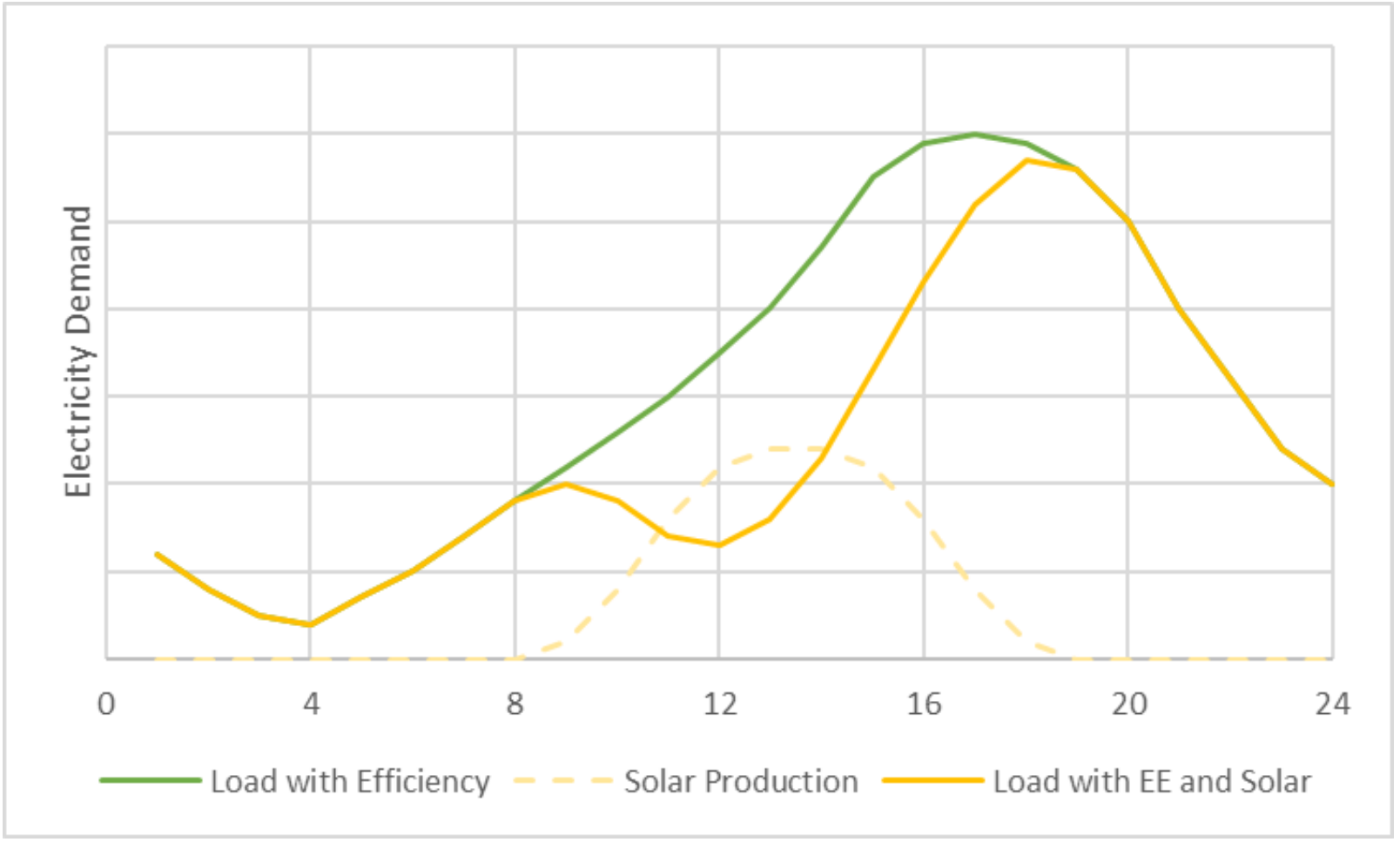
Energy efficiency reduces demand at all hours of the day



