Perspectives on Wind to Heat

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How did we get here?

- Natural Attributes
- Invest in infrastructure
- Must innovate!!!!!

Two Perspectives on Innovation!

Customer (clean low cost energy)

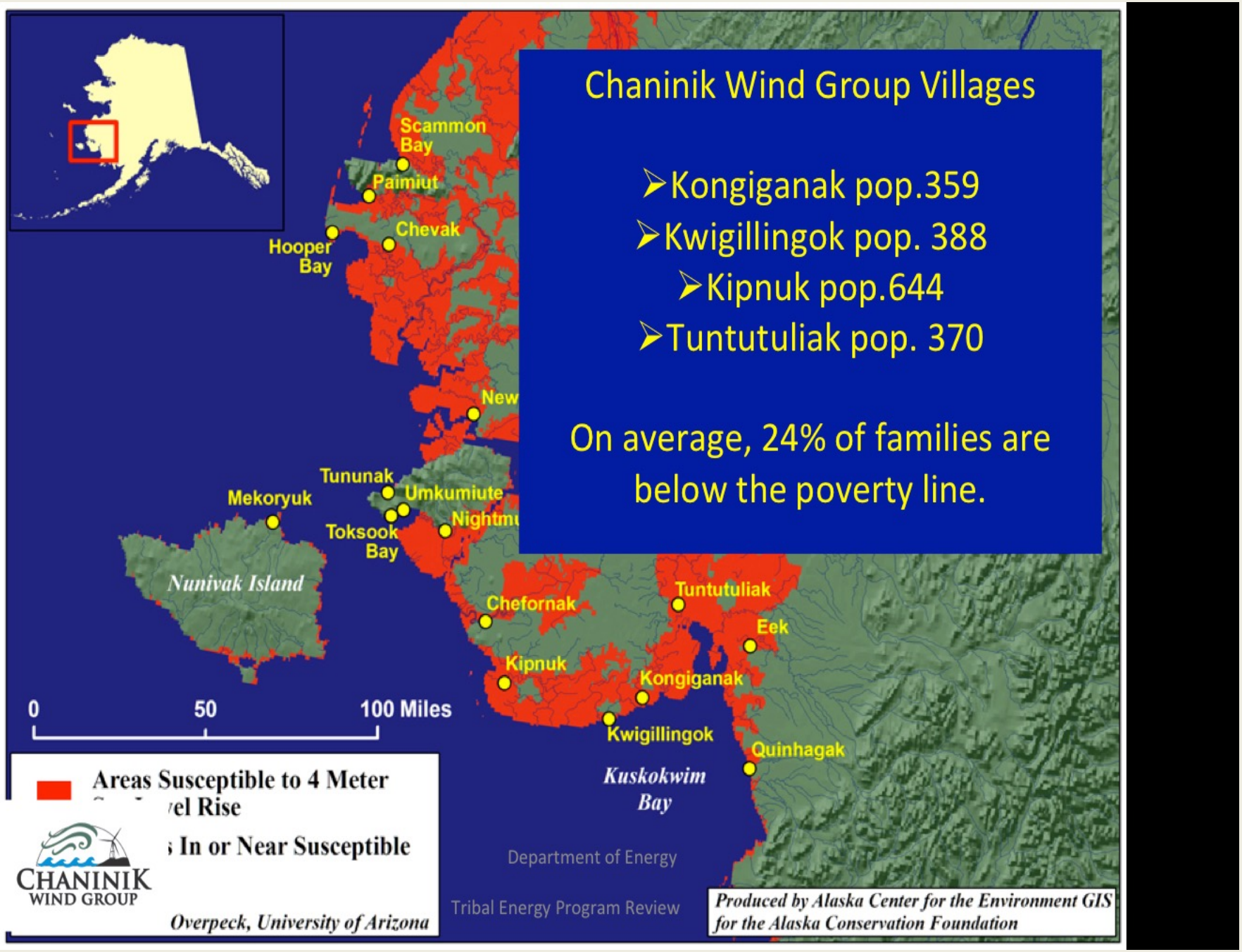
Utility (keeping lights on)

