Building the First Renewable Community Microgrid in Rural Iowa

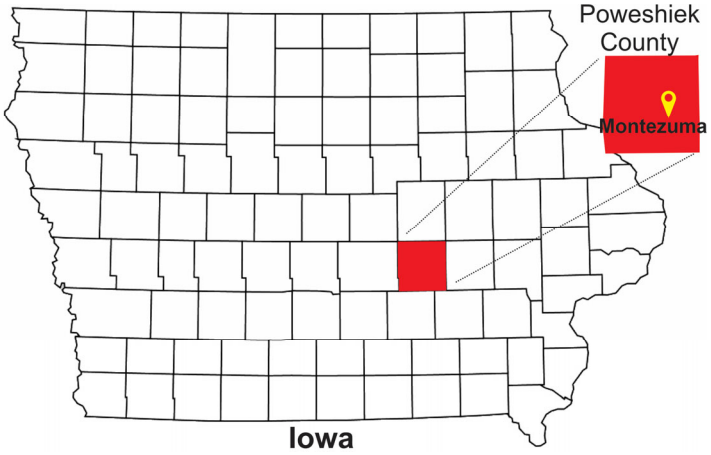
Zhaoyu Wang
(Project Lead & Presenter)
Northrop Grumman
Associate Professor
wzy@iastate.edu

Anne Kimber
(Project Co-Lead)
Director of Electric Power
Research Center
akimber@iastate.edu

Kevin Kudart
(Project Co-Lead)
Superintendent at Montezuma
Municipal Light and Power
kevin@montezumaiowa.org

IOWA STATE UNIVERSITY

Where is Montezuma?



About City of Montezuma

- The county seat of Poweshiek County in southern Iowa.
- Total population of 1,460 people.

About Montezuma Municipal Light and Power (MMLP)

- A community-owned utility founded in 1939.
- Buys electricity from the MISO market.
- Distributes electricity via seven 2.4-kV and three 13.2-kV feeders.
- Has 706 residential, 201 commercial, and 2 industrial meters.

MMLP's Energy Challenges

- Market vulnerability: energy price volatility, capacity reserve requirement, transmission cost.
- Aging infrastructure: 60-year-old substation switchgears and mechanical relays.
- Exposure to extreme events: MMLP is tied to the grid by a single radial 69-kV line, hit by 2020 Derecho

Project Overview

Goals

1. Transform Montezuma to be the first community microgrid in rural Iowa with the best reliability and resilience.
2. Demonstrate renewable MG as a technically and financially feasible solution.

Team members

- Iowa State University
- Montezuma Municipal Light and Power
- 40 community partners
- DGR Engineering
- Warren McKenna Consulting

Impacts

- Stabilizing electricity rates for Montezuma residents.
- Improving reliability and resilience.
- Transitioning to renewable energy.
- Demonstrating replicability of the technology.

Budget:

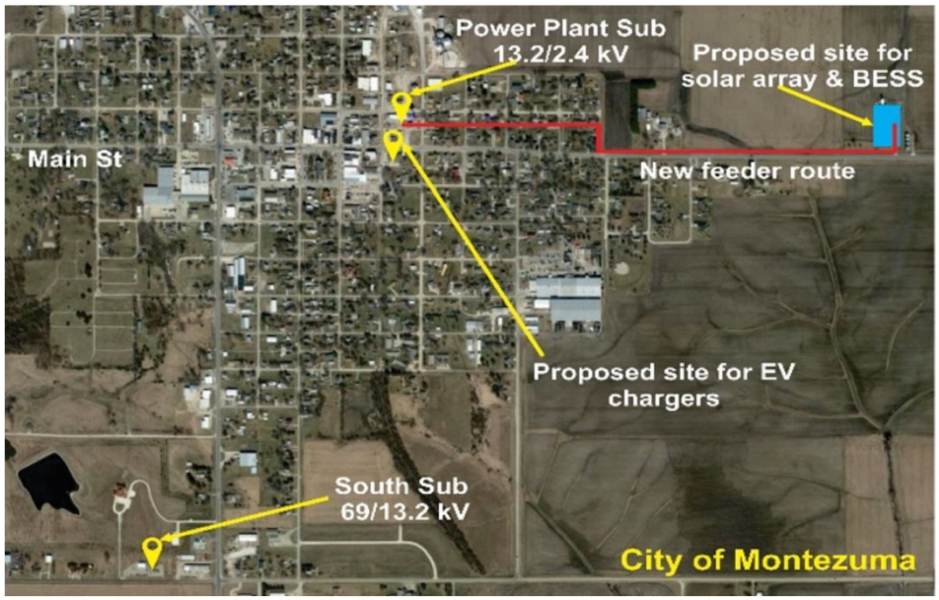
- Federal funding: $ 9,484,385
- Cost share: $2,376,570

Duration: 48 months

Technologies

2.5 MW solar array, 1.5 MWh battery energy storage system (BESS), intelligent MG controllers, a new SCADA, AMI-enabled load control, EV chargers, and new substation switchgear and relays to automate operations and enable islanding from its single radial 69-kV transmission line when conditions force it to operate as a self-sustainable MG.