Illustrative – does not use actual data

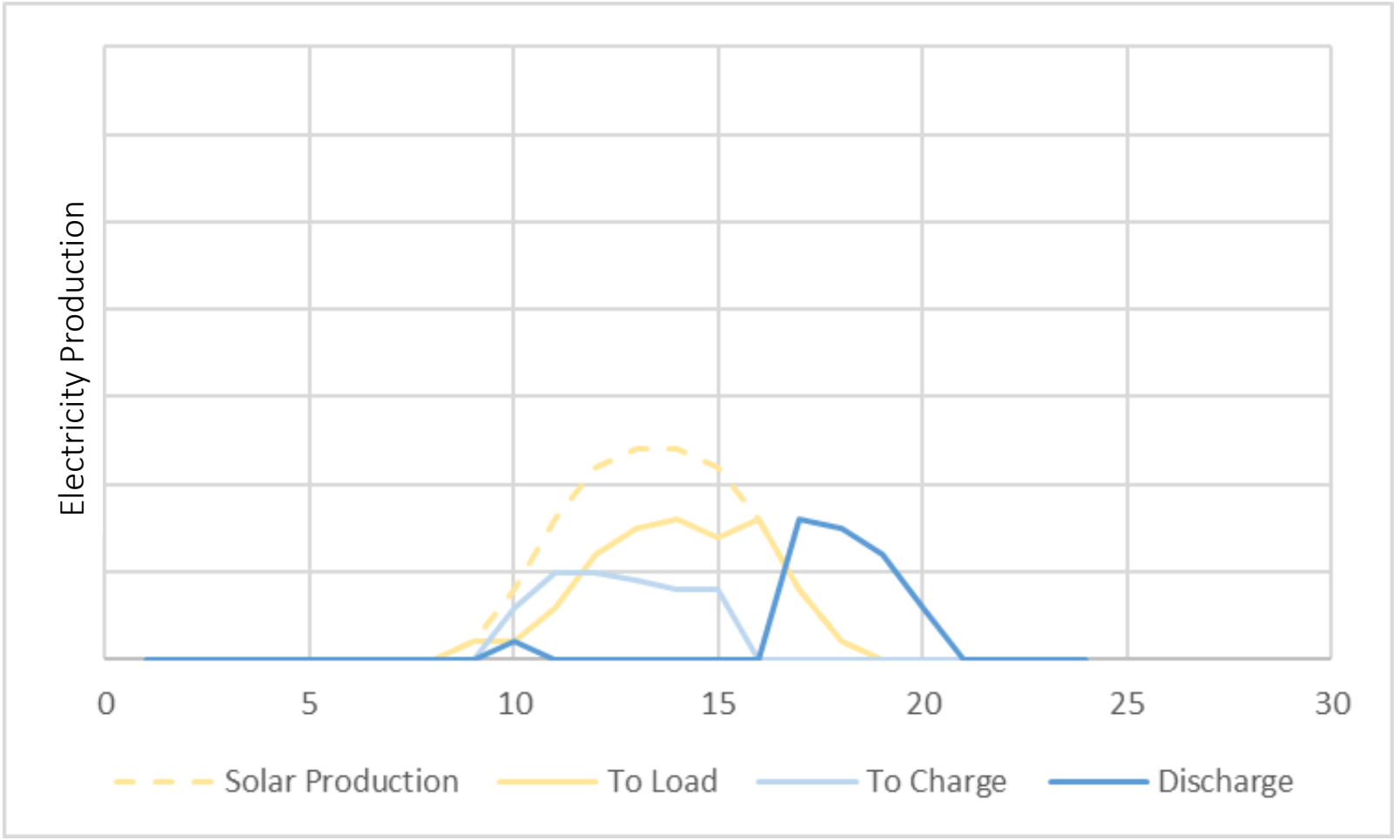
Energy Efficiency, Renewable Energy, and Energy Storage

Solar reduces demand during daylight hours



Illustrative – does not use actual data

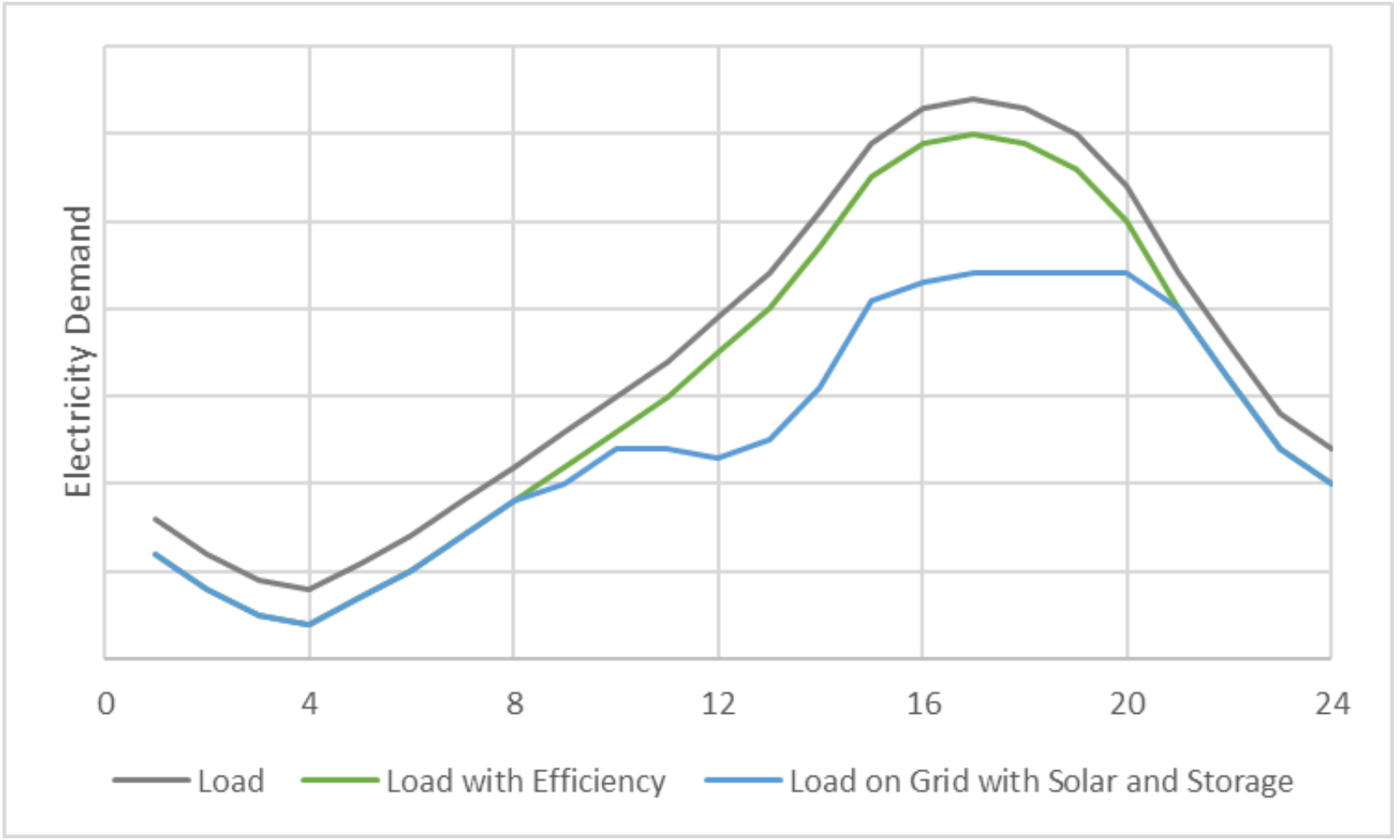
Some of the solar production can instead charge a battery, which can discharge later