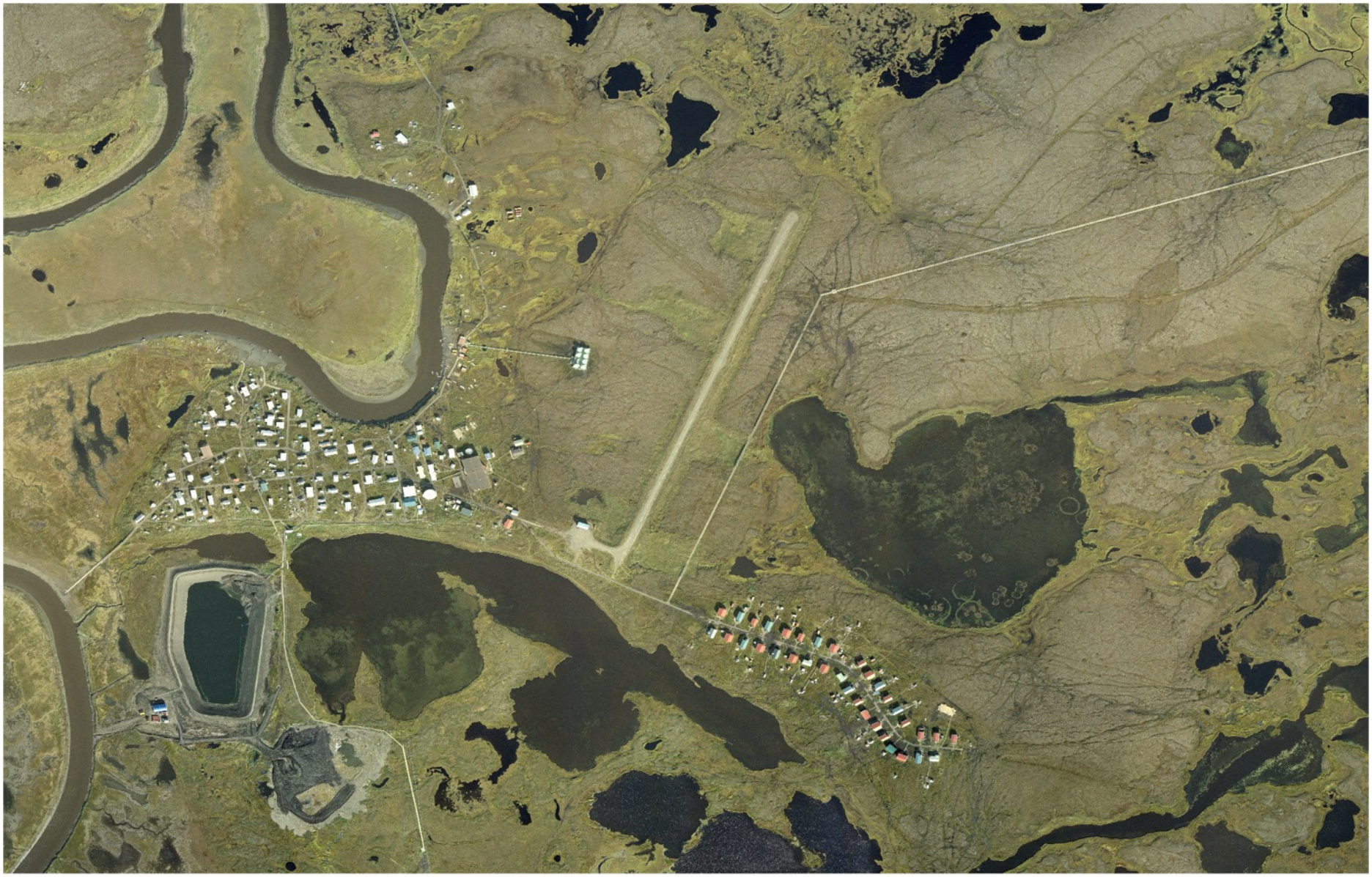
All progress is precarious, and the solution of one problem brings us face to face with another.

Martin Luther King 1963

If once a man indulges himself in murder,
Very soon he comes to think little of robbing,
And from robbing he comes next to drinking,
And sabbath-breaking, and from that to incivility and procrastination

Thomas de Quincey, english essayist and author


Chaninik Wind Group Villages
➢Kongiganak pop.359
➢Kwigillingok pop. 388
➢Kipnuk pop.644
➢Tuntutuliak pop. 370
On average, 24% of families are below the poverty line.
Scammon Bay
Paimiut
Chevak
Hooper Bay
New
Tununak
Umkumiute
Mekoryuk
Toksook Bay
Nunivak Island
Chefornak
Tuntutuliak
Eek
Kipnuk
Kongiganak
Kwigillingok
Quinhagak
Kuskokwim Bay
0
50
100 Miles
Areas Susceptible to 4 Meter
el Rise
In or Near Susceptible
CHANINIK WIND GROUP
Overpeck, University of Arizona
Department of Energy
Tribal Energy Program Review
Produced by Alaska Center for the Environment GIS for the Alaska Conservation Foundation



"We try our best to keep up with costs of fuel and lights, in order to have transportation for survival."

-Sarah

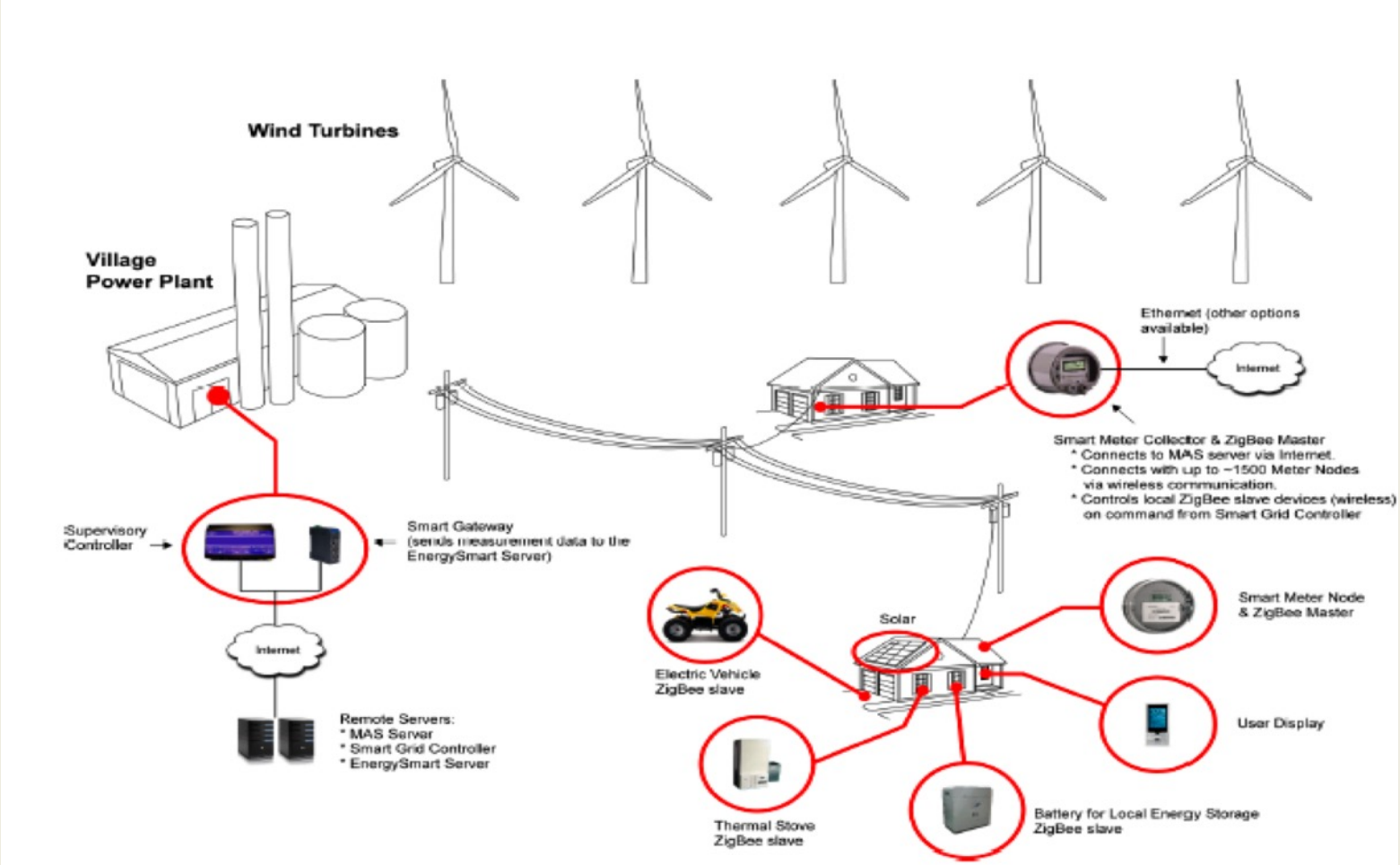
"Installing wind turbines will be great because of high prices of stove oil is too high. Helping reduce electricity bills would help to buy oil to keep the houses warm."

