

# **ARPA-E Natural Gas Workshop:** *Operating Well Sites as a Grid Supplement or Microgrid*

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# Opportunities by Location

- Natural gas production operations in close proximity to electricity T&D infrastructure
- Crude oil production operations with associated gas and no natural gas pipeline capacity (stranded gas)
- Sites with gas potential looking to establish microgrid and/or distributed generation capacity (e.g. military bases)

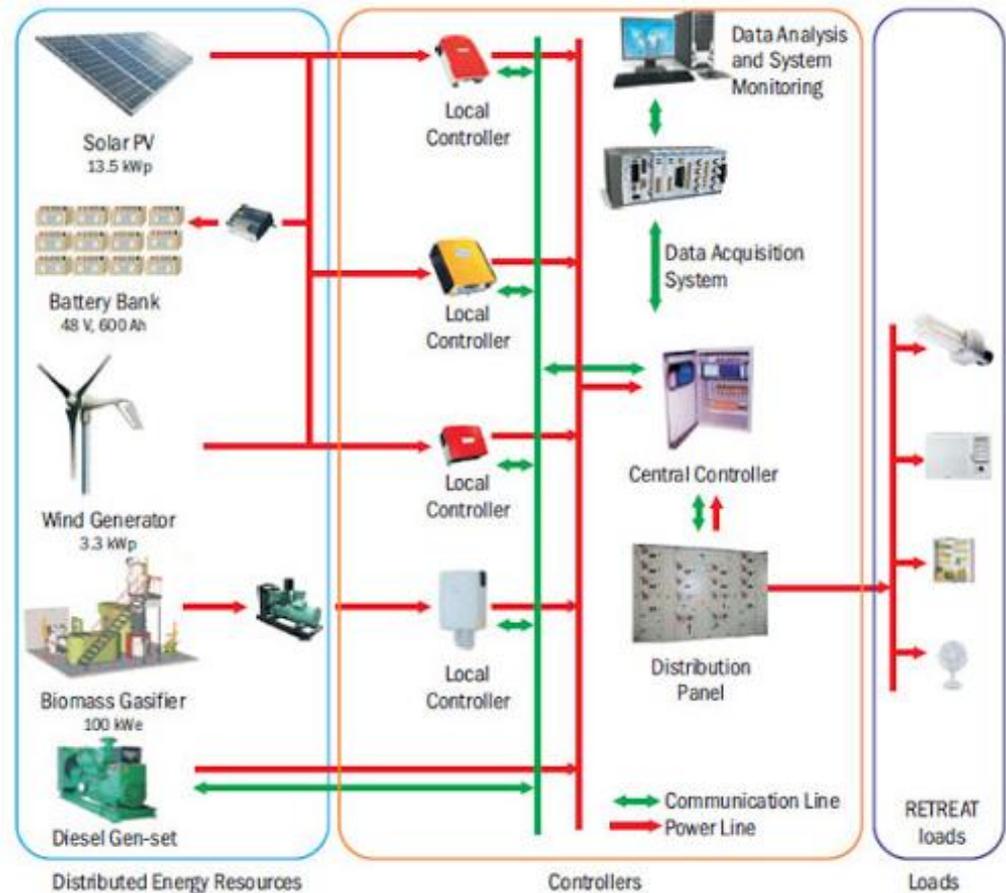
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Opportunity: Co-production of natural gas and electricity; establishment of microgrid systems

# Microgrids

**Microgrid:** An integrated energy system consisting of interconnected loads and distributed energy resources—including generators and energy storage devices—which, as an integrated system, can operate in parallel with the utility grid or in an intentional islanding mode.



Source: "Smart Micro-grid, A TERI Initiative."  
(Undated). TERI The Energy and Resources  
Institute. Accessed February 26, 2013:  
[http://www.teriin.org/events/SmartMini\\_Grid\\_Brochure.pdf](http://www.teriin.org/events/SmartMini_Grid_Brochure.pdf)

# Benefits of Deployment

## Gas Producer

- Additional revenue stream
- Leakage mitigation costs potentially offset

## Environmental

- Provides energy services from otherwise flared or leaked gas

## Landowner / Locality

- Increased revenue (contract dependent)

## Load Serving Entity / Ratepayer

- Lower cost of electricity
- More peaking capacity

## Grid Operator

- Increased grid flexibility and reliability

## Microgrid Operator

- Increased energy security
- Lower cost of electricity

# Barriers: Technical

- **Modularization of enabling technologies required**
  - On-site raw natural gas processing
    - Contaminant removal, dehydration, mercury/nitrogen extraction, fractionation
    - Ethane removal currently a challenge
  - Microgrid control systems
- **Natural gas generator response rates sufficient for microgrid applications?**
  - Need for storage
- **Efficiency of low output generators**

# Barriers: Practical

- **System design and operational optimization**
  - Depends on site specific criteria, e.g. production rate and longevity of well, proximity to load or T&D infrastructure
  - System designs will vary with intended operating schemes
    - Signing a PPA with load serving entity for baseload power
    - Participation in ancillary service market
  - How do gas production rates fluctuate throughout different timescales?
    - How could this impact generation behavior, particularly if a PPA for baseload power exists?
- **Lack of industry knowledge in navigating electricity space**

# Barriers: Economic

- **Added cost (and associated risk) for well owner due to:**
  - Generation equipment
  - Power control and load management systems
  - Gas cleaning / processing equipment
  - Interconnection and regulatory costs



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