Applications of Modern Microgrids for Off Grid Electrification

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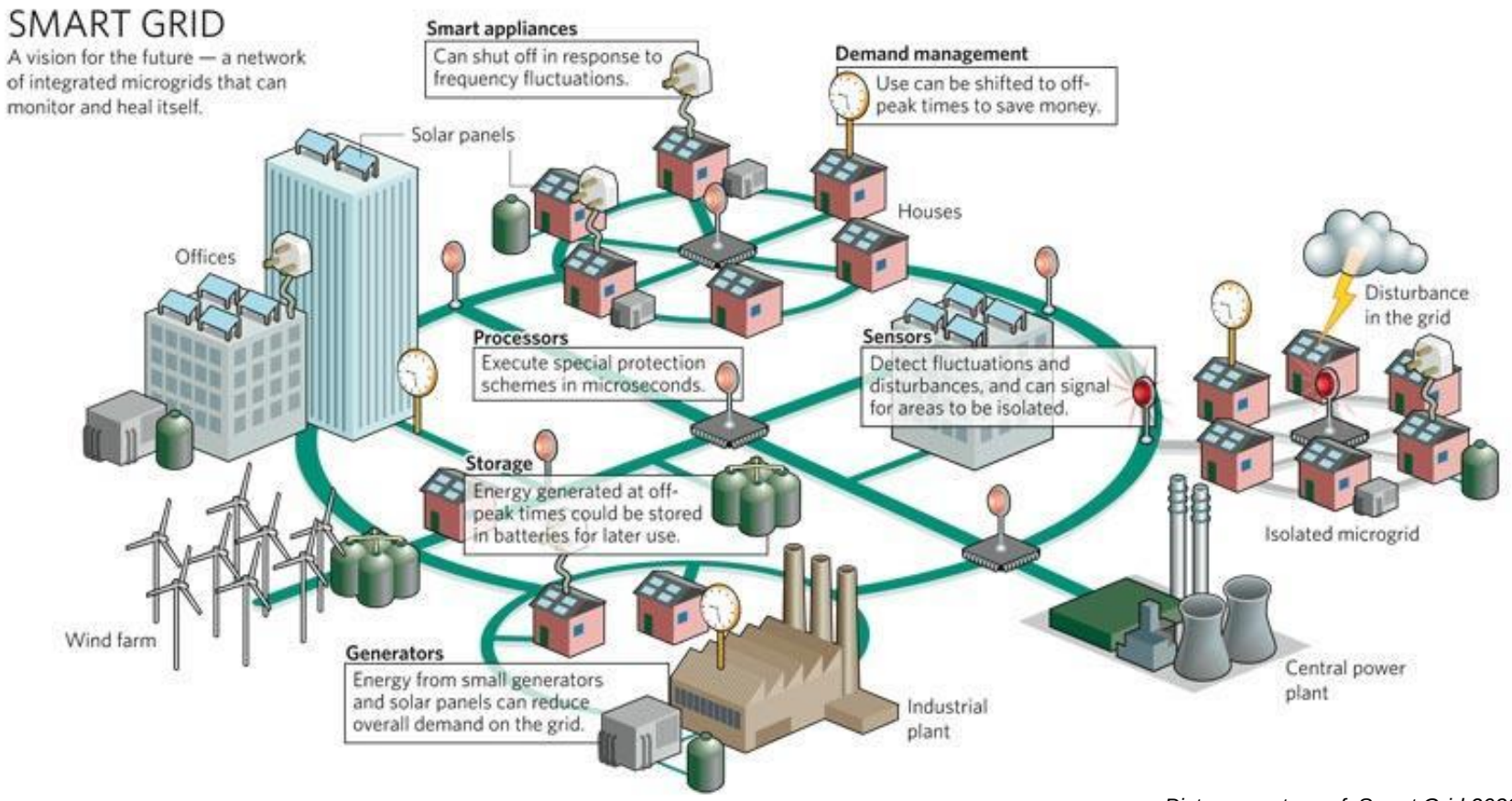
Presentation Overview

- U.S. DOE Grid Modernization Program
- Alaska Microgrid Partnership
- ISGAN Award of Excellence 2019

U.S. Vision: Grid Modernization



Picture courtesy of: Smart Grid 2030

Smart grid technologies support the goals of the Grid Modernization Initiative*

- Greater **resilience** to hazards of all type
- Improved **reliability** for everyday operations
- Enhanced **security** from an increasing and evolving number of threats
- Additional **affordability** to maintain our economic prosperity
- Superior **flexibility** to respond to the variability and uncertainty of conditions at one or more timescales, including a range of energy futures
- Increased **sustainability** through additional clean energy and energy-efficient resources

* Started in 2016 with a $220 million investment over 3 years

The Grid Modernization Program's research is based on a Multiyear Program Plan*

- **Devices and Integrated Systems**
- **Sensing and Measurements**
- **System Operations, Power Flow, and Control**
- **Design and Planning Tools**
- **Security and Resilience**
- **Institutional Support**

*https://www.energy.gov/sites/prod/files/2016/01/f28/Grid%20Modernization%20Multi-Year%20Program%20Plan.pdf

*https://www.energy.gov/oe/articles/grid-modernization-initiative-gmi-peer-review-be-held-september-4-7-2018

Alaska Microgrid Partnership (AMP)

- Alaska has approximately 200 isolated microgrid systems
- Populations range from 60 to 6000
- The project will create a development pathway for islanded microgrids which will reduce imported energy by at least 50%