-Paul

INTELLIGENT ENERGY SYSTEMS

Listen/Ask/Don't Assume

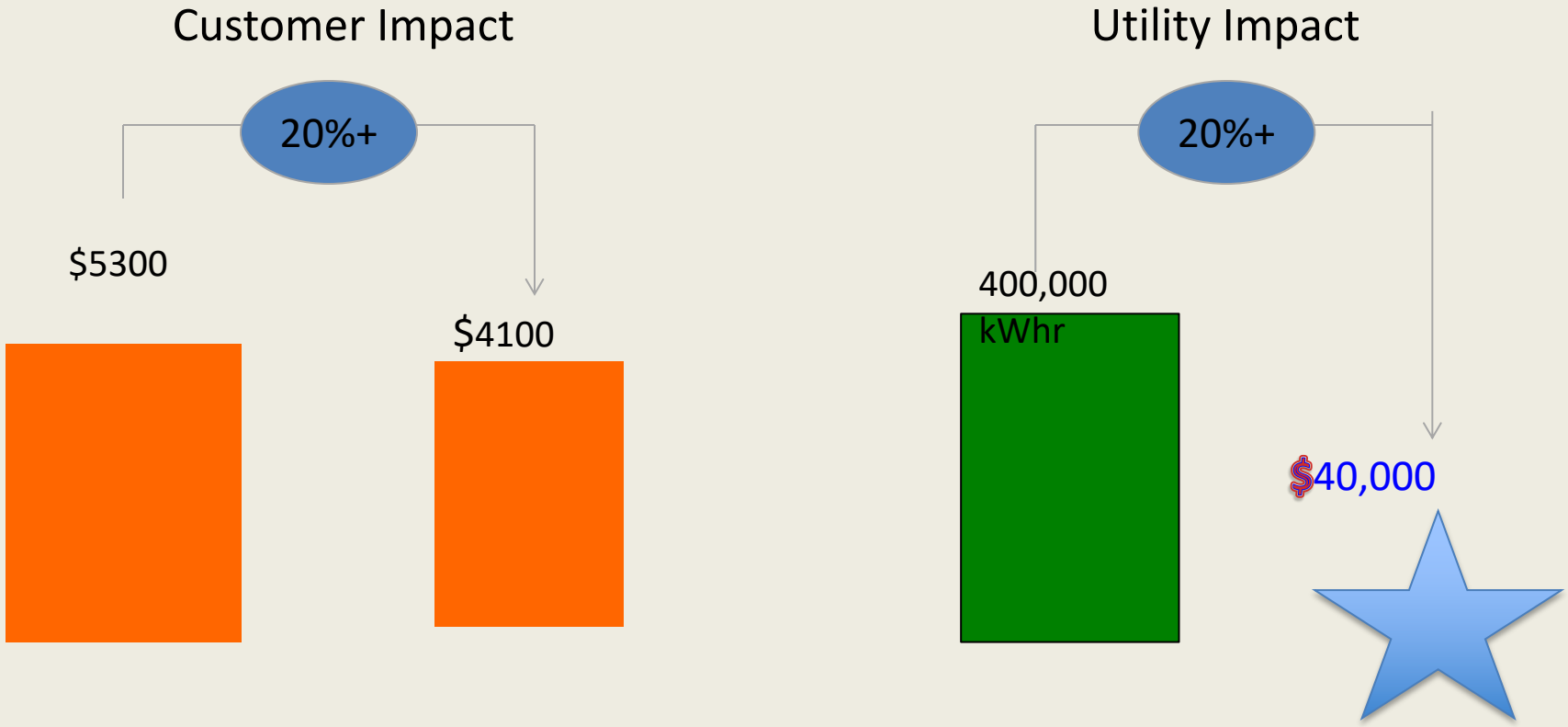
Wind-Diesel Smart Grids



INTELLIGENT ENERGY SYSTEMS

Initial Hallucination

Supplement to Hallucination #1: How wind heat lowers costs and increases revenues



Growing year-to-year impact.

