



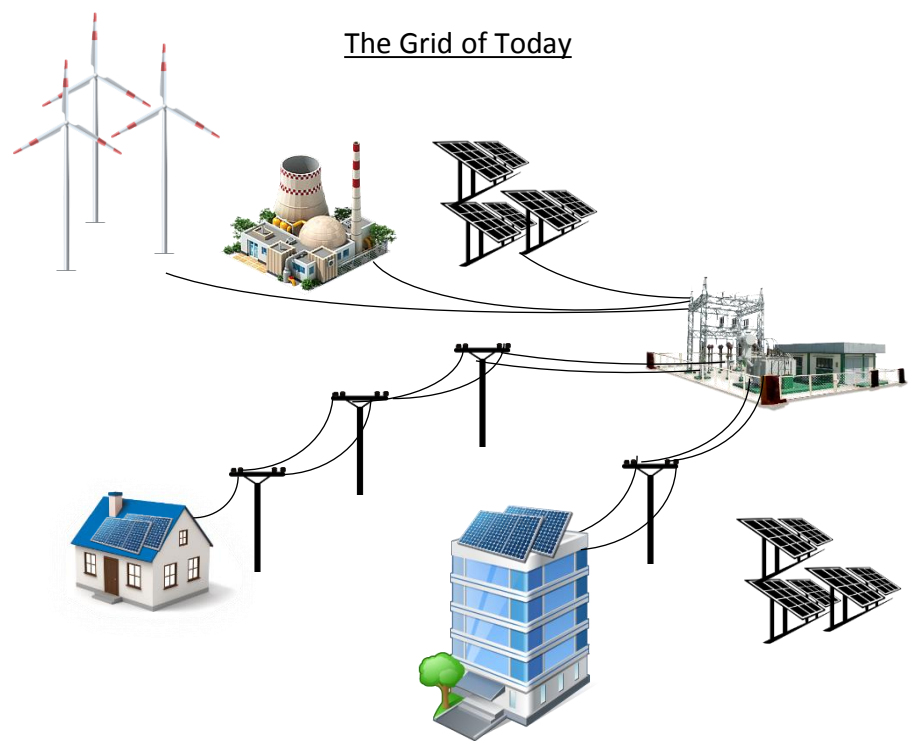
# Battery Storage and H. 501 House Energy and Technology