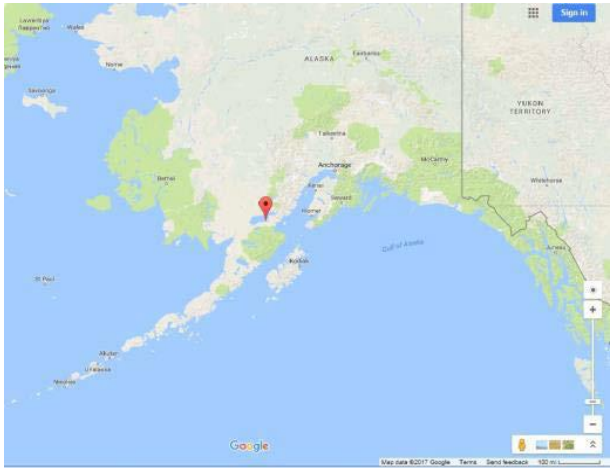
Three isolated communities were profiled in the Alaska Microgrid Partnership

- Chefornak Mini-grid Business Case
  - https://www.pnnl.gov/publications/abstracts.asp?report=264431
- Chefornak Energy Configuration Options
  - https://www.nrel.gov/docs/fy18osti/70579.pdf
- Shungnak Mini-grid Business Case
  - https://www.pnnl.gov/publications/abstracts.asp?report=264439
- Shungnak Energy Analysis
  - https://akenergygateway.alaska.edu/media/AMP/Shungnak%20Technical%20Capacity/Shugnak_Energy_Analysis_Report_Final.pdf
- Kokhanok Mini-grid Business Case
  - https://www.pnnl.gov/publications/abstracts.asp?report=264443
- Kokhanok Energy Retrofit Analysis
  - *https://www.nrel.gov/docs/fy18osti/70575.pdf*

Chefornak Mini-grid Business Case

- Population: 440
- Current electric generation system
  - 2 x 371 + 1 x 179 diesel plants
  - 1,597,000 kWh/yr (Avg. load: 180 KW)
- Proposed system
  - 800 kW wind turbines
  - 650 kW of electric thermal stoves for energy storage
  - 300 kW battery storage
- Results
  - Cost of electricity could decline from $0.407/kWh to $0.308/kWh
  - Fuel consumption could be reduced by 80% (103,000 gal)

Kokhanok Mini-grid Business Case



- Population: 152
- Current electric generation system
  - 1x 60kW, 1x 115 kW, 1x 160 kW, 1x 117 kW diesel plants with total capacity of 452 kW
  - 426,248 kWh/yr (Avg. load: 180 KW)
- Proposed system
  - 2 Vestas 17 (90 kW) wind turbines
  - 125 kW of electric thermal stoves for energy storage
  - 120 kW battery storage
- Results
  - Cost of electricity could decline from $0.69/kWh to $0.39/kWh
  - Fuel consumption could be reduced by 69% (22,000 gal)

Shungnak Mini-grid Business Case

- Population: 299
- Current electric generation system
  - 1x 202 kW, 1x 350 kW, 1x 365 kW, 1x 400 kW diesel plants with total capacity of 1317 kW
  - 1,747,196 kWh/yr (Avg. load: 181 KW)
- Proposed system
  - 500 kW wind turbine
  - 46 kW of electric thermal stoves for energy storage
  - 100 kW solar photovoltaics
- Results
  - Cost of electricity could decline from $0.632/kWh to $0.548/kWh
  - Fuel consumption could be reduced by 74% (96,000 gal)

Clean Energy Ministerial
International Smart Grid Action Network

Award Title:	ISGAN Award of Excellence
Award Purpose:	Recognize excellence in innovation, integration, and transformation of smart grid systems
Theme:	Topic or theme varies by year; each year's award is focused on one theme
Award Recipient(s):	Projects (i.e., not individuals or individual institutions)
Number of Awards:	One or more, depending on caliber of nominations and jury's preferences

Past ISGAN Award Winners*

- 2014 Consumer Engagement & Empowerment
  - Winner: ‘SmartView’ AMI pilot project from Entergy New Orleans
- 2015: Smart Grids for Renewable Energy Integration
  - Winner: GRID4EU – Large-Scale Demonstration Of European Smart Distribution Networks

    ÉlectricitéRéseau Distribution France (ERDF) (Germany, Sweden, Spain, Italy, Czech Republic, France)

*http://www.iea-isgan.org/awards/

Past ISGAN Award Winners* (2)

- 2016 Smart Grids for Reliable Electricity Service
  - Winner: CenterPoint Energy Smart Grid (USA)
- 2018: Smart Grids for Flexibility
  - Winner: Sustainable Energy's ***Coordinating Power Control (***Sweden)

*http://www.iea-isgan.org/awards/

2019 Award Theme has just been announced

- Recognizing the critical importance and the role of smart grids sustaining a reliable and resilient grid through integration of energy systems, ISGAN has chosen as the them of the 2019 Award of Excellence:

  Smart Grids for Local Integrated Energy Systems (Smart Microgrids)

- **Submission Deadline: 15 November 2018**

- Apply at: http://www.iea-isgan.org/awards/

ISGAN Eligible Projects

- Eligible projects include pilot, demonstration, and deployment projects
- Please see the ‘Official Rules’ of the ISGAN Award of Excellence and detailed ‘Submission Forms’ for more information
- The international jury panel will select winning projects based on five key criteria:
  - *Potential impact (25pt),*
  - *Economic rationale (25pt),*
  - *Potential for replication or adaptation (25pt),*
  - *Innovation (12.5pt), and,*
  - *Other benefits (12.5pt).*
- Winners will be announced during a ceremony at the tenth Clean Energy Ministerial (CEM10) in May 2019 in Canada
- Winners will be invited to participate in the ceremony for a certificate & plaque and be recognized in ISGAN products and proceedings over the following months

Thank you for your attention!

Questions?