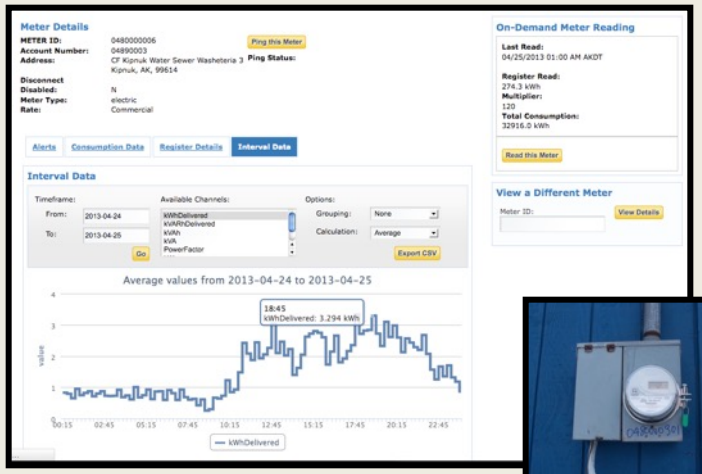
INTELLIGENT ENERGY SYSTEMS

Find Funding; Adapt Technology; & Build Local Capacity

INTELLIGENT ENERGY SYSTEMS

Its Simple!

Wind Heat Smart Grids Components



- **Wind turbines (400% penetration)**
- **Electric Thermal Storage (distributed) (Steffes)**
- **Controls and integration**
- **Energy Storage for wind only/diesel off operations**

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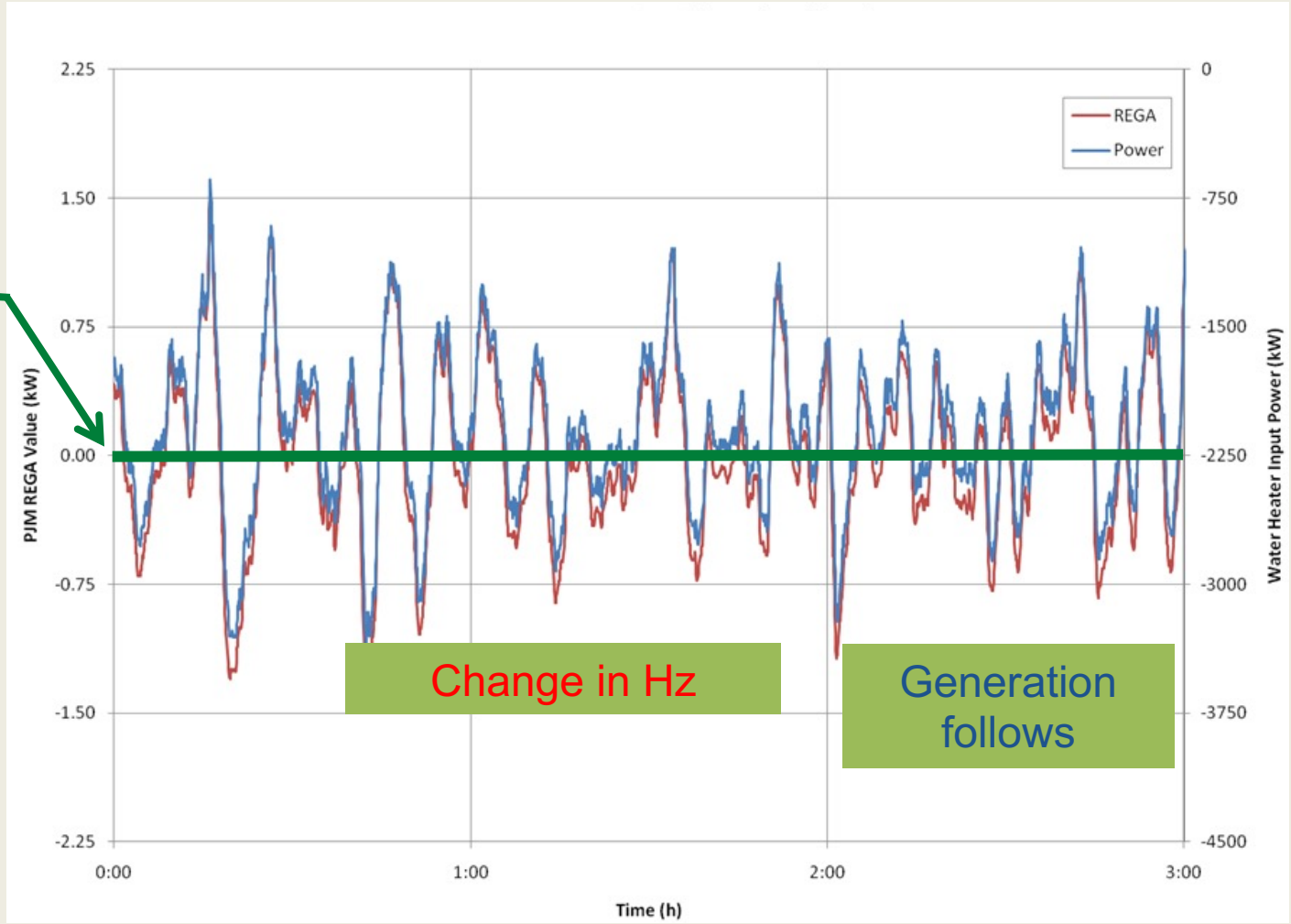
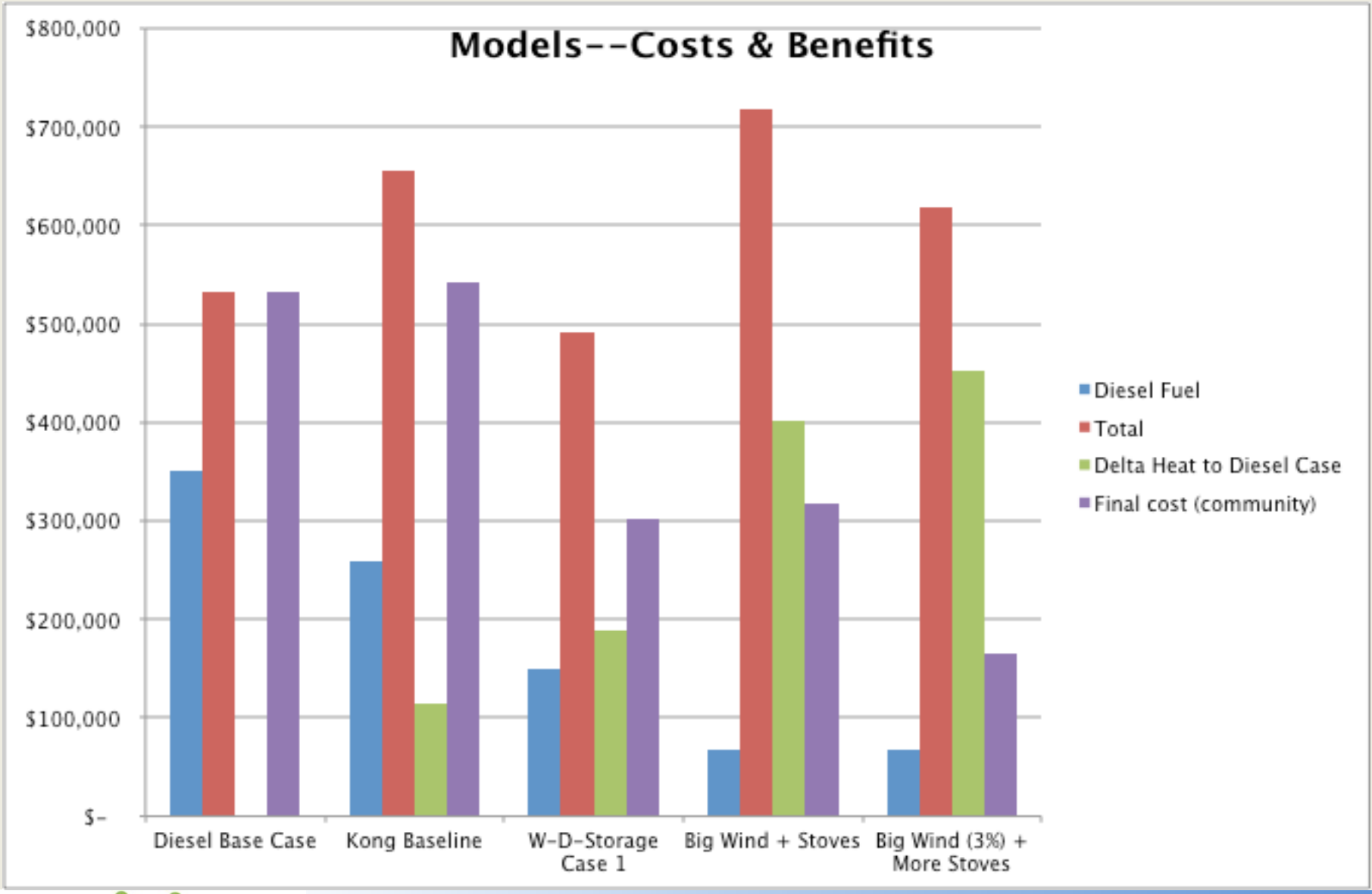
Grid Regulation