Christine Hallquist, CEO

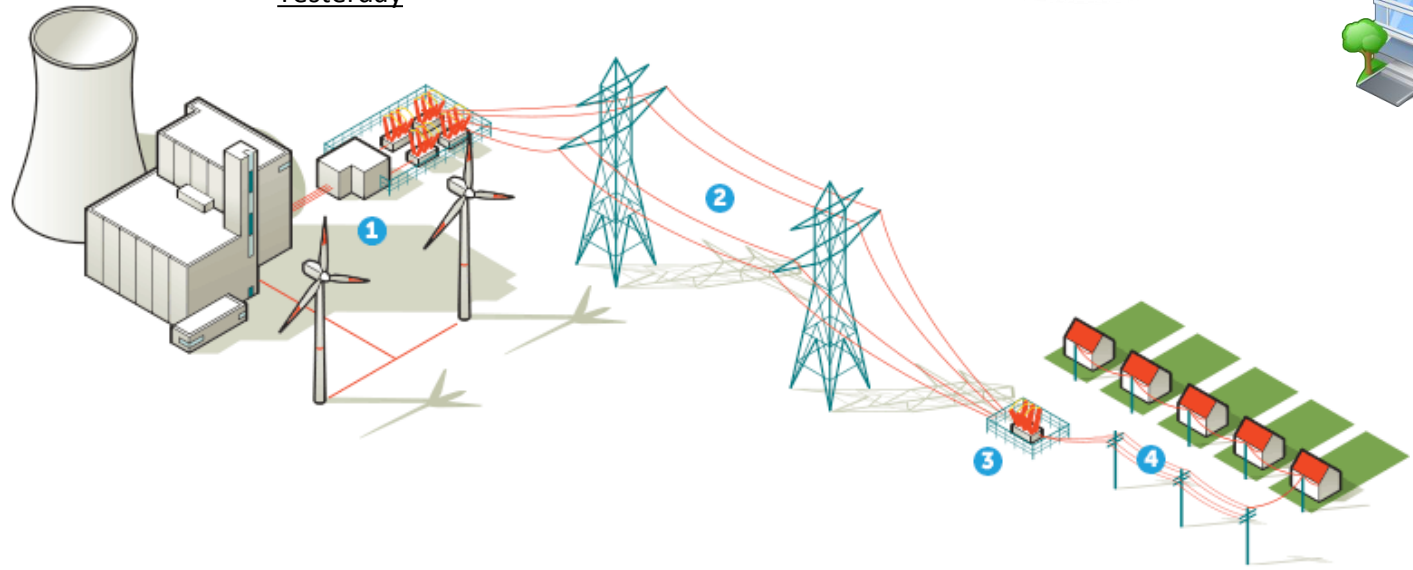
March 29, 2017

# The Grid of Yesterday and