Illustrative – does not use actual data

Energy Efficiency, Renewable Energy, and Energy Storage

The overall effect of energy efficiency, renewable energy, and energy storage changes how much electricity is needed and when



Illustrative – does not use actual data

Some real-life examples

Pika Energy: Panasonic Harbor Smart Battery

LG Chem

Tesla Powerwall

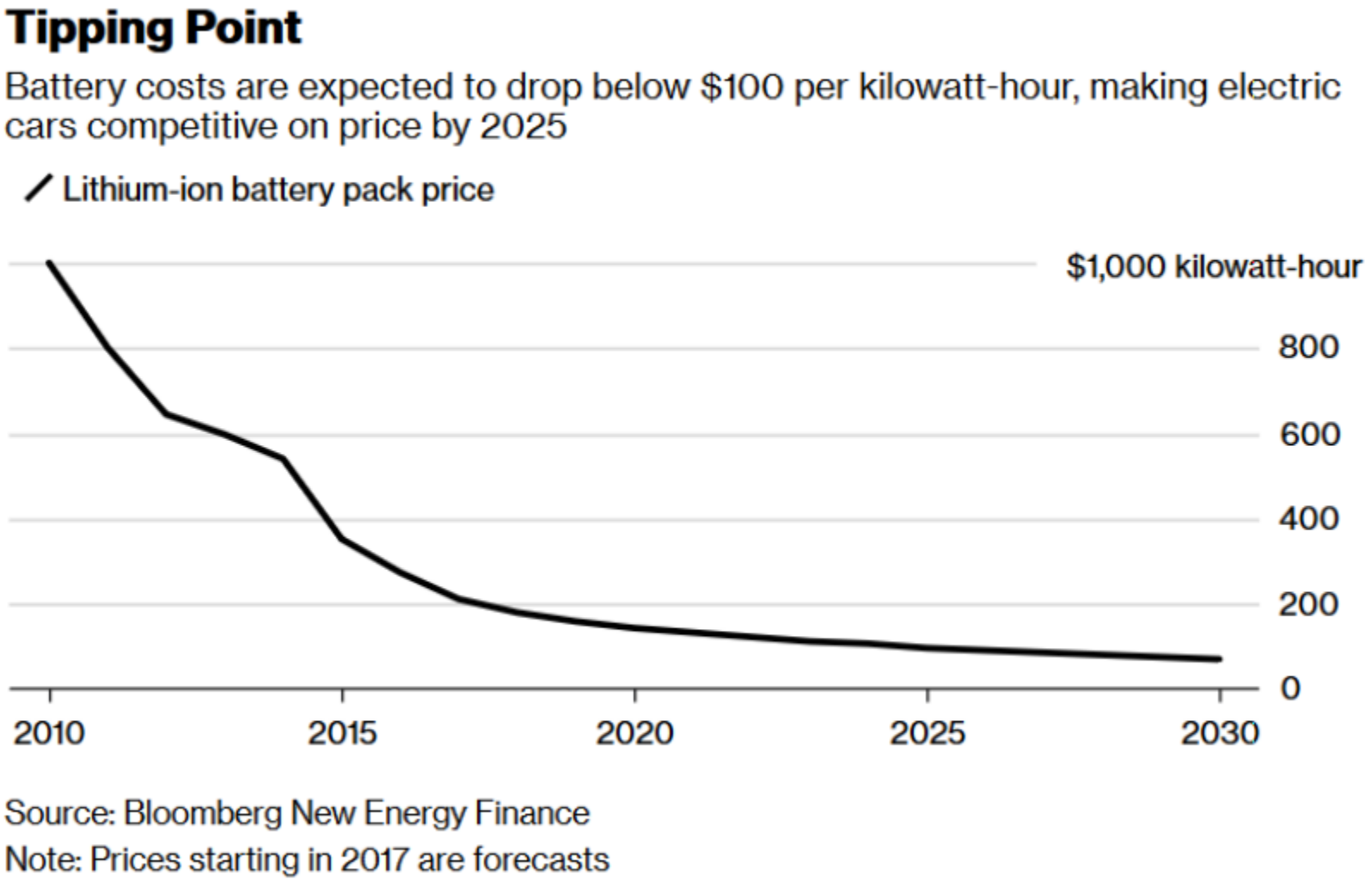
Residential Scale

Some real-life examples

Residential Scale

Tesla’s Powerwall: solar paired with battery storage

Battery Costs are Dropping



Adapted from RAP 2018 NAESCO Annual Meeting Slides

Benefits of Storage

Consumer Benefits

- Backup during outage/emergency islanding
- More use of solar energy
- Self-sufficiency
- Demand charge management (commercial-scale)
- Demand response revenue
- Resilience

Developer Benefits

- Add-on for solar system sales pitch
- Cater to different target audience
- Utility-scale and aggregate monetizable services
  - Demand response revenue
  - Regional energy market
  - Energy supply arbitrage
  - Frequency regulation
  - Voltage support

Grid Benefits

- Reduces peak demand
- Easier integration of distributed energy resources (like rooftop solar)
- Defer or avoid capacity-related infrastructure investments (for example: non-wires solutions)

Societal Benefits

- Resilience
- Economic development

State of Storage in RI

- Pairing with solar:
  - Net-metered solar systems smaller than 25 kW are eligible to add battery storage (Docket 4743 Order #22991)
  - Storage may not pair with solar systems through REGrowth tariff

- National Grid offers incentives for peak demand reduction using battery storage
  - Residential and commercial initiatives in the Demand Response program
  - Enrollment open through 7/1/2019; more info through vendors, NGrid sales reps, and Paul Wassink
  - Participants receive $400 per kW reduction achieved during peak events
  - 30-60 three-hour events each summer

- National Grid is evaluating responses to 3 RFPs for non-wires solutions to defer capacity-related investments through the 2019 System Reliability Procurement Plan
  - All proposals included utility-scale battery storage