General idea: Wind and Load are varying

Load moves **UP** and **DOWN**





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Electric Thermal Storage

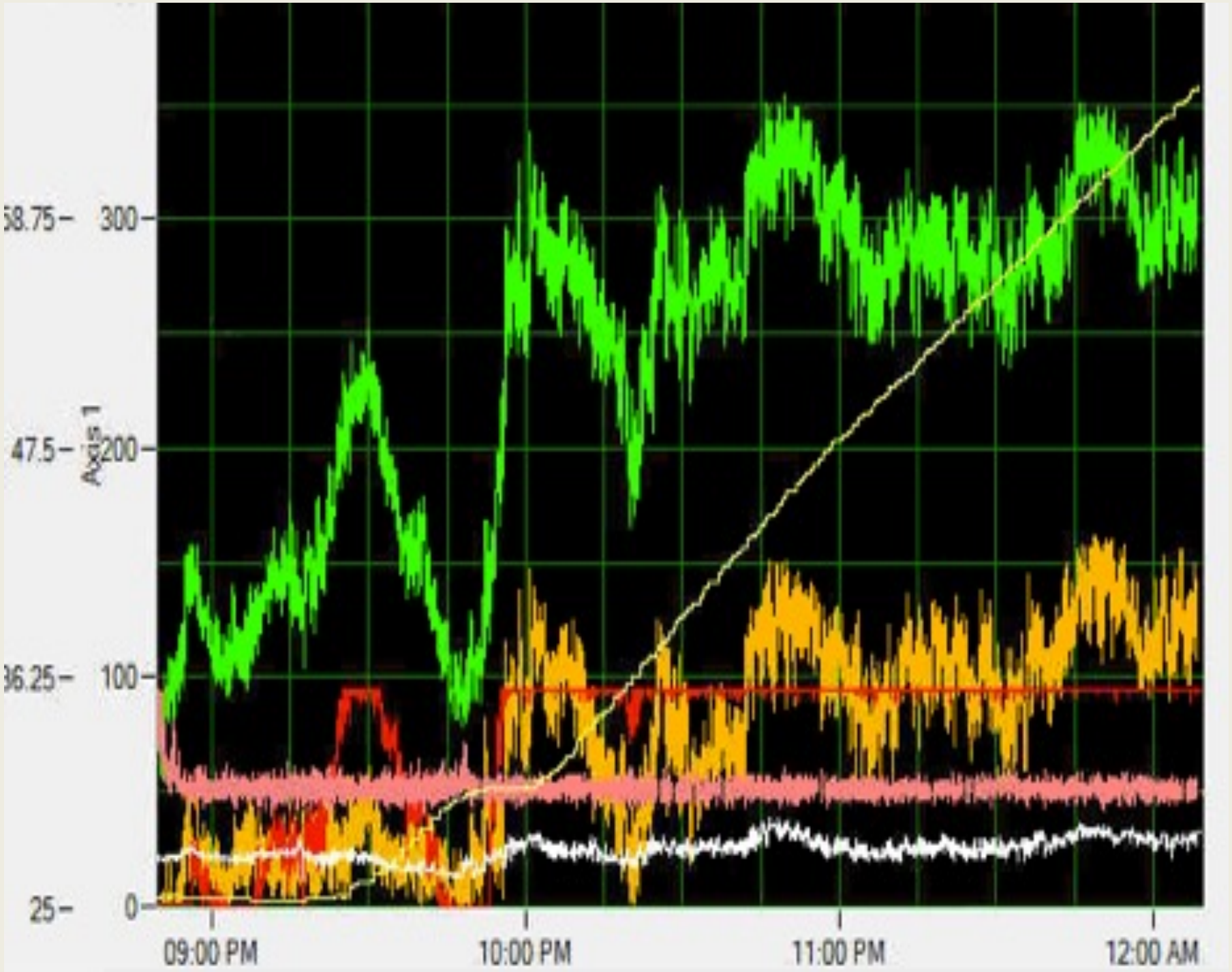
- Flexible
  - Distributed Or Dispatchable
  - Hybrid