Today

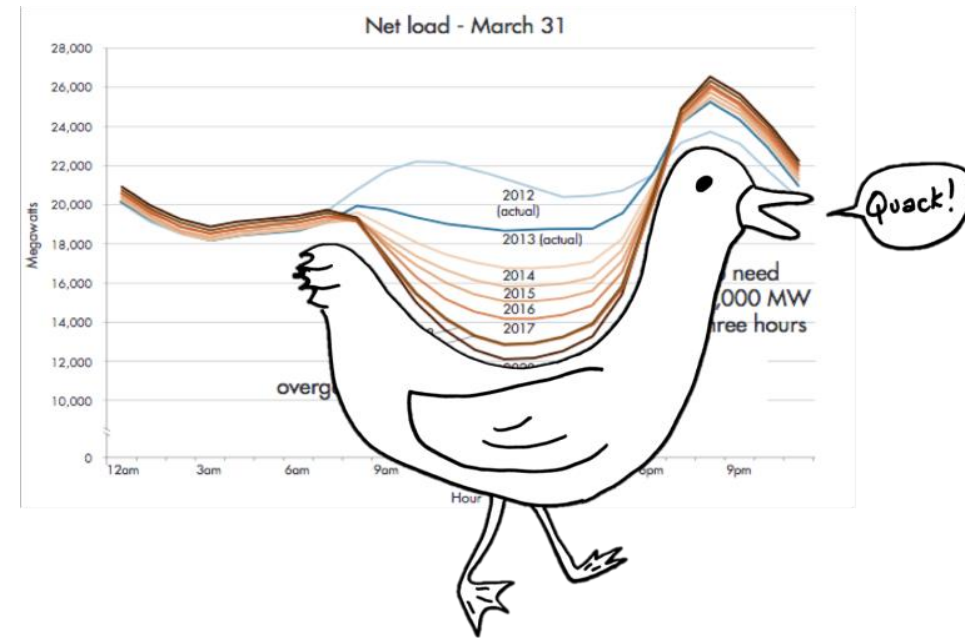
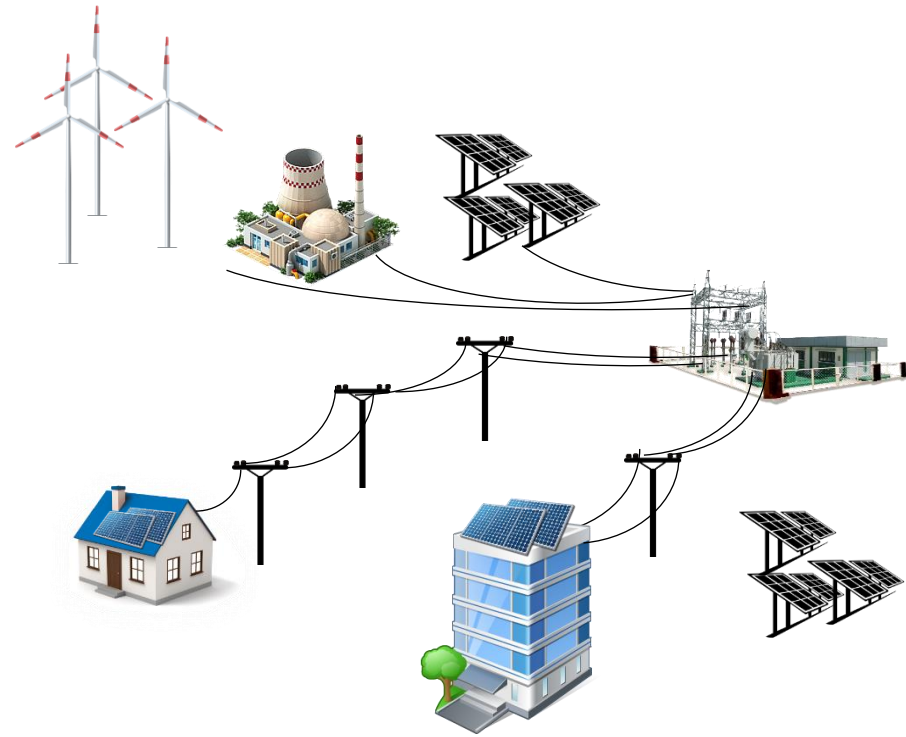
The Grid of Today