  - Would be charged from grid and/or distributed generation

- National Grid is going out to RFP for 2 utility-scale battery storage systems as part of Power Sector Transformation (Docket 4780)

Storage Considerations Related to EERMC Responsibilities

- 2020 Energy Efficiency Annual Plan
  - Should the battery storage initiatives in the Demand Response program be expanded? If so, how?
  - What are appropriate incentive structures and financing options?

- 2020 System Reliability Procurement Plan
  - Will any proposed non-wires solutions be selected for funding?
  - Are there additional opportunities for cost-effective non-wires solutions to capacity-related infrastructure needs?

- 2021-2026 Market Potential Study & 2021-2023 Targets
  - Characterize the potential of demand response covering a range of technologies including energy storage
  - Potential for energy storage may influence peak demand reduction targets

- 2021-2023 Three-Year Plan
  - To what extent should storage play a role in the Three-Year Plan?
  - What is the appropriate incentive structure for battery storage?

Acronyms Cheat Sheet

Technology

- DER – Distributed Energy Resources
- DG – Distributed Generation
- DR – Demand Response
- DSM – Demand-Side Management
- EE – Energy Efficiency
- ESS – Energy Storage System (e.g. a battery)
- EV – Electric Vehicle
- EVSE – Electric Vehicle Service Equipment (e.g. a charging station)
- NWA – Non-Wires Alternative (Non-Wires Solution)
- PV – PhotoVoltaic (e.g. solar panels)
- RE – Renewable Energy

Units of Demand (amount of energy at any given instant)

- kW – kilowatt
- MW – megawatt (=1,000 kW)
- GW – gigawatt (=1,000 MW)

Units of Energy Consumption (amount of energy used over time)

- kWh – kilowatt-hour
- MWh – megawatt-hour

Plans/Reports

- EE – Energy Efficiency Program Plan
- ISR – Infrastructure, Safety, and Reliability Plan
- SRP – System Reliability Procurement

Agencies and Laws

- DPUC – Division of Public Utilities and Carriers
- LCP – Least-Cost Procurement
- OER – Office of Energy Resources
- PUC – Public Utilities Commission

Miscellaneous

- EDC – Electric Distribution Company
- RFP – Request for Proposals
- T&D – Transmission and Distribution

