Early Experiences with Autonomous Clean Energy Systems

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Holy Cross Energy is leading the responsible transition to a clean energy future.

Holy Cross Energy (HCE) provides safe, reliable, affordable and sustainable energy and services that improve the quality of life for our members and their communities.

Founded in 1939, we serve more than 46,000 members in scenic Western Colorado with:
- 260 MW peak demand
- 3,075 miles distribution
- 120 miles transmission
- 167 employees

In 2020, 44% of our power supply came from wind, solar, biomass and hydroelectric power, as well as coal mine methane recovery.
Our “Journey to 100%”

These actions will allow HCE to achieve its vision of

100% carbon-free power supply by 2030

Carbon-neutral or better across the enterprise by 2035

in a way that does not sacrifice affordability, safety, or reliability for the sake of sustainability

• **Energy Efficiency**: obtain an additional 0.25% per year in reduction of electric sales from existing uses

• **Cleaner Wholesale Power Supply**: incorporate new, clean, dispatchable resources into HCE’s power supply mix

• **Local Clean Energy Resources**: continue our existing agreements for energy from local biomass, hydro, solar, and coal mine methane projects

• **Distributed Energy Resources**: support installation of at least 4 MW per year of new rooftop solar systems

• **Smart Electrification**: encourage the expanded use of electricity for transportation, building heating and cooling, and industrial processes

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Progress to Date

New Resources Developed or Under Contract:

Eastern Colorado
- 100 MW wind
- 30 MW solar

HCE Service Area
- 5 MW solar
- 4.9 MW hydro
- 4.5 MW/20 MWh solar+storage
- 10 MW/20 MWh solar+storage
- 10 MW/20 MWh solar+storage
Could We Have Too Much Clean Energy?

German Power Grid 2012 vs 2020
Smart Electrification Can Help

Pre-cool/heat buildings and charge EVs when wind/solar plentiful

Allow building to “ride through” peak

Discharge from batteries to address PM solar ramp (incl. V2G)

Source: RMI
“Electrifying Your Ride” EV Programs

Program Elements

FREE L2 EV chargers to every residential (limit 2) or commercial (limit 4) member

DER Service Agreement avoids up-front installation costs

Community DC fast charging supported by $150k upgrades and engineering support

Transit and school buses supported with TOU rates, no demand charge, on-site solar

174 Home Charging Ports, 59 Commercial Charging Ports, 5 DC Fast Chargers, 8 Transit Buses in 2020
“Power+” Energy Storage Program

Pilot program in 2021 and 2022: 5 MW/15 MWh BTM storage
Combines DER Service Agreement & Distribution Flexibility tariff
Target consumer cost: $30-40/month for 10 years

Initial install at HCE HQ avoided
12 interruptions/290 outage minutes in Q4 2020 alone!
“Basalt Vista” Affordable Housing Project

- Habitat for Humanity, Pitkin County, Basalt School District
- 27 homes for teachers and local service workers
- Designed net-zero energy with *all electric* construction
- Adjacent to Lake Christine Fire affected area
- Cost-shared partnership with NREL and DOE Office of Electricity
- Demonstrate value of DERs to consumer *and* grid

**Four homes with controllable loads**
- 8kW rooftop solar PV
- Battery storage
- L2 EV charging
- Heat pump water heater
- Air source heat pump
Autonomous and Resilient Operation of power systems with high RenewAbles (AURORA): Situational awareness, resiliency, and autonomy for power systems with high PV

Project objectives

Layer 1: Security Situational Awareness
1. Assess and optimize resiliency against physical threats
2. Detect and localize cyber attacks

Layer 2: Distributed Microgrid Coordination
3. Continuity of service after attack on control center or communication system

Layer 3: Autonomous Microgrid Restoration
4. Fast restoration after blackouts
5. Robust parallel grid-forming inverters
Aspen Airport Business Center Microgrid

Vision  Create a regionally resilient and 100% clean energy system that balances production, storage and distribution across four distinct public facilities, generates additional clean energy to the community and create a model for net-zero, resilient public facilities across the state.

Why  Lake Christine Fire exposed significant vulnerabilities in our public infrastructure. This project seeks to build resiliency for these core services, while simultaneously building a clean energy system for some of the highest energy consumers in the County.

Who
• Aspen Pitkin County Airport
• Roaring Fork Transportation Authority
• Pitkin County Public Works
• Holy Cross Energy electric system from Brush Creek Park n’ Ride to the Aspen Substation.
HCE aspires to become a “distribution system operator” that can manage the local grid like how RTOs/ISOs manage the bulk power system today.

The Camus Energy platform integrates data from HCE’s SCADA, AMI, GIS, weather observations, data line sensors, transformers, DERs and HCE’s energy resources.

This provides real-time visibility and coordinated grid orchestration at feeder/system level.
Electric Rate and Programs Options

**Distributed Energy Resource Service Agreement**
- Low interest on-bill payments for DERs and related costs

**Distribution Flexibility**
- Credit for allowing utility option to manage behind-the-meter DER assets

**GreenUp**
- Dynamic Renewable Pricing
- Credit for voluntary increase in consumption during forecasted “oversupply” events

**Peak Time Payback**
- Credit for voluntary reduction in consumption during forecasted peak event

**PuRE**
- Purchase 100% Renewable Energy
- Green pricing program to enable members to choose 100% renewable energy

**Time of Use**
- Optional rate structure to encourage load shifting
  - 24c/kWh on-peak (4-9 pm); 6c/kWh off-peak
For more information: www.holycross.com

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Join us on our “Journey to 100%”