The Grid of Yesterday

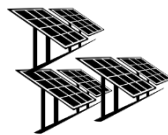


# The Grid of Today - Challenges



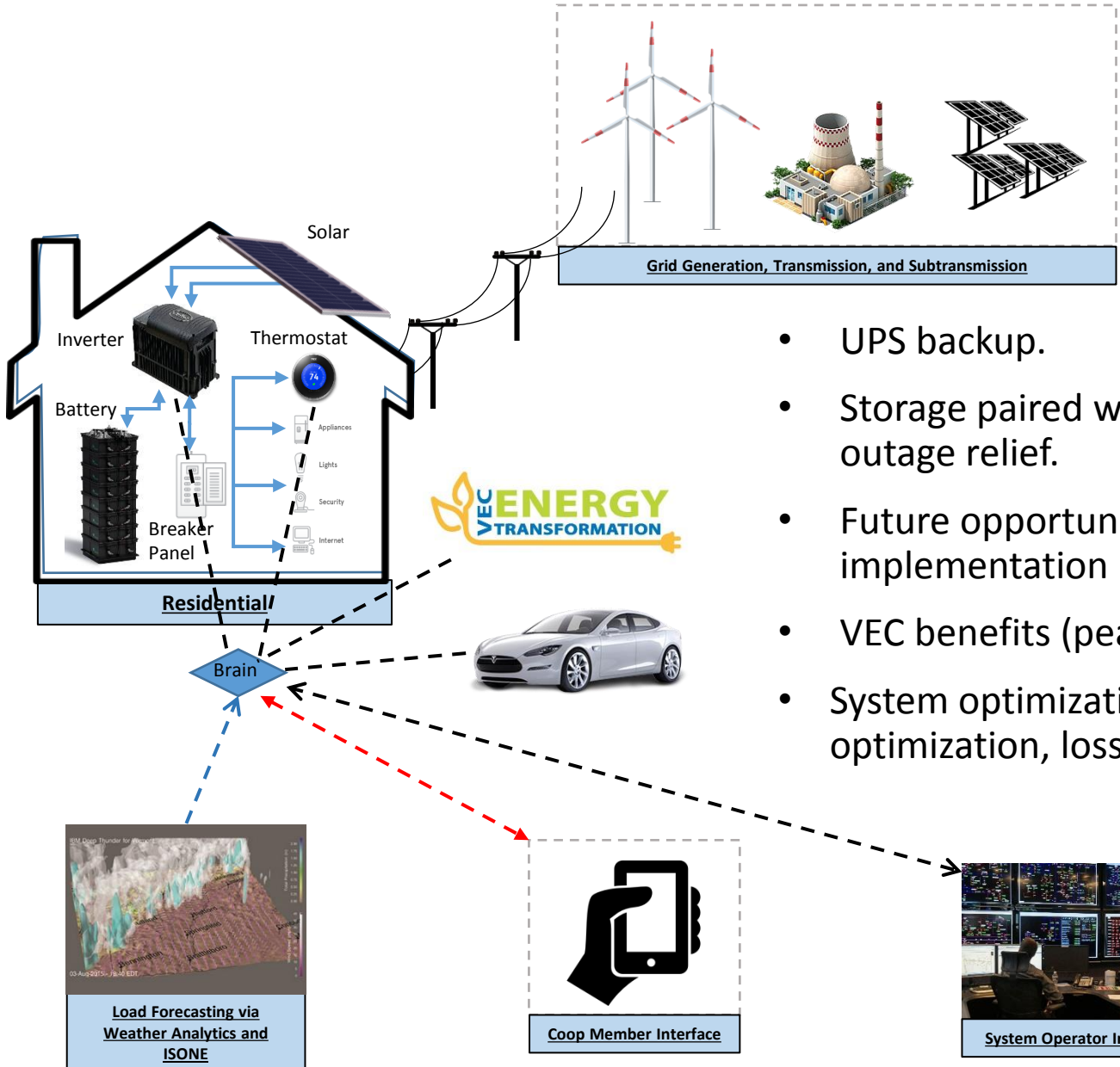
- The cost of transmission is increasing.
- The Distribution System Operator experiences a much more dynamic and difficult-to-manage system.
- As distributed energy resources (DER) penetrations increase, system coordination and effective planning becomes more important.
- A new control system paradigm is needed. Optimization and minimal intervention.