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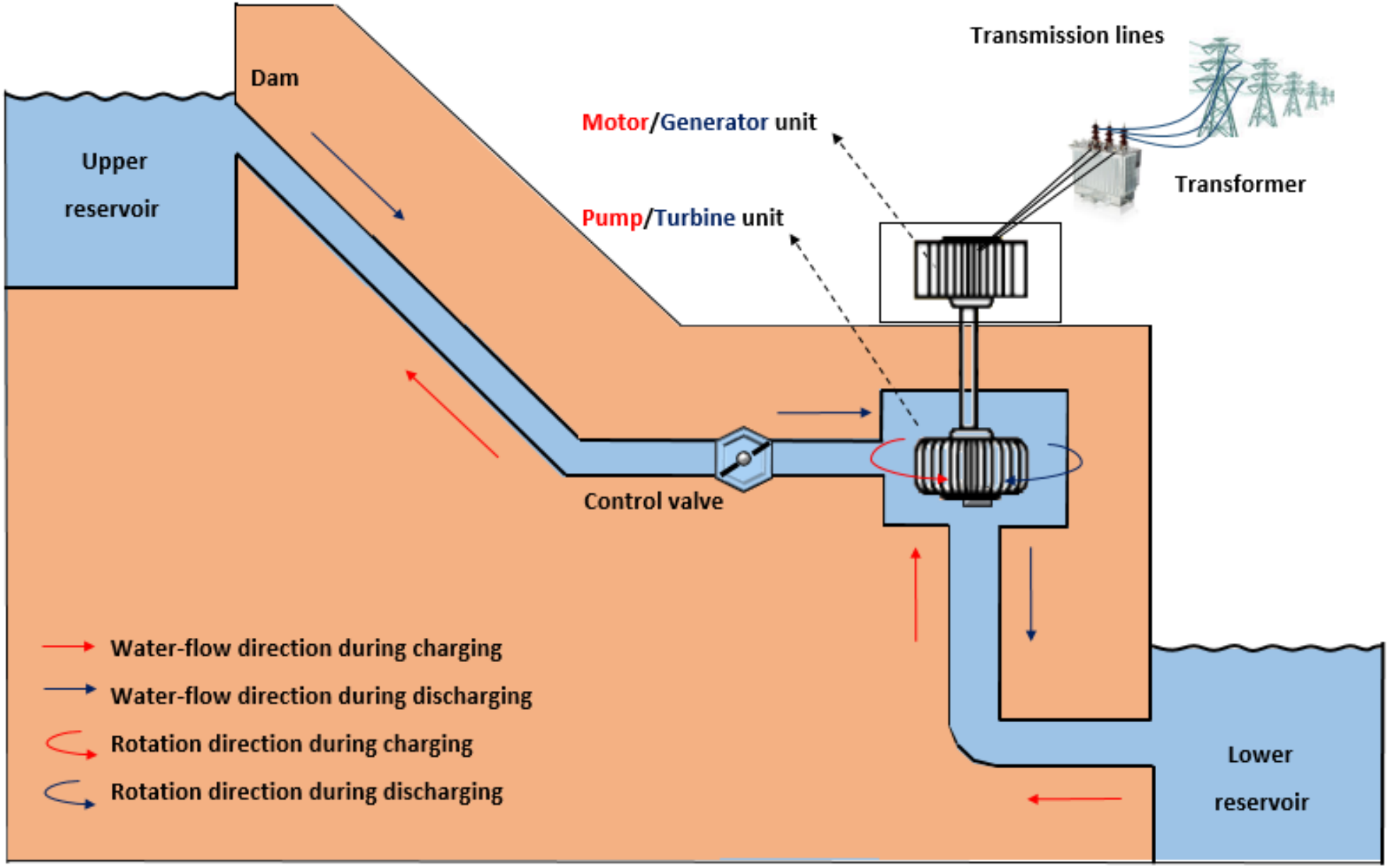
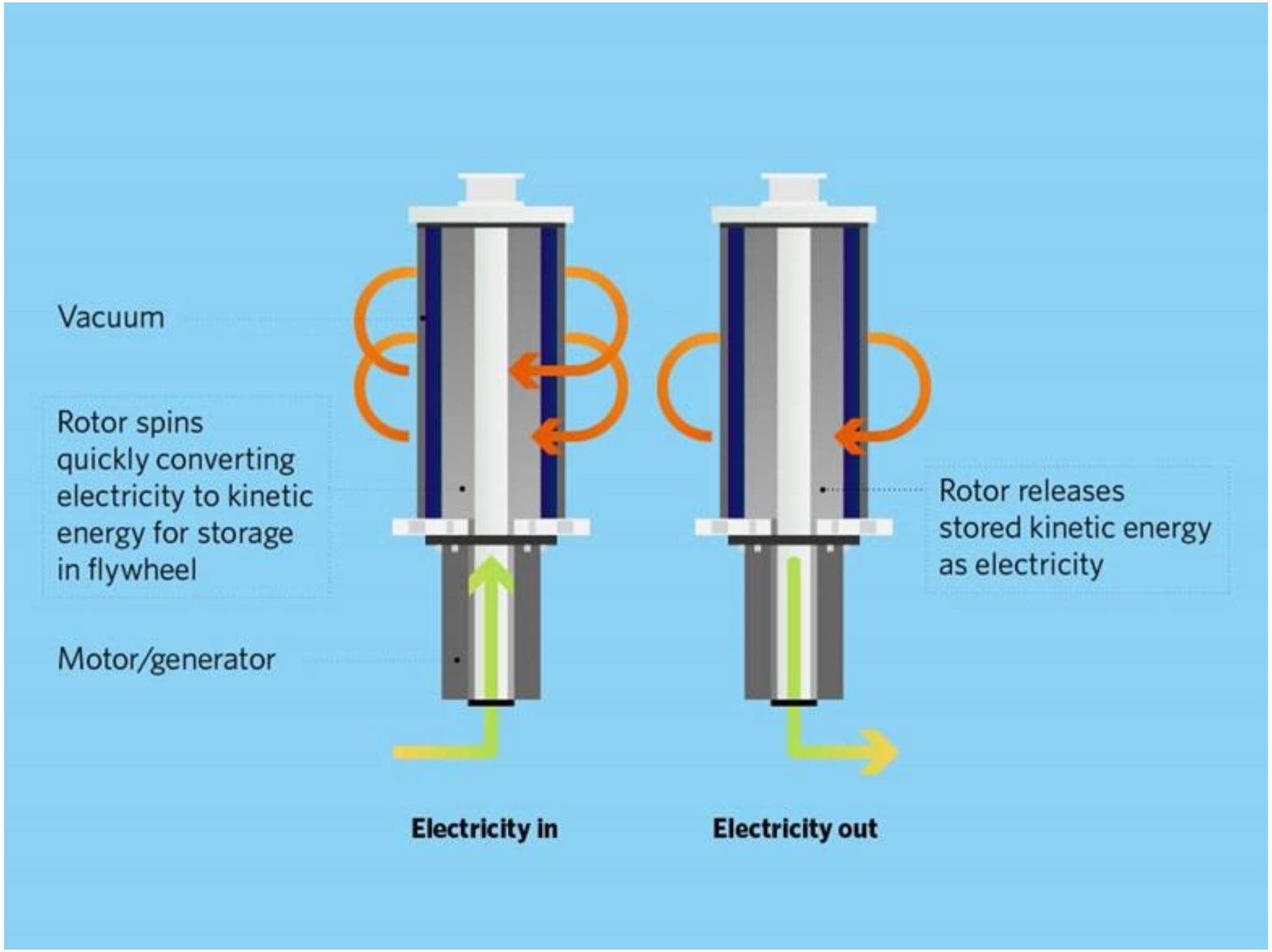
Appendix:

Energy Storage Systems

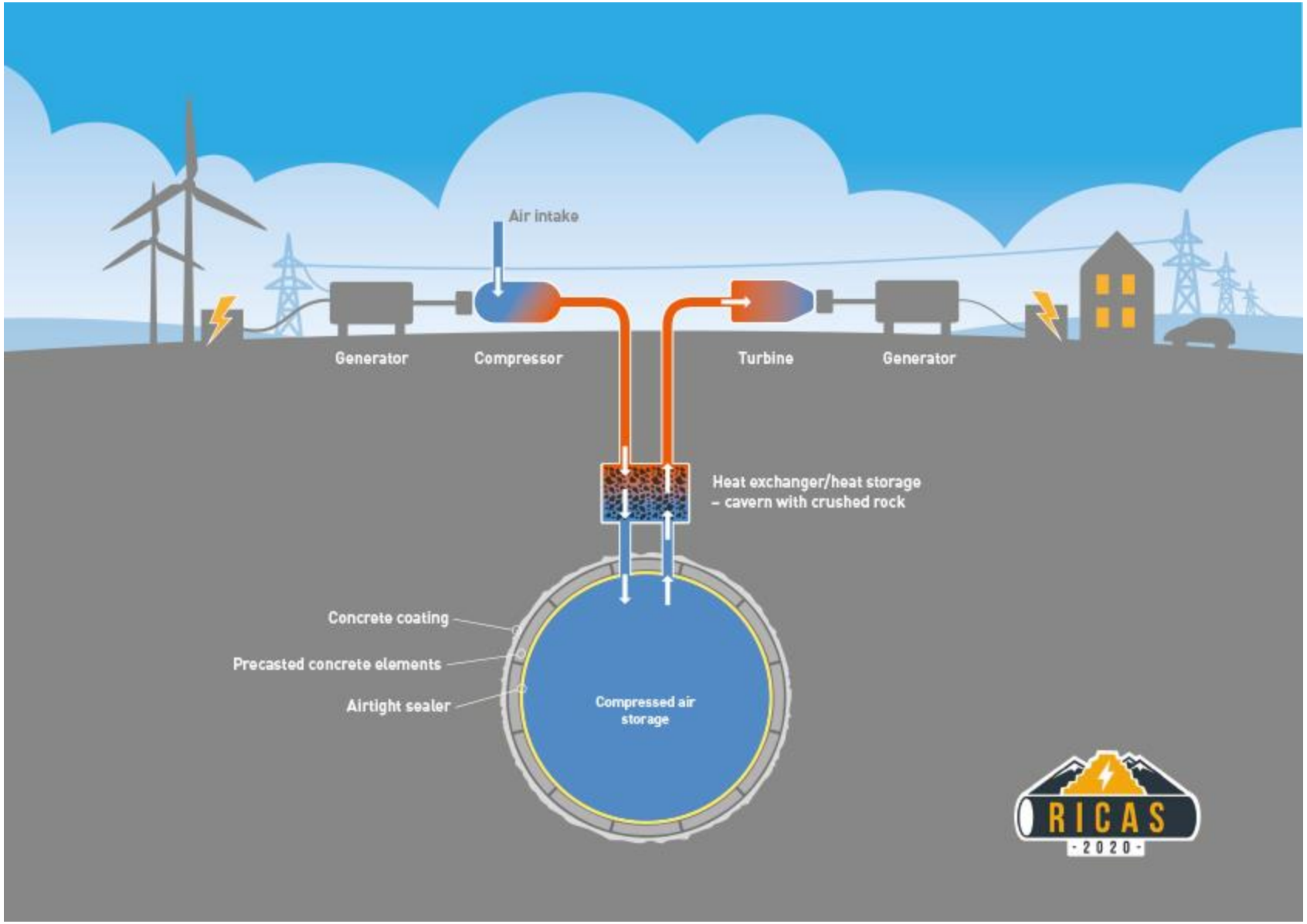
Pumped Hydro



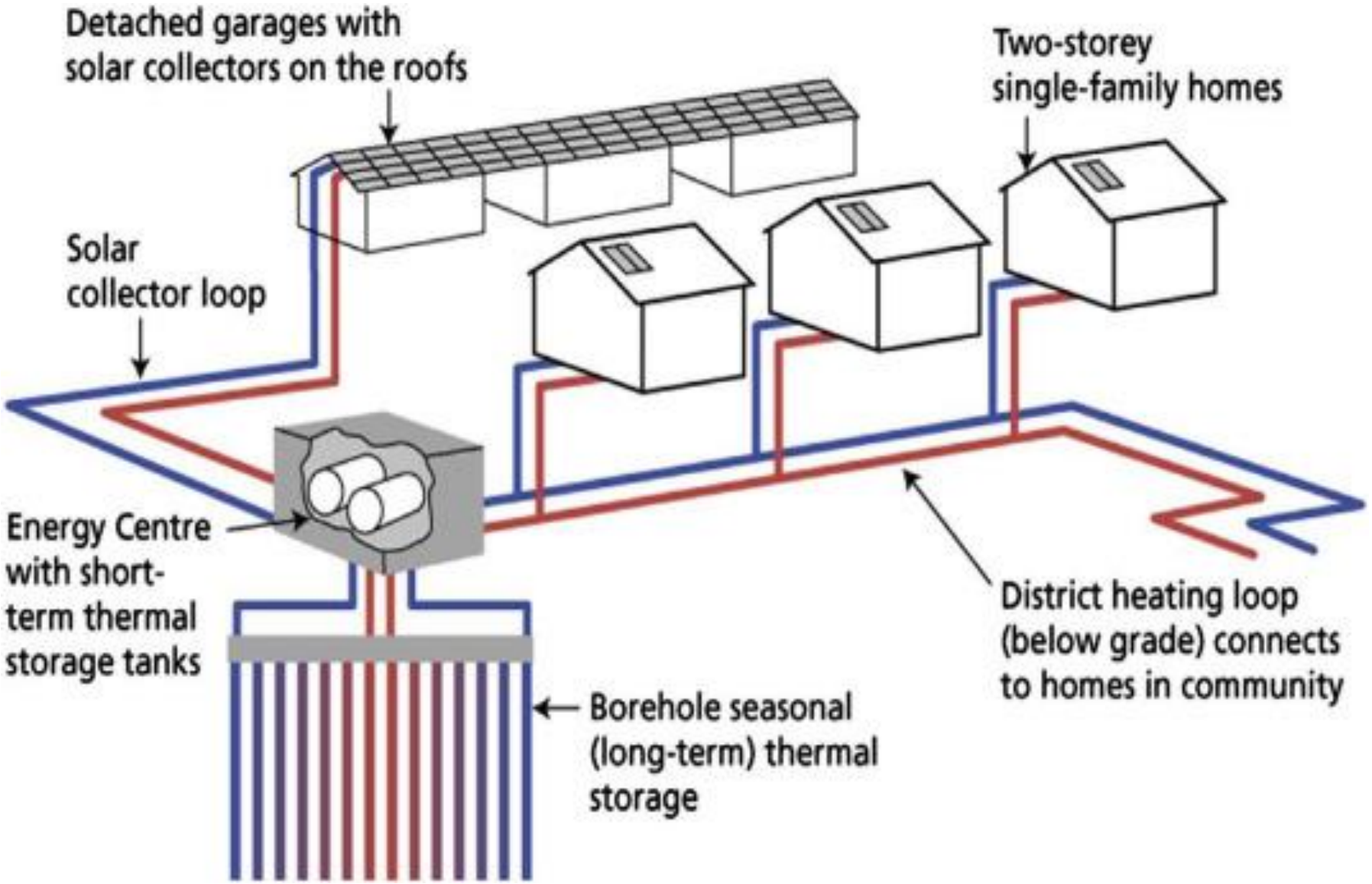
Flywheel


Vacuum
Rotor spins quickly converting electricity to kinetic energy for storage in flywheel