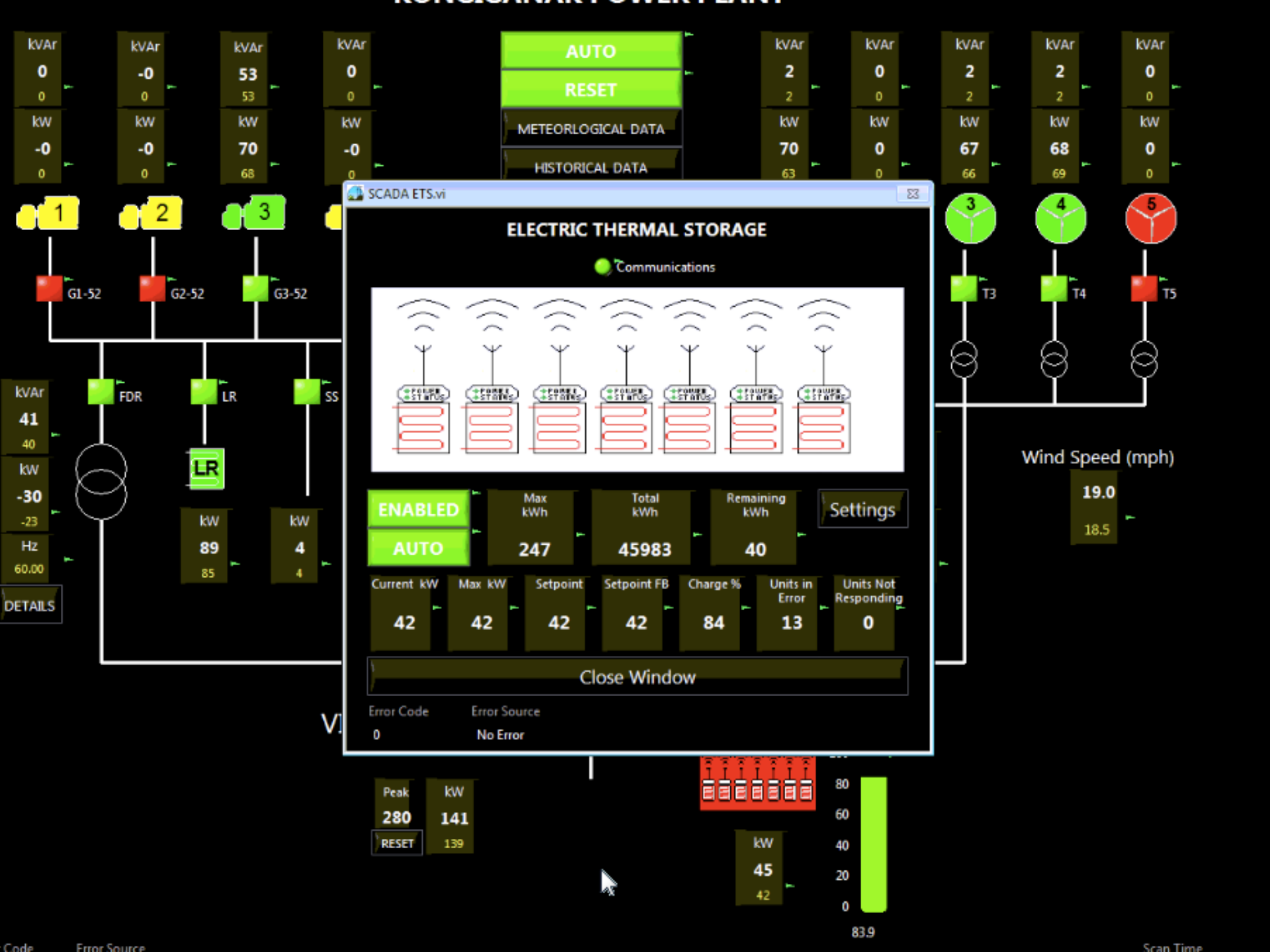
- Separation Between Utility and Customer
  - The customer can control the draw down of thermal storage.
  - The Utility can fill the thermal storage as it wishes.

- Robust
  - Mesh network requires no communication infrastructure.
  - Multiple units provide natural stability.