Integrate batteries, existing and new solar installations, as well as demand side management technologies to go beyond the meter to provide benefits and opportunities to VEC members



- Gain first-hand experience and knowledge about storage technologies and chemistries.
- Understand Inverter/Chargers technologies and capabilities.
- Identify member and utility interfaces to solar, storage and demand side technologies. Integration challenges.
- Develop insight into opportunities, capabilities, and benefits.

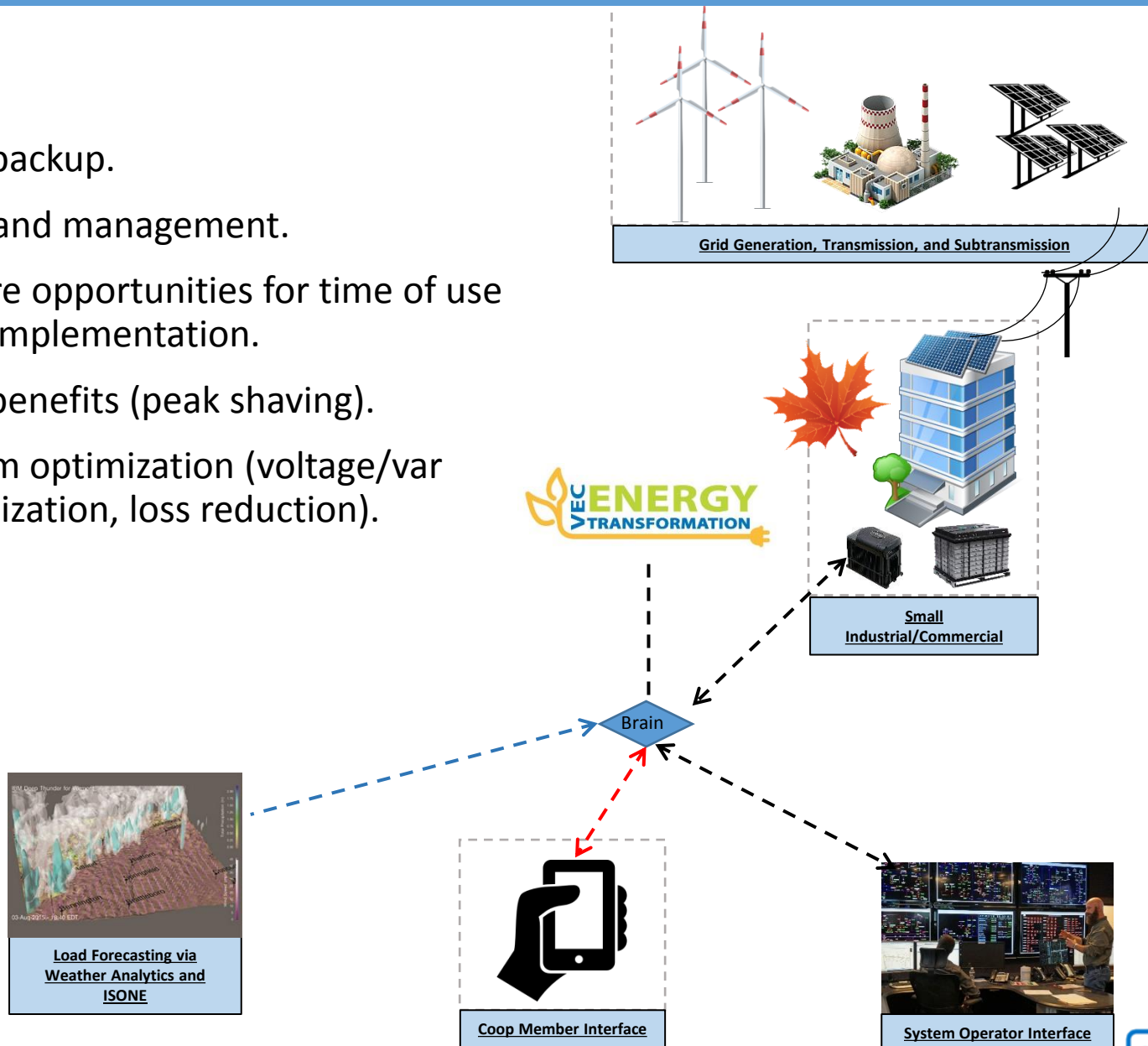
# Residential Applications

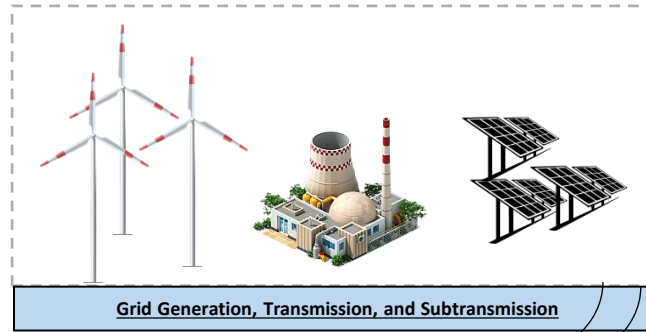


- UPS backup.
- Storage paired with solar for prolonged outage relief.
- Future opportunities for time of use rate implementation .
- VEC benefits (peak shaving).
- System optimization (voltage/var optimization, loss reduction).

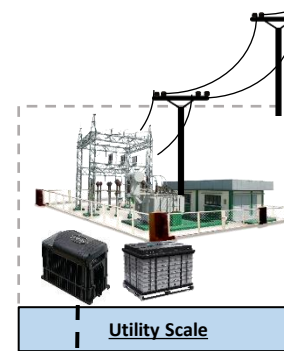
# Small Industrial/Commercial Applications

- UPS backup.
- Demand management.
- Future opportunities for time of use rate implementation.
- VEC benefits (peak shaving).
- System optimization (voltage/var optimization, loss reduction).

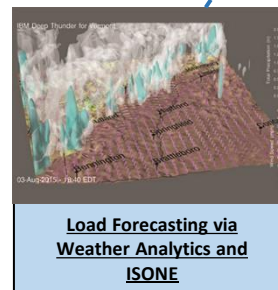




- VEC benefits - reduce capacity and transmission costs.
- Regulation market participation.
- Reliability opportunities.
- Capital deferral.
- System optimization (voltage/var optimization, loss reduction).