Motor/generator
Rotor releases stored kinetic energy as electricity
Electricity in
Electricity out

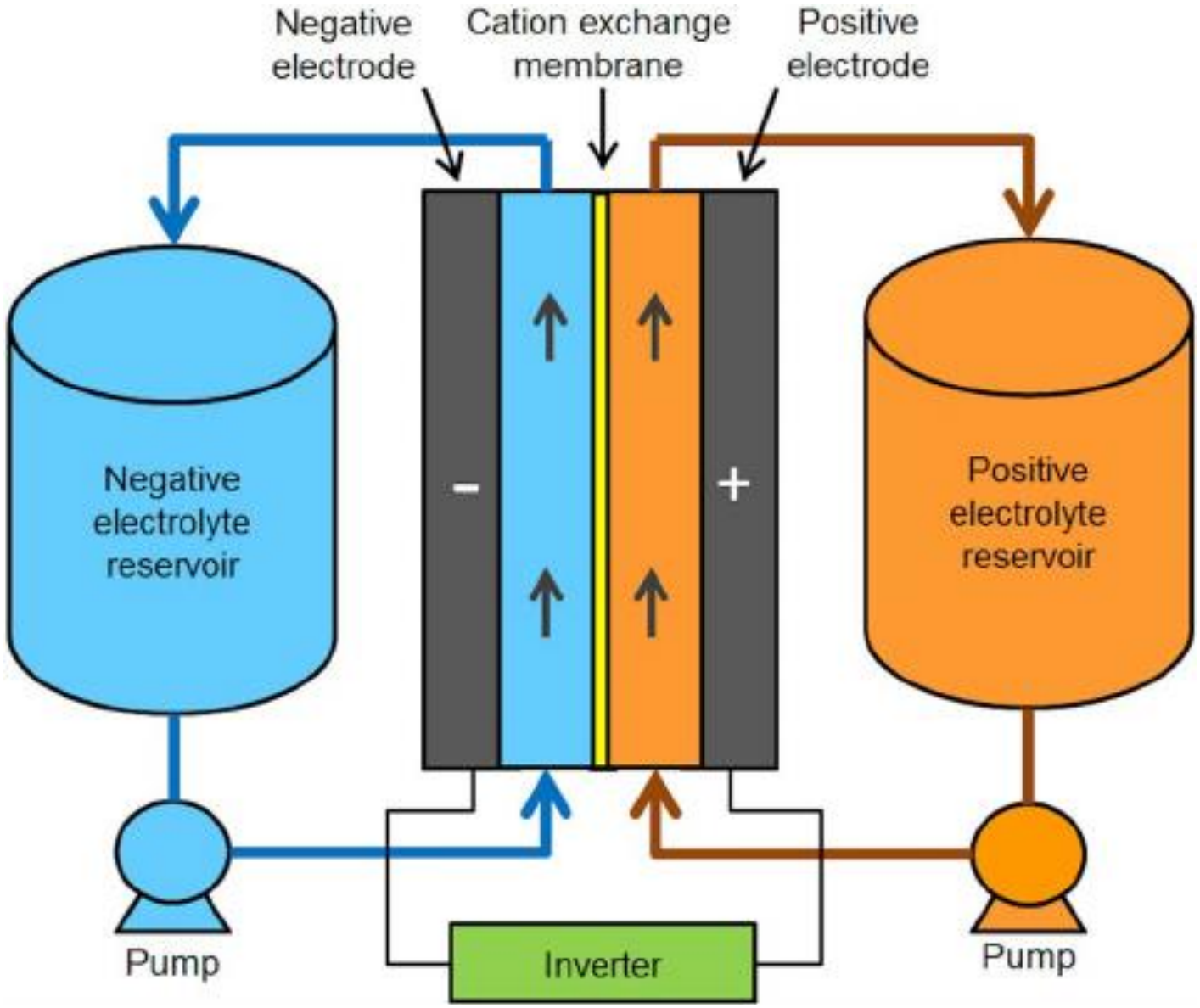
Compressed Air Energy Storage



Thermal Storage



Flow Battery



Solid State Battery