- Proof of Concept for Other Dispatchable Loads

Icons by Zlatko Najdenovski


68.75
47.5
36.25
25
300
200
100
0
Axis 1
09:00 PM
10:00 PM
11:00 PM
12:00 AM


AUTO
RESET
METEORLOGICAL DATA
HISTORICAL DATA
SCADA ETS.vi
ELECTRIC THERMAL STORAGE
Communications
ENABLED
AUTO
Max kWh
247
Total kWh
45983
Remaining kWh
40
Settings
Current kW
42
Max kW
42
Setpoint
42
Setpoint FB
42
Charge %
84
Units in Error
13
Units Not Responding
0
Close Window
Error Code
0
Error Source
No Error
G1-52
G2-52
G3-52
T3
T4
T5
FDR
LR
SS
DETAILS
Wind Speed (mph)
19.0
18.5
Peak
280
RESET
kW
141
139
kW
45
42
83.9

```
11:04:47.002 Sending lo 37 3=>0470000097H 0013A200:4078CBB1 LO 37 3 49 ms.
11:04:47.085 Sending lo 37 3=>0470000099H 0013A200:4078CBB5 LO 37 3 45 ms.
11:04:47.171 Sending lo 37 3=>0470000109H 0013A200:4078CAEE LO 37 3 39 ms.
11:04:47.262 Sending lo 37 3=>0470000114H 0013A200:4078CB50 LO 37 3 40 ms.
11:04:47.351 Sending lo 37 3=>0470000117H 0013A200:4078CAE8 LO 37 3 30 ms.
11:04:47.437 Sending lo 37 3=>0470000119H 0013A200:4078CAE6 LO 37 3 47 ms.
11:04:47.538 Sending lo 37 3=>0470000123H 0013A200:4078CBB7 LO 37 3 45 ms.
11:04:47.658 Sending lo 37 3=>0470000133H 0013A200:4078CAF0 LO 37 3 49 ms.
11:04:47.758 Sending lo 37 3=>0470000135H 0013A200:4078CB54 LO 37 3 42 ms.
11:04:47.840 Sending lo 37 3=>0470000136H 0013A200:4078CAF8 LO 37 3 41 ms.
```

Stove update rate stove @ 50 milliseconds

Time	Human Readable Message	Machine Radio Instructions	Response
11:04:47.002	Sending lo 37 3=>0470000097H	0013A200:4078CBB1	LO 37 3 49 ms.
11:04:47.085	Sending lo 37 3=>0470000099H	0013A200:4078CBB5	LO 37 3 45 ms.
11:04:47.171	Sending lo 37 3=>0470000109H	0013A200:4078CAEE	LO 37 3 39 ms.
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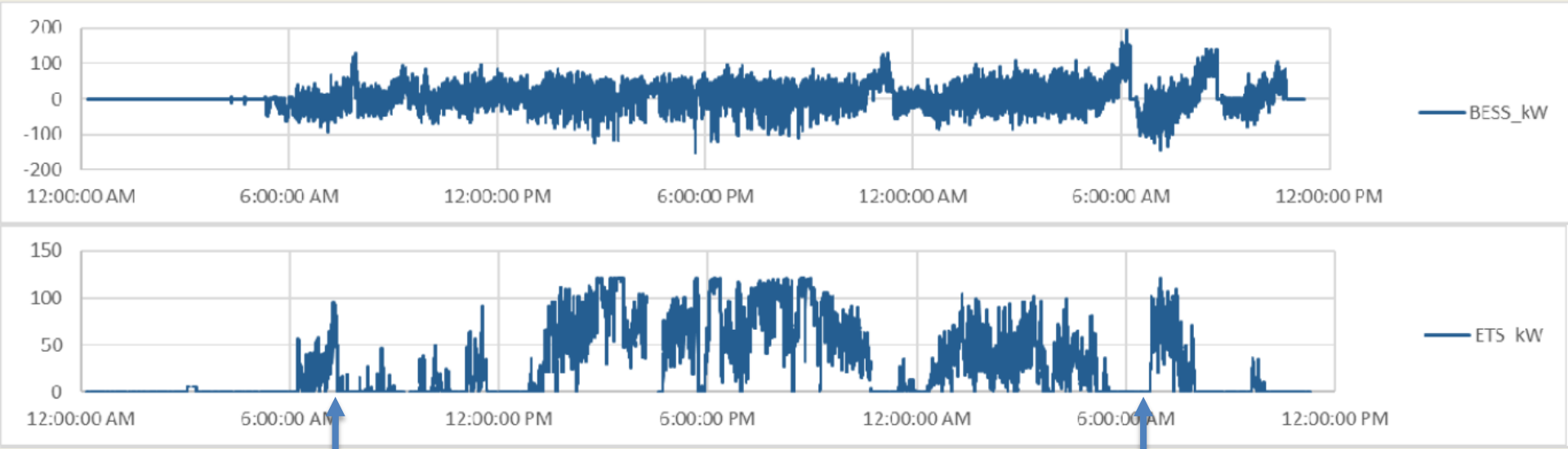
Energy Storage Power Flows (Battery and ETS)



Diesel Switched Off

Diesel Switched On

Visualization

CHANINIK WIND GROUP
Kipnuk Light Plant

ies INTELLIGENT ENERGY SYSTEMS

SAIC Smart Grid as a Service

Utility Dashboard | Report Details | Manage Users | Manage Content | Outage Analysis

Meter Details

METER ID: 0480000006
Account Number: 04890003
Address: CF Kipnuk Water Sewer Washeteria 3
Kipnuk, AK, 99614

Ping this Meter
Ping Status:

Disconnect Disabled: N
Meter Type: electric
Rate: Commercial

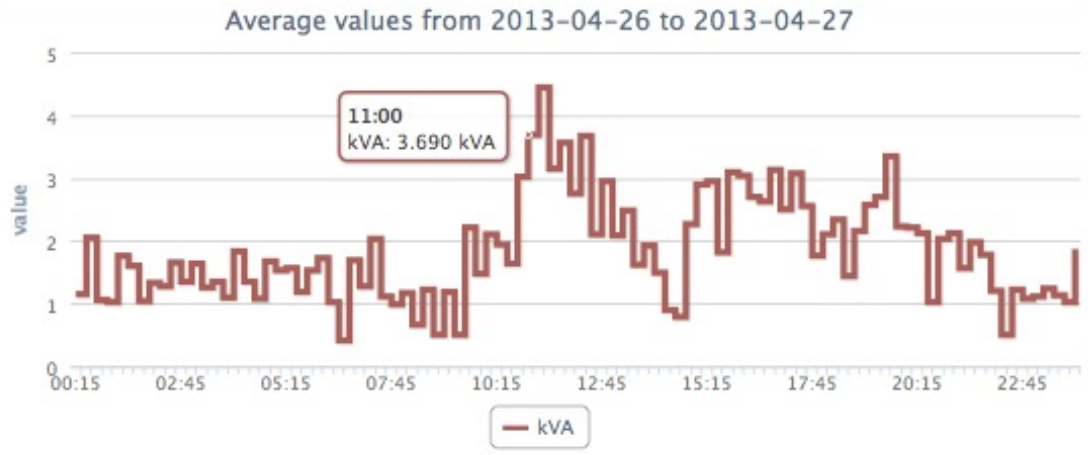
Alerts | Consumption Data | Register Details | Interval Data

Interval Data

Timeframe:
From: 2013-04-26
To: 2013-04-27
Go

Available Channels:
kWhDelivered
kVARhDelivered
kVAh
kVA
PowerFactor

Options:
Grouping: None
Calculation: Average
Export CSV



On-Demand Meter Reading

Last Read:
04/27/2013 01:00 AM AKDT

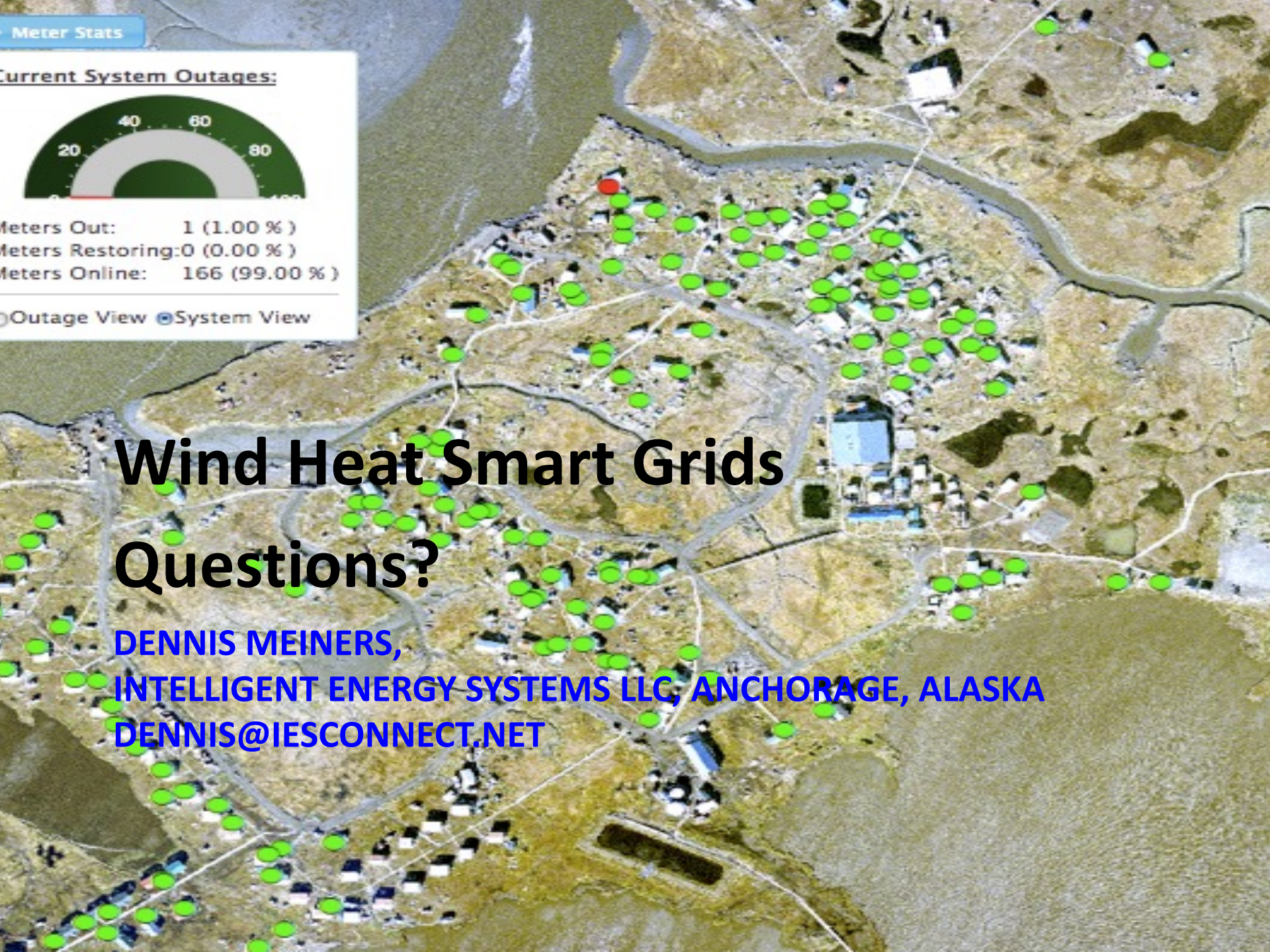
Register Read:
275.8 kWh
Multiplier:
120
Total Consumption:
33096.0 kWh

Read this Meter

View a Different Meter

Meter ID:

View Details



Wind Heat Smart Grids

Questions?

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08/14/2008