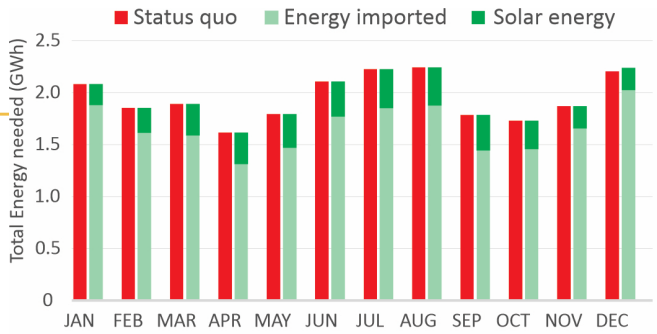
	Status quo	After project completion
Generation	No Solar, No BESS	2.5 MW Solar, 1.5 MWh BESS
Carbon Emission	Normal operation: 10,521 metric tons/year, Islanded operation: 51.5 metric tons/day	Normal operation: 8,818.5 metric tons/year, Islanded operation: 29.6 metric tons/day
Substation	Vintage substation switchgear built in 1960s, old oil switch breakers, mechanical relays are obsolete	New metal clad switchgears with 15kV circuit breakers & digital relays. Islanding and auto synchronization functionality as a MG
Load	AMR system, no load control capability	AMI system with load control
Control	No SCADA, manual control/check	SCADA + MG Controller
EV	No charging station	Two level-3 chargers

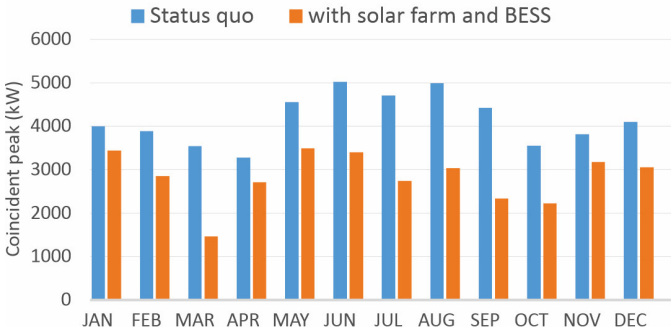


Economic Analysis

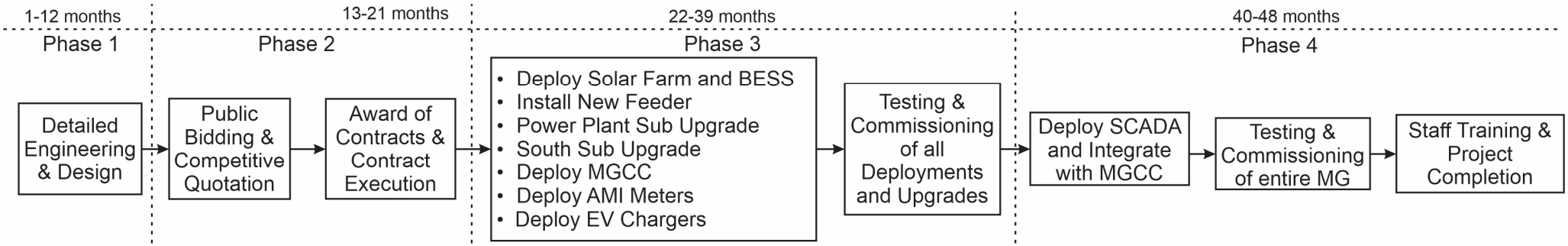
The project will reduce the overall energy cost of MMLP by 18%

Cases	Energy Purchased	Energy Cost	Transmission Cost	Total Cost	Total Savings
Status quo	23.4 GWh	$1,027.5K	$198.1K	$1,225.5 K	N/A
With solar	19.9 GWh	$872.2 K	$152.5 K	$1,024.7 K	$200.9K
With solar & BESS	19.9 GWh	$872.2 K	$130.9 K	$1,003.2 K	$222.4 K





Project Schedule:



Community Benefit Plan

All economic and environmental benefits of the project will flow to Montezuma residents.

Partners

- 8 state/county/city authorities
- Meskwaki Nation
- Labor union: IBEW Local Union 405
- 4 Community Colleges/K12
- 2 Community Organizations
- 21 Local Businesses (including women, minority & veteran-owned)

Investing in the American Workforce

- Develop a renewable microgrid curriculum using Montezuma microgrid as a demonstration site.
- Establish a digital twin of the microgrid operation for workforce training.
- Develop training opportunities through apprenticeship programs of Iowa and Meskwaki Nation.

Community & Labor Engagement: Conduct public meetings; develop community projects.

DEIA: Recruit minority students; implement energy assistance programs for low-income customers.

The Justice40 Initiative: Monetize solar generation and allocate a certain percentage to support women, veterans, and minority-owned businesses.

Thank you

Zhaoyu Wang
Northrop Grumman
Associate Professor
wzy@iastate.edu
https://wzy.ece.iastate.edu/

Anne Kimber
Director of Electric Power Research Center
akimber@iastate.edu
https://www.ece.iastate.edu/eprc/

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Key Deployments

- 2.5 MW solar farm installation on a City-owned land.
- 0.57MW/1.5MWh BESS will be AC coupled with a solar farm.
- 1-mile 15-kV underground distribution feeder to interconnect solar plus storage system.
- Upgrade Power Plant Sub with new control building, foundation, fencing, and a 15-kV metal-clad switchgear.
- Upgrade South Sub with new shelter aisle metal-clad switchgear.
- Interface VTScada system software with SEL MG controller for enabling MG functionalities.
- New level-3 EV charging station at Montezuma public library.
- Install AMI to enable demand response.