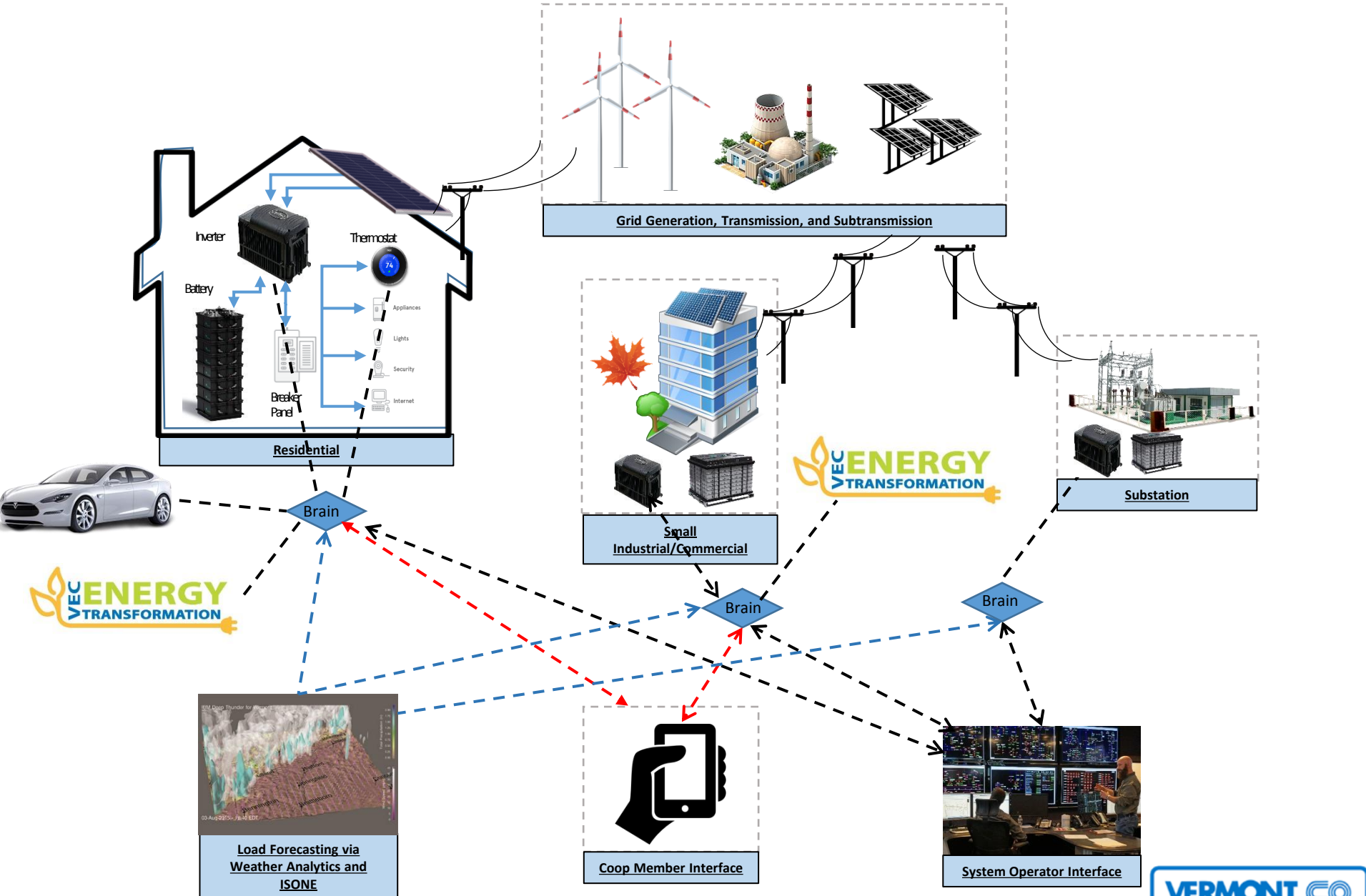


Brain





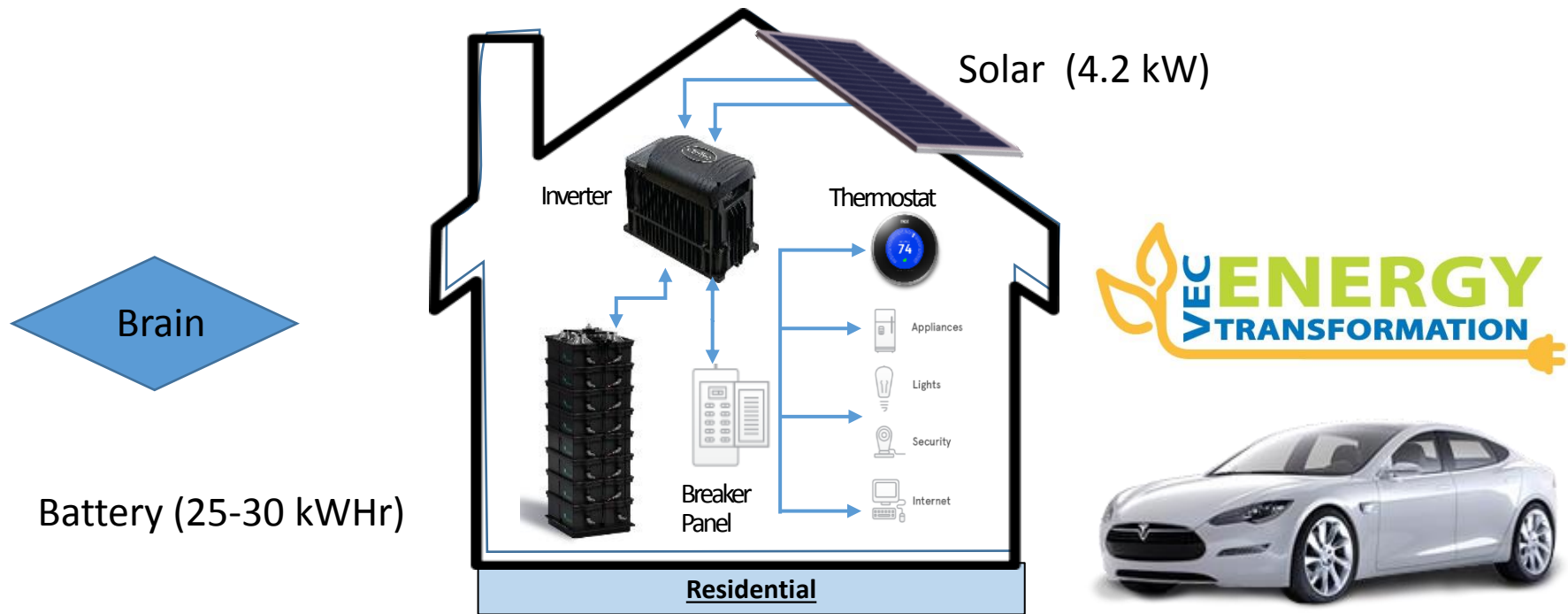
# Vermont Electric Cooperative Grid of Tomorrow Vision



- Cost of doing nothing = increased transmission costs.
- Lots of individual technologies for storage, solar, and demand side management but very few integrators/aggregators (“brains”).
- Residential Scale/ Small Commercial and Industrial Scale Storage
  - Utility interface nearly non-existent
  - Pricing
  - Vast and numerous offerings for battery and inverter
  - End-user interfaces are generally good
  - Data ownership still somewhat an issue
- Utility Scale Storage
  - Pricing is a significant factor
  - End-user interface good
  - Utility interface more common.
- Engineering challenges (IEEE 1547, islanding, generation exceeding load)

# NRECA ABC4PV - Agent-Based Coordination scheme for PV Integration

- VEC will become an optimizer of aggregated distributed energy resources
- A \$1+ million grant for project partners



- Secure 10 test sites on a single feeder
- Provide technical support, via staff involvement
- Support NRECA's modeling efforts
- Submit periodic status reports to NRECA
- Cost Share

- Participating Member Benefits
  - 30 kWh uninterruptable Power System that will enable outage protection and voltage stabilization
  - 4.2 kW solar panels for reduced cost that can be funded through on-bill payment
  - 5 to 10 kWh inverter (depending on battery topology)
  - Ability to remotely monitor heating/cooling and electric consumption in real time
- VEC Benefits
  - A low cost/no cost way to develop peak reduction tools and processes using distributed resources
  - Develop algorithms for increasing predictability and confidence in determining and controlling peaks
  - Move beyond the meter to create opportunity for VEC and its members to control costs
  - Understand how storage technology can interact with renewable generation
    - Better understanding of feeder performance
    - Turn solar into an asset by creating and demonstrating an alternative tariff to net metering (pay our members the long term market value of solar as a generation resource)
  - Learn how to integrate other appliances into our load management network by utilizing smart thermostats
  - 50 to 100 kW in peak reduction capacity (depending on inverter selection)
  - 2 to 5 year payback on out of pocket investment

- We appreciate your interest in assisting the state in promoting strategic electricity storage solutions.
- It is absolutely essential that the electric distribution utilities are the decision makers to ensure that any storage solutions are located, sized and priced appropriately. We cannot emphasize this enough. These grid efficiency decisions can only be made by the DU.
- We are still in the technology research and testing stage. It is premature for the state to invest in any particular products or technologies outside of pilot project and research.
- Utilities are motivated to make these investments and neither carrots nor sticks are necessary.
- We support the DPS doing research and reporting back to you about the status of the battery storage in the state and potential opportunities.

